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The Process Reengineering of Out-of-Hospital First Aid: The Case of Guangdong Provincial Emergency Hospital

LI Xuejin

Doctor of Management

Supervisor:
PhD Maria João Major, Professor,
ISCTE University Institute of Lisbon

December, 2023

BUSINESS
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Jury:

PhD Inna Choban de Sousa Paiva, Associate Professor,
ISCTE University Institute of Lisbon
PhD Célia Maria Rodrigues da Cova Gomes Picoito, Adjunct Professor,
Instituto Politécnico de Setúbal
PhD Ou Weiyan, Director of Doctor of Management in Healthcare Program,
SMU - Southern Medical University
PhD Alexandra Etalvina Martins Marques Fernandes, Associate Professor with Habilitation, ISCTE University Institute of Lisbon
PhD Maria João Major, Professor,
ISCTE University Institute of Lisbon

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Nome Completo: ...Li Xuejin.....

Curso: .....Doutoramento em Gestão Empresarial Aplicada.....

Número de Estudante: ...91067.....

E-mail: ...lxniu1@iscte.pt.....

E-mail pessoal: .....874316905@qq.com.....

Telefone: .....86- 13824416037.....

Iscte, ...12.../...27.../2023

Assinatura 李雪进 Li Xuejin

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Abstract

This thesis aims at better understanding the impact of business processes and their key factors on out-of-hospital emergency care, analyzing which business processes need to be redesigned to improve its efficiency without compromising the quality of medical services.

The study draws on case study research following a mixed approach of qualitative and quantitative methods. Evidence involved semi-structured interviews with key personnel and observation of the implementation of business process reengineering (BPR) in the case hospital, as well as the collection of a wide range of documents from the hospital and the sector. Additionally, a questionnaire based on key success and failure factors was used to assess the readiness of the emergency hospital in Guangdong Province for process reengineering, together with 56 (subordinate) indicators of the performance evaluation by the Chinese government. The adoption of these multiple sources of data allowed to get rich and insightful information on changes introduced not just in activities and processes but also in the technology job functions, organizational structure, and cultural aspects related to the BPR project.

In this research, the processes, and events that the hospital experienced in implementing the reengineering of outpatient emergency were consistent with the key success factors of the theoretical model described in the literature review. It was found that the theoretical model adopted encompasses the factors observed in the case study, providing a possible solution to a common problem in BPR. The study represents the practical validation of the theoretical model in the field of out-of-hospital emergency care, considering industry characteristics and case features. It also evidences that when carrying out the project for reengineering, the hospital had achieved positive and favorable effects on healthcare quality and satisfaction.

Keywords: Business process reengineering; Critical success factors; Out-of-hospital emergency care; Disaster medical rescue; Healthcare in China

JEL: I1, L9

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Resumo

O objetivo desta tese é o de melhor compreender o impacto das mudanças nos processos e quais os fatores-chave de sucesso no atendimento de emergência hospitalar, analisando de que forma os processos podem ser redesenhados para melhorar a eficiência sem comprometer a qualidade dos serviços médicos prestados.

O estudo baseia-se num estudo de caso utilizando uma metodologia mista, qualitativa e quantitativa. A evidência recolhida envolveu a condução de entrevistas semiestruturadas e a observação da implementação do processo de reengenharia (PR) no hospital em análise, bem como a recolha de uma grande variedade de documentos do hospital e do setor. Adicionalmente, foi utilizado um questionário baseado nos principais fatores de sucesso e insucesso para avaliar a prontidão do Guangdong Provincial Emergency Hospital na adoção do projeto de reengenharia, juntamente com 56 indicadores da avaliação de desempenho disponibilizados pelo governo chinês. A adoção de múltiplas fontes de evidência permitiu obter informações ricas e relevantes sobre as mudanças introduzidas não apenas nas atividades e processos, mas também ao nível da tecnologia, estrutura organizacional e aspetos culturais associados ao processo de mudança.

Neste estudo, os processos e eventos que o hospital experienciou na implementação do projeto de reengenharia da emergência ambulatorial foram consistentes com os principais fatores de sucesso do modelo teórico descrito na revisão da literatura. Confirmou-se que o modelo teórico que informa a investigação considera os aspetos críticos de implementação identificados no estudo empírico e fornece uma solução para o problema comum na reengenharia de processos. O estudo representa a validação prática do modelo teórico na área do atendimento de emergência hospitalar, considerando as características específicas do setor e do hospital estudado. Evidencia, ainda, que ao realizar o projeto de reengenharia dos processos de atendimento de emergência hospitalar, o hospital alcançou resultados positivos em termos de qualidade dos serviços prestados e satisfação por parte dos pacientes.

Palavras-chave: Reengenharia de processos; Fatores críticos de sucesso; Atendimento de emergência hospitalar; Resgate / socorro médico em desastres; Cuidados de saúde na China
JEL: I1, L9

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摘 要

本论文旨在更好地理解业务流程及其关键因素对院外急救的影响，分析需要重新设计哪些业务流程以提高院外急救的效率，同时不降低医疗服务质量。

本研究依托案例，采用了定性定量结合的混合研究方法。证据包括对关键人员的半结构化访谈，对案例医院 BPR 实施的观察，以及从医院和行业收集的大量文件。此外，还使用基于关键成功因素和失败因素的问卷，以评估广东省应急医院对流程再造的准备情况，以及中国政府部门对该院 56 个绩效评估指标的结果。多源数据的采用使研究人员得到了关于引入变更的丰富和深刻见解，不仅是在活动和流程上，还包括与 BPR 项目相关的技术、工作职能、组织结构和文化方面。

在本研究中，医院在实施院外急救流程再造过程中经历的流程和事件，与文献综述中描述的关键成功因素一致。研究发现，采用的理论模型包含了案例研究中观察到的因素，为 BPR 中的常见问题提供了解决方案。该研究是理论模型在院外急救领域的实际验证，考虑了行业特征和案例特点。它还证明，当实施院外急救业务流程再造项目时，医院在医疗质量和满意度方面取得了积极和有利的效果。

关键词：业务流程再造；关键成功因素；院外急救；紧急医学救援；中国医疗卫生

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Looking back over the past three years, it was a critical period for the global response to sudden public health events. I worked at the first provincial emergency hospital in China, and the inherent mission prompted me to engage in the fight against the epidemic immediately. I conducted in-depth research in frontline departments, organized and participated in various special meetings, bid farewell to colleagues who went to perform emergency medical rescue tasks outside the hospital, summarized the actions of colleagues in various positions in the hospital in fighting the epidemic, collected and conveyed the opinions of the decision-making level on issues in work, used various public channels to encourage frontline colleagues, and acted as a communication bridge between the hospital and the external environment. My doctoral research direction is emergency management, and when progress was made in the fight against the epidemic, I suddenly realized that the work I had been tirelessly engaged in was exactly the content of my research topic. I am grateful to the Guangdong Provincial Emergency Hospital for providing me with an inspiring empirical case study opportunity.

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With sincere gratitude, Li Xuejin

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回首过去三年，正是全球应对突发公共卫生事件的关键时期。本人在中国的首家省级应急医院工作，天然的使命让我第一时间投入了抗击疫情中去。我深入一线科室调研，组织参加各种专题会议，为到院外执行紧急医学救援任务的同事送行，整理总结医院各岗位同事抗击疫情的行为事迹，收集工作中存在的问题并把决策层的意见及时传达，利用各种公开的渠道为一线的同事们加油激励，做好医院与外部的沟通桥梁，等等。我的博士课题研究方向是应急管理，当抗击疫情工作取得阶段性进展时，突然发现，我之前夜以继日奋战的工作内容，不就是我的研究课题内容吗？感谢广东省应急医院为我提供一个富有启发性实证案例研究的机会。

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致以诚挚的谢意，　　李学进

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Chapter 1: Introduction

Process reengineering has been practiced in many organizations and has achieved good results (Habib & Shah, 2013). Process reengineering in healthcare institutions significantly improves value the quality and efficiency of medical services (Zhou & Liang, 2004). However, healthcare institutions still face some problems in the process of process reengineering. For example, process reengineering is considered a high-risk project, and there is less research on the application of process reengineering in the field of emergency services compared to other areas of process reengineering (S. Gu & Sun, 2017; Lv et al., 2012; Yang et al., 2022). Particularly, there is a lack of empirical research on process reengineering for out-of-hospital emergency care. These issues have, to some extent, affected the optimization effect of out-of-hospital emergency care processes. In order to address these problems and validate the feasibility of the theory in practice, conducting empirical research on the out-of-hospital emergency care processes of emergency hospitals in Guangdong Province is a good choice. This chapter aims to present the research background, research questions, and objectives that motivated this investigation, clarifying the research methods adopted and how the thesis has been structured.

1.1 Research background

Emergency medical rescue has become an important component of the national public health system, from the initial transport and rescue of patients during the war to the pre-hospital treatment and transfer of trauma and emergency patients during peacetime (Bao, 2011). With significant changes in the composition of human diseases and causes of death, the incidence of trauma and acute cardiovascular and cerebrovascular diseases caused by various accidents continues to rise, becoming a severe social problem. Since the 21st century, major emergencies have occurred frequently worldwide, namely the "9/11" incident in the US in 2001, the Bali bombing in 2002, the SARS epidemic and the H5N1 avian influenza virus infection in 2003, as well as the hostage-taking incident in North Ossetia and the tsunami triggered by an 8.9-magnitude earthquake in Indonesia in 2004 and, the COVID-19 pandemic since the end of 2019, just to mention a few. Each of these emergencies has resulted in hundreds, thousands, or even hundreds of thousands of casualties, with the number of global

COVID-19 infections exceeding 3 million as of May 4, 2020 (The Paper, 2020). Just like the SARS outbreak in 2003 and the COVID-19 outbreak in 2020, they have once again exposed the inadequacy of hospitals' ability to respond to new and sudden infectious diseases, becoming the biggest weakness in the entire public health service system (Shuai et al., 2020). Since the outbreak of the pandemic, China has taken prevention and control measures and paid a considerable price, and epidemic prevention and control has achieved comprehensive victory. The medical treatment system is also gradually recovering.

As an important part of the healthcare and social security system, out-of-hospital emergency care is also an important part of public management. The level of out-of-hospital emergency medical care not only reflects the level of emergency medical services (EMS) for the people but also reflects the comprehensive medical technology level and the timeliness of medical management of a country/region (F. Chen & Ke, 2013). In fact, out-of-hospital emergency care not only concerns the success rate of critical patient rescue but also reflects the government's credibility and protection of citizens' basic rights (Xu et al., 2019). The struggle between human beings and infectious diseases has never stopped, and one never knows in what way the next super virus or super bacteria will quietly emerge. Therefore, the key problem that needs to be urgently solved at present is the continuous improvement of out-of-hospital emergency care and the enhancement of emergency efficiency.

From the medical treatment perspective, emergency medical management is a widely based collaborative activity. Rapid and effective life-saving during crises and afterward is a crucial point. Close cooperation between out-of-hospital emergency medical services and hospital emergency department teams is essential for patients' rapid and effective care (Reddy et al., 2009). Research has shown that the improvement of emergency medical rescue processes does not have an adverse impact on the quality of medical care provided. In order to utilize resources effectively, detailed investigations of relevant processes are required to assist hospitals in taking necessary measures, reducing costs, and avoiding adverse outcomes (Lamooki et al., 2014). The focus of out-of-hospital emergency care process redesign is to identify core processes and key processes that directly impact emergency care, placing the patient in the center throughout the entire emergency medical process, including emergency response time and on-site emergency handling, minimizing or eliminating non-value-added processes, and optimizing necessary processes. In addition to focusing on processes, process redesign also needs to consider equally important factors such as technology, structure, communication, and personnel. People, technology, and processes are drivers of organizational change.

The process redesign approach was introduced in China in the mid-1990s and has attracted attention from all walks of life. Out-of-hospital emergency care is a key part of the emergency medical system, and the appropriate, rapid, and effective handling of critically ill patients in the early stages of illness has received unanimous attention from domestic and overseas scholars. Currently, there are still many problems with out-of-hospital emergency care in China, such as slow response times and weak on-site emergency capabilities. Therefore, it is possible to draw on the concepts and methods of process redesign to attempt a transformation of the out-of-hospital emergency care process in order to improve the success rate of out-of-hospital emergency care. Through literature review, it is found that some researchers in the current international health research have already conducted studies on improving medical and health services including emergency services, but most of the research focuses on areas other than emergencies (Huang, 2019; Yang et al., 2022). Compared with other fields or technologies in medical and health services, the application of business process redesign in emergencies is relatively rare, and there is even less research focus on the redesign of out-of-hospital emergency care processes. Some research has been conducted in China, but the existing research focuses more on the changes in processes themselves and lacks a comprehensive study of the key factors for the success or failure of out-of-hospital emergency care process redesign (He, 2013; Kan et al., 2023; Yi, 2015). During the literature search, the researcher used "out-of-hospital emergency care process redesign" and "emergency care process redesign + empirical study" as keywords and conducted topic searches in major academic databases in China such as China National Knowledge Infrastructure (CNKI) and Wanfang Medical Network. The results of the literature search show that there is a considerable lack of research literature on the redesign of out-of-hospital emergency care processes in China, and it can be said that empirical research on the redesign of out-of-hospital emergency care processes is currently blank. Rao et al. (2012) pointed out that the existing literature review indicate that most business process redesign models are based on how business processes should change and how organizations should adapt to process changes, but there is a lack of evaluation of existing practices and successful implementation experiences. In the field of business process redesign, there is relatively little attention to empirical research, but the redesign of out-of-hospital emergency care processes requires empirical research to test the feasibility of theory in practice (Habib & Shah, 2013).

1.2 Objective of the study, research questions and methodology adopted

Faced with a disaster, providing different emergency treatments could lead to completely different outcomes for the injured. In order to avoid adverse consequences and effectively utilize resources, it is necessary to conduct a detailed investigation of the relevant processes to assist hospitals in taking necessary measures (Lamooki et al., 2014). This study aims to validate whether the application of business process reengineering had positive impacts on the efficiency of out-of-hospital emergency care in a specific hospital (Guangdong Provincial Emergency Hospital) without compromising the quality of the services it provides to patients. In order to address the objective of this investigation, three specific research questions are formulated:

1. Why and how has Guangdong Provincial Emergency Hospital implemented the reengineering of out-of-hospital emergency procedures?

2. How do key actors (senior managers, operational managers, technicians, doctors, nurses, and other key personnel) evaluate the readiness of Guangdong Provincial Emergency Hospital to the reengineering of out-of-hospital emergency care?

3. What are the impacts of the process of reengineering out-of-hospital emergency care on Guangdong Provincial Emergency Hospital?

In order to help the researchers better understand the project of reconstructing out-of-hospital emergency procedures in Guangdong Provincial Emergency Hospital and answer the above three research questions, this study adopts case study method (mix). This study is conducted under natural conditions, mainly obtaining detailed data through investigation to provide a holistic description of complex phenomena within their context, carry out a critical in-depth analysis to explore how things operate in a specific context, which aligns with the scope of qualitative research proposed by Zhan and Ma (2004). Lv et al. (2013) believe that qualitative research is primarily used to describe certain situations, processes, and relationships, allowing researchers to validate the correctness of theories in the real world and to provide a means for judging the effects of certain practices. Yin (2018) considers case studies to be the most appropriate method for answering "how" and "why" questions. The research question of this study exactly involves addressing such questions, seeking explanations for existing phenomena, and providing in-depth descriptions of some phenomena. Specifically, various data sources were extensively collected, including interviews, surveys, participatory observations, document collection and analysis, and critical analysis, to describe the project of reengineering out-of-hospital emergency procedures in

emergency hospitals in Guangdong Province from 2020 to 2022.

Yin (2018) believes that, case study can be applied in various fields as a research method. In the field of management in China, the case study method has gradually received attention, focusing on multi-level dialogue with reference theories, literature, and data (Wang & Li, 2022). Case study can help people fully understand complex social phenomena, organizational management, change paths, and the impact of key factors on organizational development and change, including researchers' empirical studies. Conducting a case study involves a series of steps: initiating and designing a case study, collecting case study data, analyzing the data, and finally writing the research report (Yin, 2018). In the process of data collection, diversified data sources should be used as much as possible to meet the "triangulation" condition of data resources. Y. Wang and Li (2022) believed that in addition to conventional data collection methods such as interviews, questionnaires, and organizational annual reports, it is also recommended to expand new data collection methods, such as online questionnaires and participatory observations.

1.3 Structure of the thesis

This thesis contains six chapters. Chapter 2 introduces the literature review of process reengineering, discussing its basic characteristics, its development process, and how it can be successfully applied to healthcare management. It also revises literature on the readiness of organizations for BPR, presenting a conceptual model that, later in the thesis, will inform the study. Chapter 3 introduces the methods adopted in the empirical research and the case study method and elucidates the research objectives of this study. Chapter 4 starts with a description of the Chinese healthcare system and Guangdong Provincial Emergency Hospital, focusing on the presentation of the empirical research in order to address the three research questions formulated in the study. Chapter 5 discusses the empirical findings. The thesis concludes with Chapter 6, which presents the main conclusions of the study, its limitations as well as suggestions for further research.

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Chapter 2: Literature Review

In the field of Business Process Reengineering (BPR) and its associated domains, both domestic and international academic communities have achieved significant research results. These communities have established a scientific and rigorous system for planning, controlling, and supervising, guiding numerous organizations in successfully completing their business process reengineering projects. Furthermore, hospital process reengineering management methods share similarities with those employed by businesses and factories and have shown notable progress.

2.1 The emergence and development of business process reengineering (BPR)

The concept of process reengineering was initially proposed by Michael Hammer and James Champy as a method for transforming businesses. Practically, achieving business process reform entails modifying the operational mode of work activities. In 1903, Henry Ford introduced large-scale assembly line production, substantially reducing costs, enhancing production efficiency, and boosting widespread popularity of the Ford Model T car. Consequently, Ford rapidly grew to become the world's leading automobile manufacturer. According to Peter Drucker's book "The New Industrial State" published in 1950, he regarded Henry Ford's mass production mentality as a genuine revolution (Huang, 2004). The emergence of the assembly line introduced a new phase in process management technology, making it the primary management technique for large-scale manufacturing in enterprises and initiating a revolution in specialization-based process management. Specialization-based process management became the prevailing approach in organizational management (Huang, 2005).

From the late 1940s to the early 1990s, the information technology revolution played a significant role in societal and economic transformations. It had an undeniable impact on the institutional and economic changes. The two were mutually reinforcing, establishing a symbiotic relationship between the technological revolution and society, creating a conducive "ecosystem" for advancing the information technology revolution (Yan, 2005). Due to the

continuous progress of information technology, traditional business management models can no longer adapt to the rapidly changing market. In order to maintain competitiveness, enterprises must explore new methods to enhance efficiency and drive knowledge accumulation and innovation through economic benefits. Without fundamental reforms and innovations at higher levels, enterprises will inevitably lose competitiveness over time in a broader environment encompassing national security, economic demands, and corporate interests.

Due to the globalization of markets, the world is transforming from a fragmented market to a global market. The sales and procurement processes have developed into a globalized state, and producing high-quality products and services is one of the key issues in adapting to the global market competition. Since the 1970s, the process of European economic integration, led by Western European countries, has accelerated. This process, through eliminating trade barriers, establishing a common market, and a monetary union, has promoted economic cooperation and integration among European countries (Lu, 2020). During the 1970s and 1980s, industries in Western countries faced significant pressures. For most Western companies, globalization brought about the emergence of new competitors and resulted in numerous changes in the patterns of industrial development and upgrading (Song, 2011). As competition pressures continue to intensify, multinational companies must gain recognition from their host countries and skillfully integrate themselves into the local business environment in order to survive in an intensely competitive world. In the globalized landscape with its interconnected and rapidly changing dynamics, people are compelled to reassess the business processes of their enterprises to maintain excellence and enhance long-term competitiveness more important than ever before (Li, 2017). For this reason, in the 1990s, the United States initiated a wave of revolutionary management. Many enlightened individuals began contemplating and exploring the most valuable and optimized work processes. Among them, Michael Hammer of MIT identified that many processes in American companies were products of outdated concepts and no longer met the needs of the times. However, there was a lack of comprehensive understanding of the overall production of the enterprise and little knowledge or concern for colleagues' work. No one was responsible for the business process, yet people continued to follow and accept it as the norm. Failure to address this issue in a timely manner would have serious consequences. Therefore, Hammer first published an article in the Harvard Business Review, suggesting that the American business sector should reevaluate its management thinking and operational processes, redesign work methods, eliminate unnecessary steps, reduce complexity, and avoid generating and inputting redundant

data. This would lead to faster, more efficient, and better work. Employees should possess the spirit of being the masters of external and internal customers as suppliers, providing high-quality products. This would enable enterprises to achieve more significant improvement in cost, quality, service, and speed, differentiating them from their competitors. Only by redesigning the current work processes and abandoning the old mindset regarding functions and hierarchies can companies be saved and revitalized (Hammer, 1990). This is one of the most exciting and creative endeavors in the business world. Hammer's article served as a clarion call.

In 1993, Michael Hammer and James Champy, the Chairman of CSC Management Consulting Company, published the book "Reengineering the Corporation," introducing the concept of business process reengineering. According to Hammer's latest explanation, he believes that "enterprise reengineering" actually refers to "business process reengineering". In 1995, Champy's new book "Reengineering Management" was published, which presented a method framework for transforming existing business processes and received widespread acclaim from readers. By restructuring business process operations, companies can better adapt to the demands of survival and growth, leading the industry to recognize that American enterprise reengineering was a significant factor in surpassing Japanese companies in the 1990s. The works of Hammer and Champy have been translated and published in many countries, making the concept of enterprise and process reengineering a guiding principle for survival and development in major companies. The ideology of reengineering has brought a significant transformation in the development of management studies (Ying, 2013), attracting attention in Europe, America, and globally, igniting a wave of enterprise reengineering worldwide.

Kaizen is a Japanese word that is becoming increasingly common in many western companies. This word refers to the process of continuously improving standard work practices (J. C. Chen et al., 2001). Japan, influenced by the business process reengineering wave at the time, adopted advanced technologies from the United States and Europe on a large scale. In the face of intense competition and the pressures of globalization, Kaizen was introduced and applied by Imai in 1986 to improve efficiency, productivity, and competitiveness at Toyota (Dhongade et al., 2013). Since then, Kaizen has become a part of the Japanese manufacturing system. It is implemented nationwide in Japan, engaging in improvement projects and exploring flexible manufacturing technologies to adapt production to changing customer and market demands in a short period of time. After the Second World War, Japan experienced a miraculous economic recovery, which sparked great interest in Japanese management

practices worldwide. Consequently, Kaizen has become a widely discussed and applied manufacturing concept in various industries globally (Singh & Singh, 2009). Looking at renowned companies worldwide, they have adjusted themselves, learned from the strengths of each other's management models, and examined their own management deficiencies. Whether it is Western or Japanese companies, everyone realizes that they can truly flourish only by understanding the philosophical essence behind different management models. Production manufacturing is a global activity, and there may no longer be an absolute "Japanese-style management" or "American-style management" model. Therefore, we should focus on good process reengineering management methods and effective practices, regardless of origin.

In the late 1990s, the academic community explicitly proposed the concept of process management based on process reengineering. Process management focuses on creating end-to-end excellent business processes and is an innovative approach to studying the core concepts of operations management. Operations management refers to designing and managing business processes (Anupindi, 2003). It aims to achieve process management objectives by planning and controlling process structure and process driving forces. Process management incorporates the thoroughness and fundamentality from the original definition of process reengineering into standardization and systematization, reflecting it as a continuous improvement and systematic approach (Y. Li & Chen, 2019). As a result, process management offers businesses a more systematic choice for process improvement, functioning as a comprehensive quality management initiative with the goal of enhancing every aspect of the organization through overall improvements. The transformation of process management during this period primarily focused on establishing process management systems and highlighting the relationship between process management and strategy, demonstrating the integration and value of process management. Value creation strategies emphasize capturing all the elements in the value chain that can increase enterprise value, and comprehensive coordination of the value chain forms the company' core competitiveness (Guangzhou Zhujiang Iron Steel Co., Ltd, 2006).

2.2 The basic concept of business process reengineering (BPR)

Business process reengineering (BPR), also known as process restructuring or enterprise redesign, was first proposed by Michael Hammer in 1990. It is discussed in the articles "Reengineering: The Key to Achieving Breakthrough: How Companies are Re-Thinking and Redesigning Their Operations for Competitive Advantage" (Hammer,1990) and the

"Reengineering the Corporation: A Manifesto for Business Revolution" co-authored by Davenport and Short (1990). The term "reengineering" was first introduced, emphasizing the fundamental redesign of enterprise processes utilizing the powerful capabilities provided by modern information technology to achieve unexpected performance improvements (Hammer, 1990). It also highlights that the main challenge of management is to adjust or eliminate non-value adding processes rather than automating existing processes using information technology (Alghamdi et al., 2014). Davenport and Short (1990), on the other hand, uses the term "redesign" to refer to the analysis and design of workflows within or between organizations. Hammer and Champy (1993) co-authored the classic book "Reengineering the Corporation: A Manifesto for Business Revolution" in 1993, which first presented the definition of business process reengineering (BPR): the fundamental reconsideration and radical redesign of business processes to achieve significant improvements in cost, quality, service, and speed, which are crucial indicators of business performance. The concept of BPR presented in this book received considerable attention and widespread recognition in both the business and academic communities, sparking a wave of "business process reengineering" (Hammer & Champy, 1993). Furthermore, they further elaborated on a more insightful viewpoint: reengineering refers to the rapid, thorough, and continuous restructuring of organizational strategies, value-added operational processes, as well as the supporting systems, policies, organizations, and structures in order to achieve optimal workflow and productivity.

After Hammer and Champy proposed the definition of business process reengineering, many experts and scholars have subsequently put forward their own understanding of the definition. For example, "enterprise process redesign" by Morrow and Hazell refers to examining activities and information flows in critical processes in order to achieve the objectives of simplification, cost reduction, quality improvement, and flexibility. "Enterprise process redesign" by Short and Venkatraman refers to the reconstruction of internal operational processes in order to improve customer product distribution and shipping services performance. "Enterprise process redesign" by Johansson and others refers to how organizations achieve significant changes in cost, cycle time, service, and quality. It requires many tools and methods and emphasizes that an enterprise is a collection of customer-oriented core processes rather than a collection of functions. An organization gain recognition and support only by continuously creating value for customers (Guangzhou Zhujiang Iron Steel Co., Ltd, 2006). "Enterprise process innovation" by Davenport refers to the process innovation work that achieves significant improvements in an organization. "Core process redesign" by Kaplan and Murdock involves a fundamental rethinking of how a

business operates and simultaneous integrated redesign of its workflows, decisions, organization, and information systems (Tinnila, 1995). Japanese process reengineering expert Kobayashi Hiroshi believes that reengineering is a method of enterprise reform with no fixed vocabulary definition. If we were to define it boldly, it could be interpreted as the reintegration and combination of certain elements; that is, reengineering mean recombining and replacing the essence of existing business processes.

In general, the definitions provided by these experts and scholars emphasize the goals of business process reengineering, including process simplification, cost reduction, quality improvement, flexibility enhancement, and customer value creation. Their definitions cover aspects such as examining key processes, reconfiguring operational processes, and achieving comprehensive changes through cost, cycle, service, and quality modifications. Regardless of the definition, business process reengineering is seen as a fundamental reform approach used to reassess and improve an organization's workflow, decision-making, organization, and information systems. These different expressions have different emphases, each with its merits; however, they all agree that redesigning enterprise business processes can lead to significant changes in performance, enhance control efficiency, and improve market competitiveness (Li, 2017). Nevertheless, they lack targeted empirical analysis of business processes, which is a limitation in BPR research. Therefore, the field of BPR requires empirical research to validate the feasibility of methods and concepts in practice.

Business Process Reengineering (BPR) uses modern information technology and modern management methods to rethink and completely redesign business processes in order to improve operational efficiency. It aims to achieve technological integration and functional integration through resource integration and optimization, speeding up the transformation of management models and operation methods. By redesigning business management processes in the simplest and most direct way, it enhances the scientific, standardized, refined and informatized level of organizational operational management, and achieves significant improvements in cost, quality, service, efficiency, and value creation (Habib & Shah, 2013), in order to adapt to the characteristics of the modern business environment such as the market, customers, competition, and changes. However, only focusing on the process of business process reengineering while neglecting other important aspects of the organization such as organizational structure, personnel, communication, and technology (Grant, 2002) would be too narrow. We focus on improving the entire organization.

In this ever-changing and challenging world, the way that the work is done is a key factor in the success of a business. Some large American companies such as IBM, Ford, General

Motors, and Kodak, based on their learning from the comprehensive quality management, lean production, just-in-time production, and team management experiences of Japanese manufacturing, strive to achieve flat hierarchical structures and streamlined decision-making processes through rethinking their business transformation models (Cheng, 2002). These new management concepts and methods, through the redesign of organizational operational processes, avoid resource waste in all processes, maximize the value creation of business processes, demonstrate the potential for cost savings, stimulate process dynamics, meet the high-speed development needs of enterprise and supply chain management systems, and improve and enhance performance, enhance the competitiveness of enterprises, and achieve sustainable development. Practices have proved that these large companies, after implementing business process reengineering, have achieved tremendous success through the scientific configuration, fine management, and effective utilization of core resources such as manpower, finance, materials, and technology, as well as a series of management methods and approaches. Therefore, companies in the United States, Japan, and Western Europe have emulated this practice. According to the statistics from American research institutions, it is estimated that in the late 1990s, influenced by the wave of corporate reengineering, the vast majority of large American companies implemented various forms of enterprise reengineering to varying degrees (Zhou, 2014); according to a report by CSC Index consulting firm on the implementation of reengineering projects, 69% of companies in the United States and 75% of companies in Europe have implemented one or more business process reengineering projects (Chen, 2005). In recent years, process reengineering has not only become a hot topic in academic research in the management field but also has formed a trend of discussion and application in the international business community, promoting the deep integration of core business operations and operational management, integrating modern management concepts, methods, and technologies into various fields, levels, and processes of operational management, and enhancing the refinement of operational management. Nowadays, process reengineering is being recognized and valued by more and more people and applied in various industries in order to achieve breakthrough performance.

Since the inception of process reengineering, process management, lean improvement, and value creation have gradually become mainstream ideas in management science, especially in the current environment influenced by macroeconomic and business factors. According to Bashein et al., 88% of large companies have participated in business process reengineering projects (Fazel & Salegna, 1996). The birth of process reengineering completely changed the status of process management in management science and its

extraordinary value has been confirmed, marking the maturity of process management. An organization with this ability means it is on the road to success. However, it is important to realize that while some companies have revitalized their businesses through process reengineering, the failure rate of process reengineering is still high (Chen, 2005), and many business process reengineering projects fail mainly due to not following the correct sequence of different reengineering projects and evolutionary stages (Hussein et al., 2013).

Process reengineering is a brand-new business model that embodies the idea that practice is the only criterion to test truth. By reshaping existing business processes, it emphasizes fundamental planning and designing of corporate procedures (Dai, 2018), including appropriate adjustments to resource structures and human resource structures, transforming the organization into a new process-oriented enterprise. It is essential to integrate everyone's strengths and combine them with the practical situation of the enterprise, especially understanding how these plans are related to the organization's goals or culture. This can achieve a fundamental transformation of the business and management methods of the enterprise.

In order to fully understand the meaning of process reengineering, it is necessary to understand the concept of process. The Oxford English Dictionary defines a process as a series of continuous and regular actions that occur or are carried out in a determined manner, leading to the achievement of specific results. The classic approach is to redefine processes step by step and systematically improve them. The simplest process consists of a series of independent tasks with an input and an output (Allan, 1993). In the process, the input content undergoes transformation and ultimately generates the desired output. One of the important missions of management is to create value, focusing on managing inputs and outputs or results (Huang, 2020).

2.2.1 Key elements of the process

The main components include personnel factors, activity content, coordination situations, technological applications, which are described in detail as follows:

Focus on human resources, that is, the activity executors, considering personnel roles as steps in this process. People are easily overlooked in the process, but in fact, they are the most difficult factor to change in the process (Alghamdi et al., 2014). Ideologically, encouraging employee communication to understand the BPR process and vision, empowerment, teamwork, quality improvement, innovation, and customer focus is crucial. Employee

education and training are important factors for successful BPR implementation. Neglecting human resources, team building, and organizational culture is a major reason for failure (Habib, 2013). Creating organizational value through employee and customer satisfaction will affect personnel mobility and strategic alignment in value creation (Abdullah et al., 2019). Total Quality Management (TQM) is a widely accepted management system and is an important method adopted for improving organizational competitiveness along with Business Process Reengineering (BPR). To successfully implement BPR, TQM goals must be given priority, and team members need to accept the concepts and practices of BPR and TQM through training. Team members should have the authority to implement change and possess leadership to motivate everyone to participate in activities (González-Benito et al., 1999). In the control phase, to consolidate success, employees need to be educated and trained to continuously improve under the new systems and processes, instilling confidence in achieving fundamental reshaping. The BPR concept continues to thrive in organizations, closely related to revised reward and incentive systems.

Focus on the content of activities. With increasing social demands and competitive pressures, relying solely on continuous improvement focused by TQM is not enough. It is necessary to implement BPR, carry out cross-functional boundaries and creative redesign, and improve existing processes. TQM, focusing on changes in behavior and attitude, can provide a supportive cultural environment for the implementation of BPR (Habib, 2013). People focus on rethinking business processes, starting from the perspective of customers, understanding their needs in a timely manner, and creating more value for them (Zinser et al., 1998). From another perspective, Total Quality Management (TQM) and Business Process Reengineering (BPR) are complementary methods for achieving organizational change and process improvement. They both strive to improve business processes to the maximum extent for success (Bhaskar, 2018).

Focus on the connection methods between activities: starting point, endpoint, serial, parallel, and cross, as well as feedback structure. In fact, team trust, effective communication, training, and commitment to activities have been identified as key contributing factors to the successful implementation of process reengineering. If change is not properly communicated, it can increase resistance to change and become one of the biggest obstacles to change (Habib, 2013). Of course, the culture of the organization also has a significant impact on the process. If reform measures are found to be inconsistent with the culture, either the culture needs to be changed before implementing the reform to overcome cultural barriers, or other tools that are compatible with the culture and strongly related to achieving goals should be considered

(Fazel & Salegna, 1996). Alliance management capability is a multi-dimensional structure that requires the establishment of a cross-functional team composed of functional department members, including communication, coordination, and alliance skills. This has positive impacts on value creation, integration of resources and capabilities, and valuable information transfer. Stronger alliance management capability is positively correlated with competitive advantage and value creation for businesses.

Focus on the technical implementation methods of activities, including the use of high-tech, and computers. Information technology plays a core role in the process. If IT and BPR are used simultaneously, a more flexible, team-oriented, coordinated, and communication-based effect can be created, providing a method for achieving breakthrough performance and reducing the risks of BPR projects (Eftekhari & Akhavan, 2013). Widely valued information technology capability can create business value through its process creation and help organizations build a strong network environment. IT can simplify complex work, achieve significant improvements, and support the thorough redesign of business processes (Yin, 2010), serving as a mechanism for businesses to improve performance. Modern high-tech is a necessary facilitator in process activities. Business process tools and technologies come from various disciplines and fields, including business process analysis, coordination, industrial engineering, bench-marking, management information systems, and human resources analysis and design.

Process reengineering should be seen as a sustainable event for organizational improvement or redesign strategies, and should follow a cyclical pattern. In practical work, the ideal effect is to first make radical changes to outdated processes, then make incremental improvements, and make dramatic changes if necessary (Fazel & Salegna, 1996). No philosophy or tool by itself can save poorly designed implementation plans. If process plans are not aligned with the organization's strategy and culture, relying on tools and technology may not necessarily lead to success. Therefore, the effectiveness of processes depends on the process design, qualified execution personnel, and suitable operating environments. It is important to regard BPR as a strategy that requires various elements and resources to be successful (Irani et al., 2000). China has a famous proverb: "Heaven's timing, Earth's advantage, Harmony between people."

2.2.2 Redesigning business processes

When redesigning business processes, four main features should be found in the project:

fundamental, radical, dramatic, and process.

Fundamental refers to the process of enterprise reengineering, where leaders must address fundamental questions about the company and its operations: why are we doing this? Why are we doing it this way (Bhaskar, 2018). When processes become outdated, inefficient, and unable to meet the needs of the business, they must be redesigned or replaced. In this process, it is necessary to break free from traditional frameworks and freely reconstruct all business processes according to actual needs.

Radical means thoroughly innovating things, fundamentally changing existing things, and discarding all established practices and fixed structures, creating and inventing new methods of work. In the face of intense competitive environments, companies must either redesign their processes to adapt to the global situation and turn things around, or they will be eliminated. Typically, only 5% to 20% of processes involve value-add steps, which means that 80% or more of the steps in most processes can be eliminated (Bhaskar, 2018). Therefore, process reengineering is about reconstructing a company, not just improving, enhancing, or adjusting it. It is not enough to simply add new processes, but it is necessary to have the determination to support the new values and beliefs required for process activities in order to meet this challenge. Many studies suggest that value creation can be achieved through the development of new products and services (Abdullah et al., 2019), and innovation capability has significant positive impacts on value creation.

Dramatic means redesigning business processes with the aim of achieving breakthrough progress in cost, quality, production, customer satisfaction, service, and time. Pursuing performance improvement is also a significant goal, aiming to optimize enterprise resources to achieve the best objectives. This means that the results achieved through process reengineering will be dramatic, with significant leaps in performance, substantial cost reductions, reduced time, and improved quality. Process reengineering can bring about exceptional results, provide higher quality outcomes, and significantly enhance customer satisfaction. Total Quality Management (TQM) and Business Process Reengineering (BPR) are so popular because their successful implementation brings clear rewards to organizations. If TQM and BPR are not aligned with the organization's strategic goals and culture, or if their holistic nature is overlooked, it can lead to failure (Fazel & Salegna, 1996) .

Business processes involve two types: operations and management, both of which are the daily work based on the organization's basic business objectives. Management processes help control and plan, providing more efficient resources for operational processes. However, few companies strictly consider management activities as processes, which need to be redesigned.

Hammer and Champy believe that most business leaders are typically not process-oriented in their work, focusing only on specific tasks and lacking a concept of the value chain of business processes. Many companies that focus on quality and business process improvement find that business processes exist between cross-functional and cross-departmental teams within the organization, and most management processes are interrelated. To produce high-quality products and provide high-quality services, it is necessary to address interrelated system challenges. More and more companies are starting to focus on integrating the internal processes that create product value with the processes through which customers use the product, in order to extend the value chain (Davenport & Short, 1990).

2.3 Main directions for BPR

Currently, the research on business process is still in the early stage, and business process redesign needs further development. The main directions for the further development of business process redesign are discussed below:

(1) Highly integrated business processes: Highly integrated business processes revolutionize the traditional division of labor and commonly used assembly line production methods. In today's production methods, the responsibility is more distributed among a group of people rather than assigned to a single individual. In this production method, the emphasis is not on employees being fixed in one position or simply repeating a certain operation. Therefore, more and more companies have found it necessary to cultivate flexible, team-oriented, coordinated, and communicative work abilities to highly integrate the various activities within the business process. Complete products are produced by small teams (or an individual employee) in the same location. In summary, companies must maximize the interdependent and coordinated activities within the entire organization, rather than maximizing the individual heroism performance of specific individuals or business functions (Davenport & Short, 1990). In the implementation of BPR, a systematic and structured model is important, which establishes an integrated relationship with other ongoing process improvement plans and develops a performance evaluation scheme centered on business. Currently, this approach is mainly used in manufacturing companies and is also starting to be applied in service companies.

System integration refers to the widespread use of information technology and automation technology in the many activities of enterprise processes, in order to shorten the response time of processes. For this new method of cross-company coordination in business processes,

information technology has become the most powerful tool for reducing coordination costs. Process redesign applies the idea and methods of system integration, using information technology as a means to achieve optimal operation of enterprise management processes as a whole. Therefore, system integration is the key to process redesign. A process itself cannot exist independently; it must be embedded in an organizational structure. Process redesign emphasizes integrating as many activities as possible in enterprise processes, eliminating non-value-added activities in the process, and using collaborative work methods to solve various activities in the process. At the same time, it is necessary to reduce intermediate layers and rely on network technology to achieve information sharing and coordination among staff (Jang, 2004).

(2) Business process modularization: Business process modularization refers to decomposing the business process into several relatively independent modules with certain functions and standard interfaces, where the complete process is decomposed and each module focuses on its specialized project. Modular processes make an enterprise a dynamically assembled structure that can adapt to complex and changing agile enterprises. Business process work requires creative design or selection of a BPR model to meet the organization's current needs. Process redesign models can be divided into internal models and external models. Internal models originate from a familiar organizational cultural foundation, with the advantage of employees' familiarity and affinity, but they may also be too familiar and do not attempt to break the current operating mode. External models are based on extensive experience from other organizations and have their advantages, but if they cannot be adjusted according to the actual situation and changes in the organization, they are easily swallowed up by organizational culture. In practice, BPR is more of an art than a science. Further research is needed to identify under what conditions or domains the best practices are effective and the expected outcomes they generate (Mansar & Reijers, 2007).

(3) Virtual Integration of Business Processes: In order to adapt to the constantly changing global environment and maintain competitive advantage in the market, enterprises continuously seek external resources while integrating internal processes to achieve prominent core business and fast agility goals. Virtual integration of business processes becomes necessary. Some scholars argue that virtual integration models have higher productivity compared to hierarchical organizational models in business process reengineering (BPR), and can obtain economies of scale and scope, enhancing market responsiveness and innovation capability. Customer-driven process management across organizational boundaries has gained high recognition (Davenport & Short, 1990).

Considering individual processes without considering the impact of changes on other processes within the business may have adverse effects on the overall business. A beneficial practice is to model and evaluate the entire business, known as process integration models, to understand the interdependences and interactions of key processes (Hussein et al., 2013).

(4) Business Process Alliance: In the 21st century, businesses face increasingly fierce competition. Due to limitations in their own resources and core capabilities, businesses turn to focus on core competency areas and entrust non-core activities to strategic alliance partners, a process known as "coreization" of businesses. The increasing demand for personalized customer requirements requires related enterprises to improve flexibility and response speed, making integrated management a priority (Zinser et al., 1998). Consequently, a complete business process of an enterprise evolves into a combination of a series of related processes among multiple enterprises, known as business process alliance. Many existing business process reengineering efforts fail to focus on analyzing the business organizational environment, and BPR should apply a variety of different methods to coordinate the dynamic interaction between different types of organizational changes from a holistic perspective.

(5) Integration of Management Processes and Business Processes: In the information economy era of the 21st century, management activities such as planning, organizing, commanding, coordinating, and controlling, gradually integrate into business processes, providing real-time support and control for businesses, and tightly combine the command, control, and business chains to promptly resolve issues within the business process. This eliminates the problem of management activities being disconnected from business activities in the industrial era. Business process activities bring opportunities and challenges to management activities, integrating management processes and business processes effectively by placing management activities within the business process. Research shows that the success of BPR is related to the creativity of personnel within the organization, requiring courage for reform and not retreating even in the face of resistance (Kobu, 2002). Never forget the original intention and continue to advance.

2.4 The key success and failure factors of process reengineering

Literature research shows that since the concept of Business Process Reengineering (BPR) was introduced, many organizations have reported significant benefits achieved through successful implementation of BPR. However, it is estimated that up to 70% of organizations have not achieved the significant expected results when implementing BPR. This is because

BPR implementation involves complex situations such as organizational change. Researchers point out that by examining several key success and failure factors, traps can be avoided and successful implementation can be ensured in BPR. Many organizations need to undergo process reengineering in order to achieve their goals, meet customer expectations, and gain a competitive advantage. Through literature research on BPR, specific models based on decision leadership in planning and evaluation have been proposed, which lead to successful improvement planning and implementation (Irani et al., 2000).

In the literature review, the description of key success factors and failure factors varies among different authors. However, it can be argued that researchers have reached a consensus on five dimensions, including change management, project management, management support and leadership, organizational structure, and information technology. They have also found that most BPR projects lack dynamic management. Dynamic management with traits such as communication, feedback, and courage can enhance BPR implementation (Alghamdi et al., 2014). According to the literature, many BPR failures stem from human factors. This is because individuals lack understanding of the project, leading to emotions such as fear and doubt, such as middle-level managers fearing power loss, employees fearing unemployment, doubts about project outcomes, and discomfort with the new work environment. Key success factors in process reengineering in the UK public sector include reform management, employee commitment, effective communication, teamwork, and empowerment management. According to existing literature research, key success factors can be divided into four main categories and 17 sub-category factors (Habib, 2013). The literature research identifies preparatory indicators based on key success and failure factors, aiming to evaluate the readiness of organizations to implement successfully BPR. Among them, five categories, including equal leadership, collaborative work environment, management commitment, support management, and application of information technology, are positive indicators, while the sixth category of resistance to change has a negative effect (Abdolvand et al., 2008).

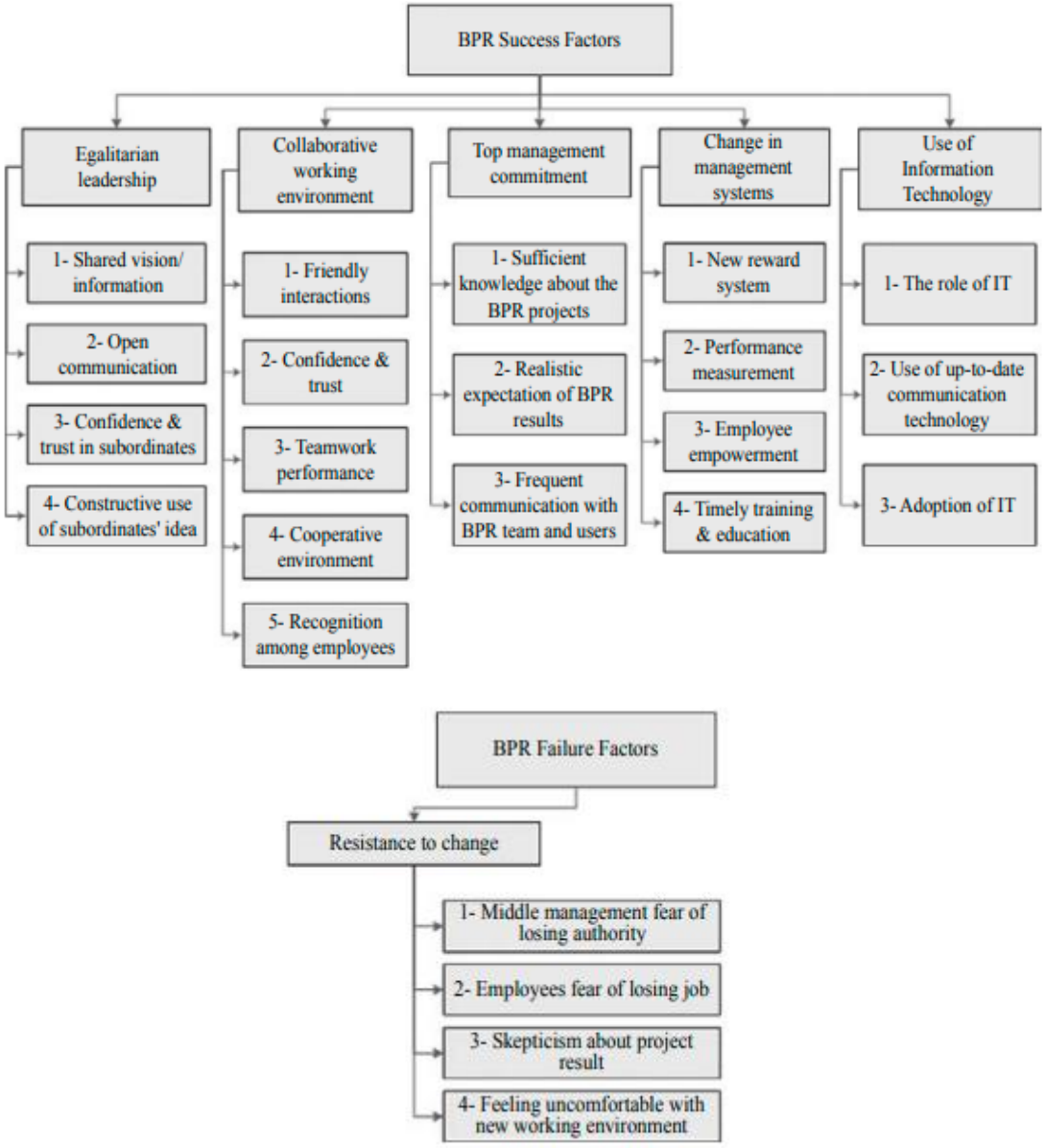

Figure 2.1 Key success factors and key failure factors

Key success factors in BPR for the higher education sector include teamwork and quality culture, quality management systems and satisfactory rewards, change management and human resource management, project management, and information technology application (Habib, 2013). Typical reengineering issues include five interrelated factors: processes, technology, people, communication and organizational structure, as well as three management levels: strategic, management, and operational. Practice has proven that the success of process reengineering no longer focuses solely on process redesign, but also emphasizes improvement in academic research and industry practices (Grant, 2002). In order to better analyze and improve existing processes, the literature research mentioned a successful BPR model, which includes allowing change, clearly defining objectives, sufficient flexibility, organizational communication, utilizing tools effectively, involving participants in the planning process,

integrating information technology, and change management. The failure of BPR often traces back to improper communication and resistance to change. In the implementation process of BPR, it is important to follow a systematic and structured model. According to existing literature reviews, most existing BPR models are not based on evaluations of current practices and successful practical experiences (Hussein et al., 2013). The literature summarizes a checklist for organizations to refer to when undertaking or preparing for BPR. The purpose of this checklist is to ensure effective BPR work and reduce the possibility of failure. Key success factors include changes in management systems and culture, management capabilities, organizational structure, project management factors, and IT infrastructure factors; while failure factors include management systems and cultural factors, management support factors, organizational structure factors, and IT infrastructure factors. Researchers also suggest further evaluating the importance of these factors in BPR work in the next step of studying implementing organizations (Al-Mashari & Zairi, 1999).

Through a review of relevant literature, other researchers have confirmed the key success factors and failure factors. Abdolvand (2008) and Habib (2013) pointed out that key success factors can be categorized into five types, namely egalitarian leadership, collaborative work environment, commitment from top management, management system change, and application of information technology. The sub-factors of these factors include achieving a shared vision, effective communication, trust and empowerment, constructive adoption of ideas from subordinates (front-line employees), mutual cooperation, self-confidence and trust, collective sense of honor, collaborative environment, recognition among employees, thorough understanding of the BPR project, realistic demand for the results of BPR, regular communication with BPR teams and users, new reward system, performance-driven approach, employee empowerment, timely training and education, IT role, the adoption of the latest technology, and the willingness to embrace IT. On the other hand, the failure factors of BPR only consider resistance to change, with sub-factors such as middle-level managers fearing power loss, employee concerns about unemployment, skepticism towards project results, and discomfort with the new work environment. The preliminary model is shown in Table 2.1.

Table 2.1 Preliminary Model of Business Process Reengineering for Out-of-Hospital Emergency Care

	Primary indicators	Secondary indicators	The connotation or meaning
Successful Key factors	Egalitarian leadership	Achieving a shared vision	Everyone has reached a consensus, which means standing together as one and working together with unity, so as to have enough patience and understanding towards the changes in organizational structure and culture.
		Effective communication	The transformation involves adjustments in organizational management, human resources, and the adoption of a new cultural environment. It is important to communicate extensively with all levels and stakeholders, ensuring that everyone understands Business Process Reengineering (BPR) through various channels and ensuring that the transformation is properly conveyed.
		Trust and empowerment	The organization and its members have reached a consensus on honesty and trust. The team is empowered to ensure appropriate teamwork, and team members should have the authority to implement change. It is also important to motivate everyone to participate and take ownership in the actions required for the transformation.
		Constructively embracing the ideas of subordinates (front-line employees)	Delegate power and responsibility as much as possible, foster cross-functional and efficient teams, and involve frontline employees who are directly impacted by the changes in decision-making processes. This approach demonstrates the supportive role of management and empowers employees to actively contribute to the decision-making process.
	Collaborative work environment	An effective BPR team that collaborates and assists each other	Team members possess skills, experience, abilities, and credibility, and collaborate without competing with each other. They work together to integrate resources and coordinate effectively, ensuring consistency in their efforts.
		Integration of BPR strategy with organizational strategy	High-level strategies, organizational readiness, and BPR strategies are coordinated and aligned. The organization's strategic guidance determines how to leverage or achieve organizational capability enhancement through BPR strategies to gain a competitive advantage. Consequently, tasks and processes are transformed accordingly.
		Collective sense of pride	Sharing and pursuing common goals while maintaining a positive cooperative attitude.
		Innovative cultural environment	The ability to adapt to change and foster a culture of innovation and development is conducive to establishing a supportive culture for change. It is important to maintain a positive and supportive attitude towards change.
		Strong leadership and	The leadership demonstrates decisiveness, courage, and capability to implement radical

	Primary indicators	Secondary indicators	The connotation or meaning
		employees who are willing to take action and follow instructions	change. They clearly communicate a clear vision to the employees, encouraging them to take proactive actions. The leaders have sufficient authority and knowledge to guide the change process effectively.
		Fully understand the BPR project	Clear understanding of work methods and clear goals; the vision of the process guides long-term and daily actions.
	Top management commitment	Have practical requirements for BPR results	Full understanding of the value and goals of BPR, setting performance goals and indicators for BPR, with expected levels of achievement.
		Regularly communicate with the BPR team and users	To avoid insufficient communication of change requirements, concealing uncertainties, and poor communication between the team and other individuals, it is important to have regular and ad-hoc communication through various forms such as meetings or written communication.
		New reward system	BPR has brought about different areas of focus, and the existing reward system is no longer applicable to the new work environment.
		Role of performance indicators	Stimulate the organization's capacity for change acceptance, encourage everyone to actively, attentively, flexibly, and systematically participate in BPR.
	Management system transformation	Employee empowerment	Top management support and commitment, formalization of new positions and responsibilities, and encouragement for everyone to participate in BPR without fear of negative consequences.
		Timely training and education	Educate and train employees to continuously improve in the new systems and processes, providing them with timely access to BPR skills and information, instilling confidence, and enabling the organization to thrive with the fundamental reshaping and ongoing prosperity of BPR principles.
		The role of IT	Establishing a robust IT infrastructure, ensuring alignment between IT strategy and BPR strategy, setting expectations for IT investments, enabling data access and utilization, leveraging IT to streamline complex tasks for significant improvements, and supporting the complete reengineering of business processes.
	Application of information technology	Adopting the latest technologies	The correct selection of IT platforms, the establishment of an effective overall system architecture, the adaptability and flexibility of IT infrastructure, and the reengineering of legacy systems into new systems that utilize the latest technologies.
		Willingness to embrace IT	Active involvement of the management in IT infrastructure planning, adequate IT investments, making the right IT procurement decisions, and converting IT investment

	Primary indicators	Secondary indicators	The connotation or meaning
Failure Key factors	Resisting change		decisions into easily understandable organizational strategies for internal dissemination.
		Middle-level managers fear losing their power	Sometimes top-level management forgets to ensure job security and position protection, leading to low morale and reduced employee commitment, as well as fear of losing job control and status.
		Employees worry about job security	During the implementation of BPR, most jobs and roles undergo changes, and employees may feel uninformed and uninvolved in the change process. They may perceive the change as too risky and fear that it could lead to bankruptcy. There is a fear of job loss and the loss of status.
		There is skepticism towards the project results	BPR may focus too much on short-term goals rather than long-term direction. Change is not appropriately communicated with all stakeholders, leading to a failure to convey the organizational vision and goals. There is a fear of the outcomes and a lack of optimism.
		Discomfort with the new work environment	Focusing solely on process transformation, lacking organizational readiness before the change, and neglecting the related elements of human resources, team building, job security, and organizational culture involved in the change.

Source: Abdolvand et al., (2008); Habib (2013)

BPR has been successfully applied in companies, providing a reference for healthcare managers in improving healthcare operational management models. Many healthcare organizations have realized the importance of process reengineering in enhancing organizational core competitiveness. Currently, BPR has been successfully introduced into numerous hospitals and healthcare systems. Therefore, by adhering to the basic principles of BPR, further optimizing the medical care and nursing processes of healthcare professionals, reducing patient waiting time, and ultimately increasing patient benefits and satisfaction can be achieved.

2.5 The development of process reengineering methods in healthcare management

Healthcare management refers to the planning, organization, coordination, and control of the entire process of medical activities in hospitals, in order to achieve optimal medical efficiency and effectiveness. The level of healthcare management is usually measured by comprehensive indicators such as the volume of medical work completed, medical quality, level of medical

technology, and medical economic benefits, among which medical quality is the most important indicator (Li, 2010). In 1996, Donabedian, an authoritative scholar in the field of healthcare system quality research in the United States, proposed three dimensions of medical quality concepts: structure, process, and outcome (Anupindi, 2003). The aim of medical process reengineering is to improve existing medical service processes, arrange patient treatment processes reasonably, and improve the overall level of medical services in hospitals without increasing hospital resources. Based on the convenience of patients, it enhances awareness of medical services and medical quality, reduces unnecessary procedures and expenses for patients, and truly achieves the requirement of "patient-centeredness" (Zhou, 2003). Process reengineering methods play an important role in the development of healthcare management.

China has successively issued the Guiding Opinions of the General Office of the State Council on Establishing a Modern Hospital Management System (2017), the Implementation Plan for Establishing a Modern Hospital Management System in Guangdong Province (2018), and the Guiding Opinions on Strengthening the Operation and Management of Public Hospitals (2020). These documents aim to design, plan, organize, implement, control, and evaluate various management activities of hospital operations, with comprehensive budget management and business process management as the core, and total cost management and performance management as tools. They also scientifically allocate, finely manage, and effectively utilize core hospital resources such as manpower, finances, materials, and technology, in order to promote the high-quality development of hospitals, accelerate the transformation of management models and operating methods, and further improve the scientific, standardized, refined, and informatized level of hospital operation management (National Health Commission, 2020).

Morgan and others have defined business process reengineering in the hospital field as follows: adjusting the work processes of various departments in the hospital, including reallocation of workflows, adjustments to work responsibilities, and service design (Dutta & Manzoni, 2001). Research has shown that a majority of the overall effect is contributed by a relatively small number of factors. Pareto referred to these relatively few factors as the "critical few". Renowned management scholar Peter Droeker also pointed out that the probability distribution of events in a social environment does not follow the "normal distribution" model of the natural world. In an organization, 90% of performance is created by 10% of the business. Therefore, when facing various business factors that affect organizational performance, the first step should be to identify the "critical few" that have a

decisive impact on organizational performance, and then focus on addressing the issues in these critical few business factors, fundamentally improving the overall performance of the organization (Peppard, 2003). Christopher Newman, fellow of the American College of Healthcare Executives, said, "Mistakes in hospital process design and operation cause about 110,000 patient deaths in the United States every year. If process management is done well, most disputes can be avoided" (Ho et al., 1999). Patient-centered research and clinical practice are becoming increasingly important in the healthcare field, as patients are able to identify gaps in services and there is a gap between healthcare providers and patients in understanding business processes. Research has shown that many epilepsy patients receiving emergency treatment experience a loss of autonomy and a sense of frustration, suggesting the need to consider the necessity of emergency hospitalizations in certain situations (Peterson et al., 2019).

Business process reengineering literature reports implementation in many other countries, including US, Sweden, UK, and Singapore.

Survey and analysis by Professor Stephen Walston of Cornell University in the United States showed that the number of hospitals implementing business process reengineering plans increased from 15 in 1991 to 144 in 1995, showing an increasing trend year by year. The growth rate slowed in the following years, with 110 hospitals launching in 1997 (Zhou, 2009). During the process of reengineering, American hospitals fully utilized the advantages of information technology and built efficient "flattened" organizations through enhanced communication, improved organizational structure, and increased empowerment, enabling hospitals to gradually adapt to fierce market competition. In California, the Daniel Freeman Hospital implemented the "clinical pathway method," studying and recording the medical behavior of patients with the same disease from admission to discharge, developing medical behavior standards to standardize medical behavior and improve the quality and efficiency of medical services. Bryn Mawr Rehab Hospital in Pennsylvania streamlined case file filling and strengthened medical record management using the BPR method.

In Sweden, the Stockholm Hospital reengineered the inpatient process by adjusting it around the "patient flow". By establishing a "surgery preparation room" for surgical process reengineering, patients no longer need to receive anesthesia in the operating room, addressing the issue of interruptions that took on average 59 minutes. By integrating the functions of the operating room, the bottleneck problem of surgeries in the hospital was solved, resulting in the closure of four operating rooms and an increase in the number of surgeries (Feng, 2005).

In the UK, the Hillingdon Hospital in London has transformed the blood testing process

from a traditional centralized laboratory to the clinical departments where patients are located in order to improve convenience for patients. This has reduced the average waiting time from at least one day to five minutes (S. Ma et al., 2001). Additionally, a rapid response team has been established to monitor various aspects of the healthcare service process to ensure the effectiveness of the process reengineering (Ekholm & Thor, 2000).

In Singapore, the Alexandra Hospital has analyzed and simulated new processes for the emergency department with the help of the Nanyang Technological University in New York, using applied engineering and new analysis techniques to improve the level of healthcare services (Hu, 2008).

Since the late 1990s, scholars in China have begun to apply BPR in the healthcare industry. In 1997, S. Ma et al. (1999) from Peking University Health Science Center conducted a study on the process of hospitalization surgery for a single disease using Restuccia's "appropriate length of stay criteria" from the United States. They found that due to an unreasonable process, 46.94% of the hospitalization time was classified as non-appropriate length of stay. They further conducted research on the hospitalization process of more than 20 common clinical surgeries, including nodular goiter surgery, laparoscopic cholecystectomy for chronic cholecystitis with gallstones, modified radical mastectomy for breast cancer, uterine smooth muscle surgery, and lung cancer, revealing the main problems and common causes in the hospitalization process. They distinguished between "valuable hospitalization days" and "non-valuable hospitalization days", "appropriate hospitalization days", and "non-appropriate hospitalization days", and proposed the concept of "standardized hospitalization process" (S. Ma et al., 1999). In 2002, Zhan and Ma (2004) used the "systematic reintegration" method of process reengineering to study the outpatient and hospitalization processes and services at Puning Hospital in Harbin. After reengineering, the number of hospitalized patients increased by 19.1% without affecting the quality of medical care and medical business income. The time required for hospital admission procedures was reduced from 50 minutes to 35 minutes, the patient satisfaction rate increased from 96% to 98%, and both the quality of medical care and medical business income improved. Therefore, it can be concluded that the reengineering of hospitalization processes can improve the efficiency of medical services without affecting the quality of medical care and medical business income, leading to increased patient and family satisfaction (Zhan & Ma, 2004). In 2004, a survey conducted in a tertiary hospital in Beijing confirmed that the length of patient waiting time directly affects the level of patient satisfaction with the hospital. The results of the survey of 100 outpatient patients showed that the average time patients spent in the

hospital was 1.5 hours, with 54% of this time spent waiting, and 65% of patients were dissatisfied with the hospital environment. One of the main reasons for dissatisfaction with the internal environment was the long waiting time for elevators. The long waiting time for elevators was due to the unreasonable layout of the pharmacy, sometimes requiring patients to take elevators multiple times to collect medication, causing inconvenience to patients and leading to a congestion of patients. By treating the outpatient pharmacy as a key point and starting point for process reengineering, the original decentralized management model of small unit pharmacies was transformed into a centralized and unified management model. Based on BPR methods, a central pharmacy model with 8 to 12 medication service windows was established using quantitative methods, which achieved good results after the reengineering (Chen, 2006). In addition to optimizing and restructuring the process for specific diseases, many large comprehensive hospitals have also reorganized and optimized their outpatient processes. In 2005, Southeast University Affiliated Zhongda Hospital utilized information platforms and technical support to achieve information sharing, improve efficiency, standardize and institutionalize workflows, reduce medical procedures, and implement process reengineering and quality control to optimize the allocation of medical resources (Zhao, 2006). On May 16-17, 2005, the "Sino-US Hospital Process Reengineering Symposium" was held in Beijing, organized by the Chinese Hospital Management Association. From different perspectives and levels, the symposium elucidated the background of hospital process reengineering, the basic concepts and elements of process reengineering, the basic significance of hospital process reengineering, and the current situation and development of hospital process reengineering both domestically and internationally, which promoted the widespread application of BPR in medical management in China (Feng, 2005).

Of course, in previous literature reports, some scholars also had reservations about the process reengineering of hospital management. Walston et al. (2000) indicated through research on relevant data from the American Hospital Association (AHA) that process reengineering must consider comprehensive services and coordination services, otherwise it would have an impact on economic benefits. Jackson and Massanari (2000) believed that the main reason why BPR cannot be widely promoted in the healthcare system is that government departments are not accustomed to rapid improvement and innovation. Osorio pointed out that when making significant process changes in public hospitals, many organizational and human factors must be considered in advance (Acosta & Alonso, 2001). Ho et al. (1999) believed that factors such as the lack of employee support and technology would hinder the

implementation of BPR. Caccia-Bava et al. (2005) believed that not paying attention to changes in customer/market-related business processes, added value elements of various business activities, and the correct use of innovative technology would also affect the implementation of BPR.

Emergency medical rescue is an important component of the national public health system. Initially, it was aimed at transporting and rescuing patients during wartime, but now it is also used for out-of-hospital treatment and transfer of trauma and emergency patients during peacetime. Due to significant changes in the composition of human diseases and causes of death, the incidence of trauma and acute cardiovascular and cerebrovascular diseases caused by various accidents continues to rise, becoming a serious social problem. Since the 21st century, major emergencies have occurred frequently around the world, such as the 9/11 attacks in the United States in 2011, the Bali bombing in 2002, the SARS epidemic and H5N1 avian influenza outbreak in 2003, the hostage crisis in North Ossetia, Russia, and the unprecedented tsunami caused by the 8.9 magnitude earthquake in Indonesia in 2004, Hurricane Katrina in the United States in 2005, severe winter weather and the Wenchuan earthquake of 8.0 magnitude on May 12, 2008, the 7.3 magnitude earthquake in Haiti in 2010, the tsunami and nuclear leakage caused by the 9.0 magnitude earthquake in Japan in March 2011, and the COVID-19 pandemic in 2019. Each emergency event has caused a large number of casualties, intensifying the battle between humanity and natural or man-made disasters. Every year, more than 78 million emergency patients in China visit emergency departments at various levels of medical institutions, with 6.42 million patients needing immediate and effective assistance (Shen et al., 2004). At the same time, more than half of the patients who die due to severe trauma cannot be transported to the hospital in time and die at the scene (Hao et al., 2008). If these people can receive timely and effective emergency medical rescue, the mortality rate of severe trauma will be significantly reduced. Therefore, out-of-hospital emergency care is particularly important and a focus of public attention.

2.5.1 The development of process reengineering methods in out-of-hospital medical care

Out-of-hospital medical care refers to the on-site rescue and safe transportation under monitoring of various life-threatening emergencies, injuries, poisonings, and disasters outside the hospital. It refers to the emergency medical care and the disposal from the onset of illness or injury to arrival at the hospital. The overall task of out-of-hospital medical care is to take timely and effective emergency measures and techniques, minimize the suffering of the

injured, improve their physiological condition, maintain their vital functions, reduce mortality and disability rates, and create conditions for treatment upon arrival at the hospital. Pre-hospital medical care is characterized by its suddenness, urgency, difficulty, and diversity.

The development of out-of-hospital medical care has gone through a long process. In 1966, the National Academy of Sciences published a research report entitled "Accidental Death and Disability: the Neglected Disease of Modern Society", proposing 24 recommendations for the construction of the Emergency Medical Service System (EMSS). This report marked the entry of pre-hospital medical care into the modern EMS era. In 1973, the United States enacted the Emergency Medical Service System Act (EMSS Act, Public Law 93-154), which established principles for the scope, content, organizational structure, management system, and admission standards for emergency medical services, thereby legally regulating the basic contents of the emergency medical system. A complete emergency medical service system (EMSS) has gradually formed (Peng et al., 2018).

The emergency medical service system is an integrated emergency network that combines pre-hospital medical care, emergency department diagnosis and treatment, intensive care unit (ICU) treatment, and the "green path" of various specialties. Pre-hospital medical care is responsible for on-site emergency care and care en route, while the emergency department and ICU are responsible for in-hospital care. It is suitable for both routine emergency medical work and emergency response to large-scale disasters or accidents. A complete emergency medical service system includes a sound communication and command system, on-site rescue, transportation vehicles with monitoring and emergency equipment, as well as high-level hospital emergency services and intensive care. The components of this system have their respective duties and tasks while maintaining close connections, forming a well-organized and centrally commanded emergency network. The emergency medical service system has been proven to be an effective and advanced structure for emergency medical services, playing an increasingly important role in rescuing the lives of the injured. It quickly delivers emergency medical measures to critically ill patients, at the site of illness onset, providing initial diagnosis and treatment to maintain their basic life. Then, the patients are safely transferred to the hospital, saving time for life-saving efforts and improving prognosis, ensuring the safety of patients' lives to the greatest extent.

The biggest characteristic of emergency medical services in the United States is that volunteer organizations undertake about half of the out-of-hospital emergency work, while private emergency medical institutions and fire departments play the main role in

emergency medical services (G. Li et al., 2001). Out-of-hospital emergency services consist of ground ambulances and air ambulances.

Ground ambulances are divided into basic ambulances and enhanced ambulances (Zhu & Wang, 2000), and are equipped with different emergency personnel according to the severity of the patient's condition. Emergency personnel in the United States include emergency physicians, emergency technicians, and emergency nurses (G. Li et al., 2001). Emergency physicians are a specialized type of medical professional; emergency technicians are mainly responsible for out-of-hospital rescue and transportation, including emergency medical technician-basic (EMT-B), emergency medical technician-intermediate (EMT-I), and emergency medical technician-paramedic (EMT-P) (Pozner et al., 2004). On-site rescue is generally carried out by emergency technicians, and emergency physicians only accompany the ambulance when necessary. Ground ambulances are located at hospitals and police stations in cities, with each hospital or police station equipped with an ambulance, one emergency technician, and one ambulance driver, sometimes with an intern (medical assistant or driver assistant) (Cai, 2010). Emergency nurses generally do not accompany the ambulance (X. Chen et al., 2017), but in many hospitals (especially rural hospitals), emergency nurses take on the responsibility of providing emergency medical services and provide support to on-site emergency personnel through radios and remote control systems.

Compared to ground ambulances, air ambulances in the United States have the ability to perform medical activities outside of hospitals. Medical helicopter teams consist of two pilots, one emergency physician or a third-year emergency department resident, and one nurse (Xin et al., 2018). Air ambulances perform initial on-site first aid and secondary transfer tasks, with 90% of the tasks being secondary transfers. Secondary transfer tasks mainly refer to transferring patients from peripheral hospitals (or level II and III trauma centers) to level I trauma centers, as well as transferring patients to cardiac centers when they are eligible for emergency bridging or emergency vascular intervention. Air ambulance teams can perform all emergency operations to stabilize the patient's condition during the transfer.

Dispatchers are usually responsible for answering emergency calls and recording the caller's address, nature of the accident, and other information, and provide telephone guidance to the caller on how to perform self-help before the ambulance arrives (Wander et al., 2014). At the accident scene, emergency technicians, based on their own judgment, send the patient to the nearest hospital without the need for instructions from the medical

dispatch center. They can directly contact the emergency department doctors at the receiving hospital through the wireless telephone on the ambulance, without going through the center's dispatch. When a patient needs to be admitted to the trauma treatment room, after contacting the hospital through the phone, relevant personnel from the receiving hospital immediately go to the trauma treatment room, make necessary preparations, and wait for the arrival of the patient (Zhu & Wang, 2000).

The emergency medical service system in France is the most representative model of emergency medical services in Europe, reflecting the aim of providing timely and effective medical services to emergency patients. In this system, in addition to the emergency medical dispatch center (abbreviated as SAMU in French) responsible for out-of-hospital emergency services, there are also fire departments, private ambulances, Red Cross volunteers, and military civilian security. SAMU is a nationwide emergency medical service organization primarily composed of physicians and is the core of out-of-hospital emergency services. It is responsible for answering emergency calls and assigning ambulances to respond (X. Gu & Nie, 2013). Each administrative region in the country has a major hospital with SAMU, while other central hospitals have mobile medical teams for monitoring and care (abbreviated as SMUR in French). Hospital doctors can participate in on-site treatment as attending physicians in SAMU for emergency tasks, or they can take regular shifts in related departments to improve the level of emergency medical services provided by SAMU (P. Wang et al., 2005). The dispatch personnel of SAMU consist of two parts: Auxiliary medical operators, who are non-medical personnel with high school education and must undergo 600 hours of professional training and assessment before being on duty. They are responsible for answering calls, filtering out non-medical calls after initial screening, determining the nature of the calls, and recording relevant information of emergency callers. After confirming the need for medical assistance, they forward the information to the dispatch doctors. Dispatch doctors, who are experienced emergency experts and the core of out-of-hospital emergency services. Dispatch doctors analyze various emergency calls based on patient conditions, addresses of occurrence, and surrounding circumstances, and make judgments. They may provide medical advice to callers, guide on-site treatment, contact hospitals, and have the authority to decide whether to transport patients to the nearest emergency department or a suitable hospital according to the patient's condition. If necessary, they can command doctors both inside and outside the hospital to participate in disaster medical rescues (P. Wang et al., 2005). In order to reduce the number of secondary transfers and the probability of transfer errors, dispatch doctors use online queries to understand the situations in major emergency

departments and the utilization of specialty department beds, aiming to improve the accuracy of referrals. In addition, the emergency network system in France also has a set of standardized and supervised management mechanisms to ensure that patients receive timely and effective emergency medical assistance and specialized treatment. The dispatch doctors of the emergency medical dispatch centers in France participate in the entire process of out-of-hospital emergency services, and the on-site doctors reporting the situation on site (on-site doctors) can seek guidance from the dispatch doctors at any time. When on-site doctors encounter difficulties during rescue operations, dispatch doctors should guide their rescue work, or transmit patient information to hospitals through information platforms and contact internal experts to provide on-site rescue guidance via video or phone calls. For critically ill patients who require immediate rescue, the dispatch doctors at the command center directly notify the receiving hospitals to prepare for the rescue. When critically ill patients arrive at the hospital, they are admitted directly to the intensive care unit or specialized wards to minimize treatment time. Throughout the rescue process, on-site doctors, dispatch doctors, and hospital doctors can share patient information, reducing the handover time between doctors and ensuring that patients receive the best follow-up treatment promptly (Xu, 2018).

Japan's emergency medical system includes three systems: emergency medical care, emergency transport, and emergency information. These systems are relatively independent in administrative management but closely cooperate in emergency operations, forming a relatively complete and coordinated emergency system (Tian & Gao, 2002). The professionals in emergency medical care include emergency responders, emergency medical technicians, emergency nurses, and emergency physicians. Different emergency personnel have different qualification requirements. The emergency transport system includes transport vehicles and emergency professionals, similar to China's out-of-hospital emergency system; the difference is that emergency work in Japan is carried out by fire departments. Emergency transport vehicles are divided into three types: ambulances, medical escort vehicles, and helicopters, each equipped with different emergency personnel. The emergency information system includes the emergency medical information center and the poisoning information center, which operate on a 24-hour shift basis. The center provides emergency medical information to fire departments, medical facilities, and residents, such as whether physicians in a specific department are present, whether emergency surgeries can be performed, bed availability, and blood and fluid inventory. Additionally, the center can provide professional guidance and advice to out-of-hospital emergency professionals. Emergency physicians

usually take shifts at the emergency information center. The poisoning information center is responsible for collecting, organizing, and providing information on the diagnosis and treatment methods of acute poisoning caused by chemicals, animals, and plants. It is staffed by physicians and pharmacists who are available to answer inquiries from residents and medical institutions (Yin, 1999). Because the information center is familiar with the situation of various medical institutions and closely connected to fire departments, when the center receives distress calls from patients or their families, it can choose the most suitable medical institution based on the patient's condition and the situation of relevant medical institutions, and notify the family or dispatch an ambulance from the emergency center (Ding, 1999). This method of emergency assistance helps transport organizations promptly deliver patients to appropriate medical facilities, ensuring valuable treatment time and avoiding unnecessary transfers due to improper selection of medical institutions.

Germany's emergency system is similar to France's, but the difference lies in the strict organization and legal protection of Germany's emergency system, which is orderly and smooth in its entirety. Whether it is land or air transport of casualties, rescue work in Germany is efficient. One notable feature of German emergency work is air rescue, which has been well demonstrated in the transport and treatment of COVID-19 patients. The specific responsible unit for German emergency is the fire brigade, which is responsible for coordinating and implementing emergency work and signing emergency agreements with municipal hospitals and university-affiliated hospitals. The hospital emergency organization is specifically responsible for the treatment of patients. Germany's emergency equipment is top-notch, and the configuration on all ambulance transport vehicles is standardized, including ventilators, electrocardiogram monitors, and automated external defibrillators, which are equivalent to a mobile ICU. The vehicles are also equipped with high-sensitivity communication devices. The emergency dispatch center is also very advanced, with five computers in front of each operator's desk. Dispatchers can use computers to access information about the location of the emergency, the utilization of each ambulance, and the vehicles at the emergency stations. The emergency dispatch center is connected to the police department via four lines and is responsible for dispatching ambulances and helicopters in the area, as well as coordinating the reception of casualties by hospitals (Zhao, 2002). The emergency dispatch center not only dispatches emergency stations within its jurisdiction but also can dispatch air forces, sea ambulances, and emergency forces from other regions, implementing multi-level rescues by land, sea, and air.

Australia's emergency measures are comprehensive, with a well-established coordination

mechanism and sufficient emergency preparedness across the country. The emergency experience of Australia can be summarized as follows: to expand the coverage of rescue services, the Australian government has developed both public and private hospitals, which together undertake rescue missions; the community emergency medical service system is improved because it directly faces the public and can provide assistance in a timely manner; due to the vast territory, the government has vigorously developed helicopters to provide an aerial rescue system (Fitzgerald et al., 2008).

China's emergency medical service system originated from the primary battlefield first aid and the rapid transportation of wounded soldiers during the Anti-Japanese War and the Liberation War. In the 1950s, some major cities established professional institutions for out-of-hospital emergency care called ambulance stations, mainly responsible for simple first aid and patient transportation. In the 1980s, emergency medical services entered a rapid development stage. In October 1980, the "Opinions on Strengthening Urban Emergency Work" was issued, and out-of-hospital emergency units across the country continued to grow and expand. In April 1995, the Ministry of Health issued the "Management Measures for Medical Rescue in Disasters and Accidents", which promoted the development and improvement of China's emergency medical service system. The SARS outbreak in 2003 and the Wenchuan earthquake in 2008 were severe tests for the medical and health departments' response capabilities. In 2005, the State Council issued the "National General Emergency Response Plan for Public Emergencies", and in 2007, the "Emergency Response Law of the People's Republic of China" was enacted and implemented (Liu, 2020). These actions marked a qualitative leap in establishing the comprehensive emergency management system known as the "One Plan, Three Systems" and laid the foundation for the establishment of a disaster emergency system in the country. In 2018, after the establishment of the Ministry of Emergency Management, efforts have been made to build an all-weather and all-hazard emergency rescue system, with health emergencies and medical emergencies as important components of emergency management. Since the outbreak of the global COVID-19 pandemic in 2019, China has promptly dispatched emergency medical rescue teams to establish temporary hospitals, implement triage treatment, strict isolation, dynamic containment measures, and accumulated valuable treatment experience.

The 120 system is responsible for out-of-hospital rescue missions in China, while Beijing has both the 120 and 999 emergency medical systems. The in-hospital emergency system mainly refers to the emergency departments, ICUs, and relevant departments that receive emergency patients in hospitals. In recent years, out-of-hospital emergency work has rapidly

developed nationwide, and various operational models for emergency medical systems have emerged, including the independent Beijing model, the out-of-hospital Shanghai model, the reliance-based Chongqing model, the administrative command-based Guangzhou model (Liang, 2017), the emergency linkage Hong Kong model (Cai, 2010), and the linkage-based Suzhou model (Zheng, 2009). Each of these six out-of-hospital emergency models has its own advantages and limitations. Due to the lack of unified emergency standards and non-standardized emergency work in different regions, it is obviously unfavorable for the overall improvement of the national emergency level and has led to imbalanced development of in-hospital and out-of-hospital emergency work in various regions.

Currently, emergency centers can be divided into three levels: good, medium, and poor. Good emergency centers have been established in developed cities such as Beijing, Shanghai, and Guangzhou, and they have rapidly developed in terms of scale, equipment, and team construction. Medium-level emergency centers have certain working conditions in most cities, with ambulances only equipped with simple emergency equipment such as first aid kits, stretchers, and oxygen bags. Poor emergency centers are only in name and cannot carry out out-of-hospital emergency services. Some remote areas or counties have not yet established emergency centers, resulting in significant gaps in out-of-hospital emergency services.

2.5.2 Comparison between out-of-hospital emergency medical service models

Below it follows a brief comparison of out-of-hospital emergency medical services models in the UK, the US, Europe, Japan and China.

The characteristic of the English and American out-of-hospital emergency medical service model is rapid intervention and management, with a focus on on-site stabilization and simple treatments. The main principle is "load and go", prioritizing hospital-based care.

The European model, represented by France, emphasizes on-site stabilization and emergency treatment. The concept is to dispatch emergency doctors to the scene and provide high-level medical care before reaching the hospital.

The Japanese out-of-hospital emergency medical service is organized into three levels: transport system, treatment system, and emergency information communication system. The system is well-structured with detailed division of labor and quick response.

The Chinese Guangzhou Model Command-oriented establishes a unified emergency medical communication and command center for the entire city. Emergency departments of hospitals are assigned different areas and specialties to provide out-of-hospital emergency

care. Chongqing Model (Reliance-based): Positioned as a department within a hospital, receiving coordination and supervision from both the hospital and health bureau. Works in parallel with other hospital emergency departments. Shanghai Model (Sole-type): Out-of-hospital emergency care is managed by the municipal medical rescue center, while emergency departments and ICUs in hospitals are responsible for in-hospital emergency care, serving as the support for out-of-hospital emergency services. Beijing Model (Independent-type): Establishes a modernized and well-equipped emergency medical center (Cui, 2014), implementing an integrated model of both out-of-hospital and in-hospital emergency care. Suzhou Model: Collaborates with dispatch commands "119", "120", "122", and "110", with the advantages of reducing emergency response time and receiving technical and equipment support in critical situations, as well as special support for rescue in dangerous areas, reducing duplicate investments in communication equipment. Hong Kong Model (Fire Department-affiliated): The organization responsible for out-of-hospital emergency care is under the jurisdiction of the fire department, supervised by the fire brigade, and closely connected to the police department, with a shared emergency hotline. The operational mechanism consists of out-of-hospital emergency care, network hospitals, and specialized rescue systems.

Based on the above comparisons, researchers have summarized the following characteristics: Shared responsibility for daily emergency care, accident and disaster rescue, and medical support for large-scale events, emphasis on on-site treatment and the requirement for licensed emergency doctors to provide on-site care and transport to the hospital, and unified planning, construction, and management by the respective countries with a national unified emergency hotline.

However, there are differences in collaboration, requirements for emergency personnel, and training methods between domestic and foreign out-of-hospital emergency medical service models, as described in Table 2.2.

Table 2.2 Comparison between Domestic and Overseas Models of Out-of-Hospital First Aid

Contents	**Overseas models**	**Chinese model**
Coordination of different departments	Various platforms coordinate and coexist with each other. Firefighting department and other rescue agencies work with emergency department. Emergency department has the right to dispatch and command firefight department and other rescue agencies.	Working in a single platform. Playing a major role in out-of-hospital first aid, "120" system is under the leadership of health authority but cannot dispatch and coordinate with other agencies.
Post requirement and training	Overseas, emergency doctors are 9-year doctors of medicine. They stay at the emergency department half the time, with	With education background at different levels, most emergency personnel are

Contents	Overseas models	Chinese model
for emergency personnel	rich clinical emergency experience. An ambulance driver is not only a driver but also a medical assistant. They have to receive professional pre-post training so as to assist doctors and nurses to complete the first aid of critically ill patients.	engaged in emergency after graduating from medical college. Few of them have received continuous education and training of standard emergency medical rescue.
Dispatching and commanding	Medical dispatching is completed by assistant medical telephone operators and dispatcher doctors, both of which are medical workers. As the core of rescue, dispatcher doctors need to confirm patients' conditions and make different treatment and contact corresponding hospitals based on patients' conditions.	There is no uniform and clear requirement for assistant medical telephone operators and dispatchers. Most of them do not receive higher medical education or practice and lack emergency medical rescue knowledge. Dispatchers only dispatch vehicle and personnel based on calling.
Equipment in ambulances	In addition to conventional equipment, the ambulances are equipped with on-site treatment and monitoring devices and some ICU devices.	Most ambulances are only equipped with conventional devices.
Linkage of out-of-hospital and in-hospital first aid	Based on information platforms, on-site emergency doctors, dispatcher doctors and doctors of recipient hospital are able to share information so that patients receive rapid, accurate, effective and reasonable distribution and follow-up treatment. Specialist doctors in the hospital guide on-site doctors to take emergency measures through this information system.	Out-of-hospital and in-hospital medical care is independent from each other. Major contact is through telephone. Patients' conditions fail to be transferred to the hospital in time.
Payment methods	Complete social medical insurance systems are constructed. Payment is made by governmental welfare agencies or insurance companies. Rescuers and patients are not worried about payment.	Medical services are basically paid by patients themselves or the government gives financial subsidies to the hospital according to regulations. The hospitals have difficulties in normal operation of first aid services because of financial shortage.

2.5.3 Main problems with out-of-hospital emergency medical services in China

The main problems affecting out-of-hospital emergency medical services China are several. Firstly, the rescue level and capabilities of medical personnel need to be improved urgently. In China, on-site emergency medical work is mainly carried out by one doctor and one nurse. However, the randomness and diverse demands of various major accidents and disasters create the need for handling diverse diseases. Rescue work needs to cover various departments such as internal medicine, surgery, obstetrics, pediatrics, as well as toxicology and infectious diseases. Doctors need to accurately and quickly diagnose and treat diseases, while nurses need to perform tasks such as "clear listening, clear seeing, clear asking, and

double-checking". Therefore, emergency medical personnel need to possess solid theoretical knowledge, proficient operational skills, and good psychological qualities. Currently, there are three main sources of medical personnel engaged in out-of-hospital emergency medical services: transfer from hospitals or other departments, allocation from medical schools, and temporary hiring or borrowing (Zeng, 2003). At the same time, there is a shortage of out-of-hospital emergency medical personnel (He & Nie, 2007), and there is a high workload in the emergency department. Many medical personnel are not willing to transfer to work in the emergency department or continue working there (Chu, 2012), making it difficult to ensure the quality of treatment.

Secondly, there is a lack of public self-rescue and mutual aid awareness, as well as community rescue capabilities. The primary task of out-of-hospital emergency medical services is to save lives. The optimal rescue time is within the "golden 10 minutes of emergency assistance" and the "golden 1 hour for trauma", which means cardiopulmonary resuscitation (CPR) should be performed within 10 minutes, and rescue after trauma should be completed within 1 hour. Therefore, the self-rescue and mutual aid of the public and the community's rescue capabilities are crucial (Chen & Ke, 2013). However, China has not yet popularized emergency medical knowledge among the public, nor have departments such as medical services, flight attendants, tourism, law enforcement, and traffic police conducted standardized training in emergency medical skills. Some people even believe that CPR is a professional skill for medical personnel and that individuals do not need to learn it. This has resulted in most cardiac arrest/respiratory arrest patients being found helpless after being discovered (C. Liu et al., 2005), missing the golden time for rescue (Y. Wang et al., 2007).

Thirdly, the out-of-hospital emergency medical equipment in most cities is relatively simple, and there is a lack of modern emergency equipment in ambulances (Zhang et al., 2020). Due to the lack of automatic positioning information in China's emergency dispatch command centers, dispatchers need to spend some time asking for the patient's detailed address, resulting in delayed response times (Li, 2015). The use of GPS satellite positioning systems can accurately locate and improve out-of-hospital emergency response times. If an information sharing system is further established and electronic maps are applied, it can improve the speed and level of the out-of-hospital emergency medical system, reducing the mortality rate.

Fourthly, dispatchers are the core strength of out-of-hospital emergency medical services, and dispatching doctors are essential. The quality of dispatching command directly affects the speed and quality of out-of-hospital emergency medical services (Chen, 2013). However, in

most places, dispatchers are not medical personnel and lack knowledge in emergency medical care. They only act as "message takers" and transfer distress calls to the corresponding hospital, without the ability to analyze and judge, let alone guide on-site treatment.

Fifthly, the accuracy and timeliness of records made by out-of-hospital emergency medical personnel are poor. They rely on the memory and verbal statements of attending doctors to carry out emergency medical work, resulting in a disconnection between out-of-hospital and in-hospital emergency medical information. Therefore, through the connection between the ambulance work platform, the terminal radio, the emergency command center database, and the expert guidance information platform, and by effectively monitoring and improving the level of business management, it is possible to establish and improve a seamless green channel mechanism between out-of-hospital and in-hospital emergency medical care, thereby improving the success rate of patient resuscitation and reducing the mortality rate (H. Chen & Tao, 2007).

Out-of-hospital emergency medical services are an important part of the healthcare and social security system, as well as a constituent part of public administration. The improvement of out-of-hospital emergency medical care not only reflects the level of access to medical emergency services enjoyed by the people, but also reflects the comprehensive medical technology level and timeliness of medical management in a country/region. Out-of-hospital emergency medical care is not only related to the success rate of critical patient rescues but also demonstrates the government's guarantee of basic rights and interests to its citizens. Especially during the 2019 epidemic, medical and health institutions around the world faced tremendous challenges. Therefore, continuously optimizing the process of out-of-hospital emergency medical care, improving emergency medical efficiency, and ensuring the medical health and safety of the public are critical issues that need to be addressed urgently in emergency medical work.

Chapter 3: Methodology and Research Methods

This study aims to explore whether the application of Business Process Reengineering (BPR) had a positive impact on the efficiency of emergency medical services outside the hospital, without compromising service quality. This research contributes to understanding whether the changes implemented to maximize the utilization of emergency medical resources in the shortest possible time were able to create added value for patients.

3.1 Research objectives

We know that after in-depth and effective research, outpatient emergency care, emergency care, and process reengineering are not entirely new knowledge systems for individuals. The efficiency of emergency services, especially outpatient emergency care, is related to the efficiency of life-saving measures. Therefore, adopting process reengineering and optimization to support outpatient emergency activities should be seen as a top priority and further research is needed in this field. With the widespread application of 5G networks, "5G + emergency medical care" has become a strong exploration of high-quality emergency medical resources (Qiao & Zhang, 2020). Researchers believe that 5G technology will bring new development opportunities for pre-hospital emergency care (Guo et al., 2021). However, existing research does not explicitly address the core process of process reengineering. The researcher will achieve the objectives of this study by answering a set of research questions that are described next.

3.2 Research questions

This study aims to better understand the benefits of business process in out-of-hospital emergency care and to analyze whether the business processes redesigned were able to improve the efficiency of out-of-hospital emergency care without compromising the quality of medical services. The goal of process reengineering is to simplify workflows, increase work efficiency, reduce service costs, and meet patient needs. Successful implementation of business reengineering can improve patient satisfaction and increase organizational competitive advantage (Cui & Teng, 2006). The core principles of process reengineering

include process orientation, people orientation, and customer orientation. The ultimate goal of hospital process reengineering is to eliminate non-value-added activities, retain core value-added activities, and create more value for patients through various approaches. Based on the aforementioned research background, the researcher proposes to address the following specific research questions:

(1) How and why has Guangdong Provincial Emergency Hospital implemented the reengineering of out-of-hospital emergency care processes?

(2) How do key actors (senior managers, operational managers, technical staff, doctors, nurses, other key people involved in the reengineering process) evaluate the readiness of Guangdong Provincial Emergency Hospital to the reengineering of the out-of-hospital emergency care?

(3) What is the impact of process reengineering in out-of-hospital emergency care on Guangdong Provincial Emergency Hospital?

According to Yin's (2018), case study is the most appropriate method for addressing "how" and "why" questions. Researchers need to conduct case studies if they want to gain in-depth understanding of specific management plans, such as business process reengineering, and why they can solve management problems, as well as the outcomes and impacts of the plans on organizations. The purpose of case studies is to study contemporary phenomena, considering the environment in which they occur. This method is based on the triangulation of data, using extensive sources of data such as interviews, surveys (questionnaires) and observations, with the researcher having little or no control over the phenomena being studied.

To answer the above three research questions, the researcher has selected Guangdong Provincial Emergency Hospital, which has implemented business process reengineering, collecting evidence using different sources of evidence.

3.3 Case study steps

The case study conducted by the Emergency Hospital of Guangdong Province consists of seven steps (Yin, 2018): planning the case study, preparing evidence collection, collecting evidence, evaluating data quality, analyzing evidence, developing theory, and writing the thesis.

This is a single case study, that focuses on the analysis of process reengineering in out-of-hospital emergency care during the period 2020-2022. The researcher has been

working at the Emergency Hospital of Guangdong Province since 2005, which allows for convenient understanding of the out-of-hospital emergency-related business in the period covered by the investigation. Through direct investigation and involvement, a series of descriptive data was obtained, providing an opportunity for a successful case study. In other words, this case was chosen because of its illuminating nature (Yin, 2018). Additionally, the researcher utilized action research, which helps in both the development of the study and finding solutions to the inadequate out-of-hospital emergency services in the Emergency Hospital of Guangdong Province.

The researcher conducted a descriptive case study aimed at providing a description for practice. Such research helps exploring past and present technologies and practices. According to Stringer (2017), the basic route of action research is to observe, reflect, and act. Researchers are asked to become catalysts and agents of organizational change. As a solution-oriented approach, action research aims to involve people directly in the process of devising solutions. The researcher was engaged in a rigorous exploration of out-of-hospital emergency services in the Emergency Hospital of Guangdong Province, drawing on both primary and secondary data in order to gain a deep understanding of the nature of the problem. How the researcher conducted his researcher is depicted in Figure 3.1 below.

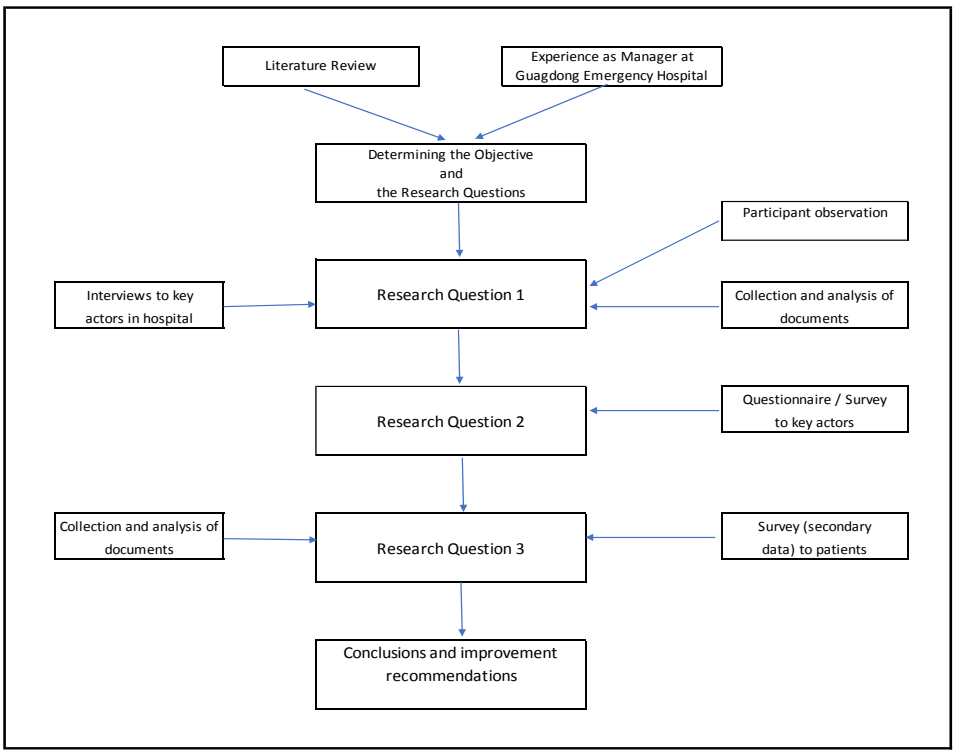

Figure 3.1 Research Roadmap

Different sources of evidence were adopted to answer each of the three research questions,

as is indicated in Figure 3.1. To study how and why has Guangdong Provincial Emergency Hospital implemented the reengineering of out-of-hospital emergency care processes (research question 1), the researcher interviewed 29 experts and managers who have been actively involved in front-line out-of-hospital emergency work for a long period of time. The interviewees were selected basis on the ability to providing genuine and enriched viewpoints to answer the research question. Concretely, interviewees needed to fulfill the following requirements: Firstly, they should have been involved in the hospital's out-of-hospital emergency process redesign work for the past three years; Secondly, their roles should include senior management, doctors, nurses, quality control managers, administrative leaders, and commanders, holding knowledge about the implementation and operation of the project. The researcher conducted 12 sessions of specialized group discussions or one-on-one interviews in meeting rooms that were familiar and convenient for the experts, based on their professional expertise and relevance to the work. Interviews were semi-structured and an interview guide was prepared beforehand (see Annex A). During the discussions, the interviewees were encouraged to inspire each other and actively share their thoughts without deviating from the topic. The interview process was recorded and transcribed into written archives. The research team conducted a total of 29 interviews with key participants who were involved in the implementation of the out-of-hospital emergency process redesign in the emergency hospital in Guangdong Province. The semi-structured interviews with the 29 interviewees contained a total of 86,883 words. In this study, the researcher first transcribed the recorded interviews into written documents, made corrections and revisions to the documents, and confirmed unclear parts with the interviewees. Once the researcher became familiar with the interview content, they compared the transcripts with the interview guide and used NVivo12 software to create initial codes. Then, the codes were revised and finalized based on the research topics and content. Table 3.1 includes information about the personnel interviewed, including details on the interview dates, interview's duration, the interviewee's responsibilities/roles in the hospital, and whether the interview was recorded or not.

Table 3.1 Information About the Personnel Interviewed

No.	Date	Role of The Interviewee	Duration of the Interview	Tape Recorded (Yes/No)
1	2023.08.31	Dispatched to Hainan, Hong Kong, and Guangzhou, the head of the emergency medical team	40 minutes	YES
2		Administrative personnel of medical management at Guangdong Provincial Emergency Hospital		
3		Head of nursing management department at Guangdong Provincial Emergency Hospital		
4		Dispatched to Hubei, the head of the emergency medical team for nursing management	40 minutes	
5		Dispatched to Hainan, the head of the emergency medical team for nursing management		
6		Head of cardiovascular hospital at Guangdong Provincial Emergency Hospital		
7		Head of nursing management for cardiovascular hospital at Guangdong Provincial Emergency Hospital		
8		Director physician of Chest Pain Center at Guangdong Provincial Emergency Hospital		
9		Physician at Chest Pain Center at Guangdong Provincial Emergency Hospital	30 minutes	
10		Head nurse at Chest Pain Center at Guangdong Provincial Emergency Hospital		
11		Nurse at Chest Pain Center at Guangdong Provincial Emergency Hospital		
12		Nurse at cardiovascular hospital at Guangdong Provincial Emergency Hospital		
13		Head of Emergency Medicine Department at Guangdong Provincial Emergency Hospital		
14		Head of nursing management for Emergency Medicine Department at Guangdong Provincial Emergency Hospital	60 minutes	
15		Director physician for Emergency Medicine Department at Guangdong Provincial Emergency Hospital		
16		Physician at the outpatient precheck and triage area of Emergency Medicine Department at Guangdong Provincial Emergency Hospital		

No.	Date	Role of The Interviewee	Duration of the Interview	Tape Recorded (Yes/No)
17	2023.09.01	Head nurse for Emergency Medicine Department at Guangdong Provincial Emergency Hospital	45 minutes	Yes
18		Nurse in the isolation and treatment area of Emergency Medicine Department at Guangdong Provincial Emergency Hospital		
19		Head of the emergency medical team and dispatched to the Hubei emergency medical team at Guangdong Provincial Emergency Hospital		
20		IT manager at Guangdong Provincial Emergency Hospital, resident engineer at the emergency medical team	40 minutes	
21		IT engineer at Guangdong Provincial Emergency Hospital		
22		Logistics and equipment head for the emergency medical team at Guangdong Provincial Emergency Hospital	100 minutes	
23		Equipment management engineer at Guangdong Provincial Emergency Hospital		
24		Head of organization culture at Guangdong Provincial Emergency Hospital	20 minutes	
25		Main leaders at Guangdong Provincial Emergency Hospital	20 minutes	No
26	2023.09.04	Head of the Division of Laboratory Medicine at Guangdong Provincial Emergency Hospital	25 minutes	Yes
27		Director at the Division of Laboratory Medicine at Guangdong Provincial Emergency Hospital		
28		Person in charge at Guangdong Provincial Emergency Hospital (in charge of medical treatment)	30 minutes	
29		Head of medical affairs management department at Guangdong Provincial Emergency Hospital	20 minutes	

In addition to this, the researcher used observation and collected written documents that could provide him with relevant information about the process that the hospital followed to implement BPR. The researcher has worked at the Emergency Hospital of Guangdong Province for 16 years and has participated in and witnessed the establishment of the first provincial-level emergency hospital in China, the National Emergency Medical Rescue Team (Guangdong), and the Chinese International Emergency Medical Team (Guangdong), known as the "three major brands". Also, observation of emergency medical services outside hospitals in Guangdong Province, allowed the researcher to gain insightful information about

the actions taken by hospital staff in the process reengineering at the Emergency Hospital of Guangdong Province. This allowed the researcher to develop a detailed and intimate knowledge of the project, which revealed very important to answer research question 1. Additionally, the researcher actively participated in meetings and group discussions related to emergency medical services outside hospitals, making full use of their advantage of working in the hospital. As an observant and alert participant, the researcher followed the action research method of "plan-action-observation-reflection". The hospital has implemented a series of measures to reengineer emergency medical services outside the hospital and has achieved significant improvements in practical operation. In order to better understand the development process of emergency rescue in the hospital in the past three years, as well as ongoing situations and events, the researcher collected in-depth, long-term, specific data, results, and achievements, aiming to understand management practices, establishing and continuously improving a case study database. During the process of collecting evidence, the researcher continuously read the research database, further annotating and classifying data. Preliminary summary and analysis of the data were conducted through the first round of coding. During this process, researcher paid close attention to several questions, including whether the coding process was meaningful, which information was contradictory, and whether any information was missing or incomplete. Data analysis started with data simplification, constructing a chain of evidence, and identifying information clusters and categories (Huberman et al., 2019). Coding was used as a means for the researcher to seek in-depth analysis and interpretation of the data. Additionally, the next round of coding allowed the researcher to obtain more meaningful and concise analysis units from the first round of coding. By integrating organized information into a compact form for immediate access, the researcher was able to notice the ongoing events and to lay a solid foundation for further analysis. This ultimately allowed researcher to answer the questions of "how", and "why" and draw conclusions. Annex D provides the list of codes identified by the researcher to answer research question 1.

Based on the aforementioned research work, case studies focus more on variables rather than data points, and rely on multiple sources of evidence to aggregate the data (Yin, 2018). Annex E describes the documents used by the researcher to address research question 1 and indicates the importance of observation (participant observation) in obtaining in-depth data regarding the implementation process.

To help the researcher analyzing all the collected data for answering research question 1, Miles and Huberman's (1994) recommendation of using displays was followed. Concretely,

the researcher adopted timelines and a state network display for making sense of the processes and events followed when BPR was implemented in Guangdong Provincial Emergency Hospital (See Table 3.2 and Figure 3.2).

Table 3.2 Timeline of Events Related to the Implementation of Out-of-Hospital Emergency Care BPR in GDPEH

2020	2021	2022
Establish a working group for the treatment of pneumonia infections.	Establish the first intelligent integrated smart hospital in the country.	Dispatch emergency medical teams to support Hong Kong.
Conduct training on the prevention and control of infectious diseases such as pneumonia.	Hold training courses for emergency medical rescue team leaders (coordinators).	Dispatch emergency medical teams to support Hainan.
Pioneered the "Infection Control Observer" system nationwide.	Dispatch emergency medical teams to support communities in Guangzhou.	Dispatch emergency medical teams to support communities in Guangzhou.
Form a specialized team for the treatment of specific infectious diseases.	Host the 2021 Guangdong-Guangxi Health Emergency Joint Exercise.	Undertake the screening of fever patients and the treatment of critically ill patients in Guangzhou's Haizhu District.
Activate infectious disease areas and prepare for admissions.	Use drones for the first time to transport disaster site nucleic acid test samples.	Adjust relevant organizational structures, responsibilities, and reward systems.
Reserve 500 treatment beds in emergency standby areas.	Put into use 12 newly purchased vehicles to form a mobile hospital.	Explore the establishment of intelligent applications for infection prevention and control in hospitals.
Dispatch the first batch of emergency medical teams to support Wuhan.	Conduct drills for tent hospitals.	Undertake the designated treatment tasks for COVID-19 patients in Guangzhou.
Strengthen the cultural development of emergency hospitals.	Awarded as a National Advanced Stroke Center construction unit.	First-time use of a national major epidemic treatment base.
Dispatch the second batch of emergency medical teams to support Wuhan.	Establish a national major epidemic treatment base.	Emergency deployment to complete the conversion of designated treatment hospitals within 12 hours.
Provide support to Wuhan with mobile hospitals and tent hospitals.	Compile and organize reports and experiences of key personnel involved in out-of-hospital emergency care, including managers, doctors, nurses, and technical staff.	Undertake the treatment tasks for critically ill COVID-19 patients in Guangdong Province.
Dispatch the third batch of emergency medical teams to support Wuhan.	Carry out skill training for new projects.	Pioneered a regional batch pre-triage model for infectious diseases in the country.
Dispatch the fourth batch of emergency medical teams (critical care) to support Hubei Province.	Carry out PDCA project competitions.	Innovate treatment mechanisms to cope with the peak of critical care.
Carry out emergency drills for	Guide the construction of	The hospital quickly completed

2020	2021	2022
the transportation of critically ill patients.	emergency medical rescue systems at the municipal and county levels in Guangdong region.	the conversion tasks from a large comprehensive tertiary hospital to a designated COVID-19 treatment hospital.
Dispatch emergency medical team members to support Beijing.	Establish an emergency medicine department.	Adjust the main responsibilities of the Emergency Medicine Department.
Dispatch emergency medical team members to support Hong Kong.	Establish a cardiovascular disease hospital.	Compile and organize records of the hospital's workflow reconstruction during the fight against the epidemic.
Passed the review of the Guangdong Province Chest Pain Center.	Become a professional training base for infectious disease prevention and control in the Guangdong Health Supervision department.	Become one of the first training bases in Guangdong Province for dedicated infection prevention and control personnel in medical institutions.

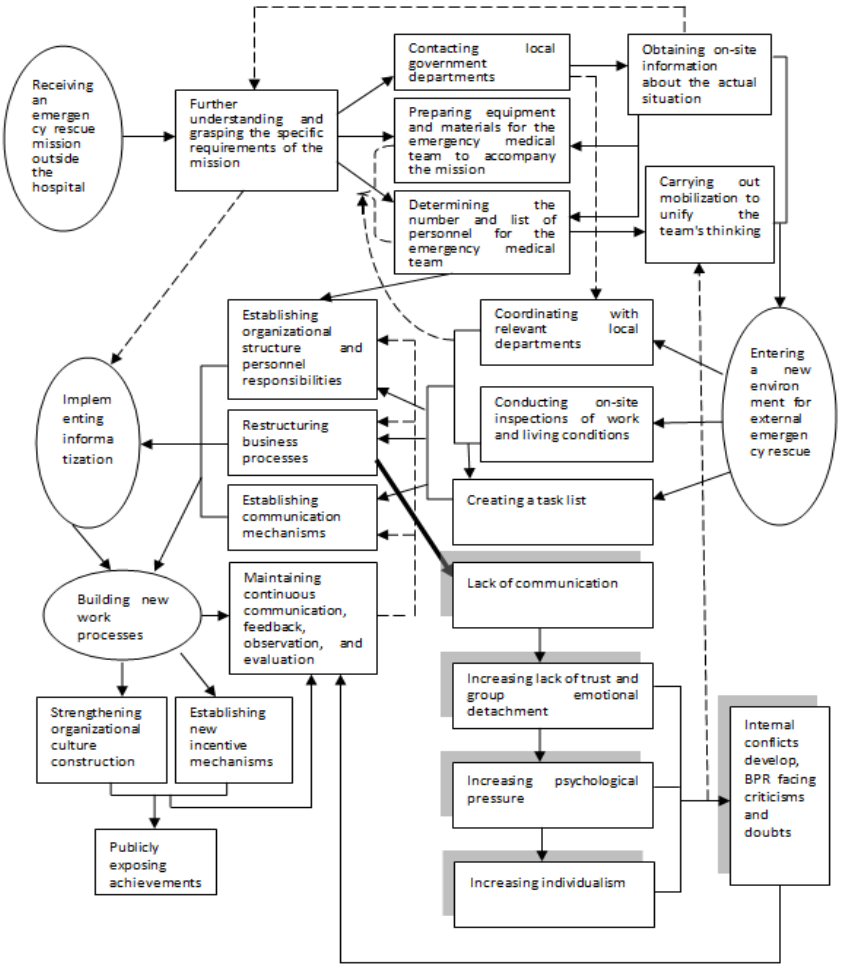

Figure 3.2 The Status Network Display of Out-of-Hospital Emergency Care BPR in GDPEH

To evaluate the readiness of Guangdong Provincial Emergency Hospital to the reengineering of the out-of-hospital emergency care (research question 2) the researcher used the questionnaire developed by Abdolvand et al. (2008) (see Annex B). These authors

developed a questionnaire, egalitarian leadership, collaborative work environment, top management commitment, management system change, and application of information technology as key enabling factors of BPR and resistance to change as failure factors. Figure 2.1 is presented the conceptual model developed by these researchers, and that forms the basis of the questionnaire they propose.

The researcher adopted the same questionnaire to collect the perspective of key actors about their perception of the level of readiness of Guangdong Provincial Emergency Hospital to reengineering the out-of-hospital emergency processes. The questionnaire is divided into six parts: Egalitarian leadership, cooperative work environment, top management commitment, supportive management, application of information technology, and resistance to change. The first five parts are mapped to the Critical Success Factors (CSFs) model, while the last part is mapped to the Critical Failure Factors (CFFs) model. Each part consists of 3-5 questions related to the sub-factors of the CSFs or CFFs model. The questionnaire consists of 23 multiple-choice questions, and it can generally be completed within 10 minutes.

The questionnaire provided a rating scale ranging from "always", "more,""moderately", "less" to "never" to evaluate the preparedness of Guangdong Provincial Emergency Hospital for the redesign of the out-of-hospital emergency process. Questionnaire surveys are an important method in social science (Zang & Xu, 2023). The researcher asked key participants from Guangdong Provincial Emergency Hospital who were involved in the redesign of the out-of-hospital emergency process from 2020 to 2022 to serve as respondents for the questionnaire. These participants included the hospital leadership team (the highest level of management decision-making), senior hospital management personnel, operations management personnel, technical personnel, doctors, nurses, ordinary staff, logistics support personnel, and other key personnel involved in process redesign, totaling 550 individuals. In order to facilitate the participation of respondents holding different backgrounds and positions, the researcher entrusted nine research assistants to distribute electronic questionnaires to 11 major working communication groups related to the out-of-hospital emergency process redesign via WeChat platform. During August 2023, the researcher transcribed the questionnaire to Chinese and sent a survey questionnaire titled "How do you evaluate the preparedness of the hospital for the redesign of the out-of-hospital emergency process" to key participants in the out-of-hospital emergency process redesign at Guangdong Provincial Emergency Hospital. The questionnaire came from practical testing by its authors, and the selection of survey subjects was highly relevant to the research question, further enhancing the scientific rigor and persuasiveness of the research conclusions (Luo et al., 2022). The

questionnaire data are shown in Table 3.3.

Table 3.3 Questionnaire Distribution and Collection Data

No. of questionnaires sent	No. of collected questionnaires	No. of completed questionnaires	No. of incomplete questionnaires	Duration of sending out the questionnaire	Response rate
550	134	134	0	14 days	24.36%

The researcher also followed Abdolvand et al.'s method to analyze the questionnaire responses. He used Cronbach's alpha coefficient to measure the internal consistency of the scale and conducted factor analysis to assess the construct validity and determine the strength of the relationships between the indicators. Statistical calculations were used to evaluate the indicators, with scores ranging from four (Always) to zero (Never). The indicators in the first five parts were considered positive indicators, while the indicators in the sixth part were negative indicators. The final score was calculated by subtracting the negative indicator score from the positive indicator score. The scores were divided into five levels: "Completely unprepared, Unprepared, Average, Prepared, and Fully prepared", corresponding to scores of "0-0.5, 0.51-1.5, 1.51-2.50, 2.51-3.5, 3.51-4", respectively. The analysis also involved a detailed examination of the scores for each indicator to provide a more accurate assessment of the readiness level for the reengineering of the external emergency rescue process in Guangdong Provincial emergency hospital.

To evaluate the impact of process reengineering in out-of-hospital emergency care on Guangdong Provincial Emergency Hospital (research question 3), the researcher adopted a set of indicators for each of the relevant dimensions of the BPR project (quality, efficiency, organizational change and satisfaction). Annex C shows the performance evaluation of national tertiary public hospitals was initiated in 2019 following the announcement made by the head of the National Health Commission at the routine policy briefing of the State Council on January 30, 2019. This initiative aims to establish a performance evaluation system that allows the development of a unified support system and a standardized evaluation procedure in China. Its goal is thus to promote the standardization of an internal management of public hospitals that guides the effective improvement of medical service quality and efficiency.

The existence of this performance measurement systems revealed of great relevance to the researcher in order he can evaluate the impact of BPR project on Guangdong Provincial Emergency Hospital. Drawing on secondary evidence produced officially by the Chinese National Health Commission was an efficient way to collect data for answering research question 3.

The evaluation indicators that had been included in the performance measurement system

of the national tertiary public hospitals encompass the dimensions of medical quality, operational efficiency, sustainable development, and satisfaction evaluation; these dimensions correspond to the ones the researcher proposed to evaluate the BPR initiative. The performance of each of the four dimensions is evaluated on the basis of 55 (secondary) indicators, which are presented in the Annex F.

As Annex F shows, indicators of functional positioning, quality and safety (including surgical patient complication rate and mortality rate of low-risk cases), rational use of medication, and service process (including average waiting time after outpatient appointments) are adopted for measuring medical quality. Operational efficiency is evaluated drawing on the indicators of resource efficiency, income and expenditure structure, cost control (including outpatient average cost increase and inpatient average cost increase), and financial management. Sustainable development is assessed using information on personnel structure, talent cultivation, discipline construction, and reputation's building. The indicators for satisfaction include patient's satisfaction (including outpatient's satisfaction and inpatient's satisfaction), and medical and staff satisfaction.

To evaluate their medical experiences, patients can use smartphones to scan QR codes and access the satisfaction survey platform of the National Health Commission, where they can select and answer questions about their medical experience (cf. Head of the Medical Administration Bureau of the National Health Commission's routine policy briefing of the State Council). The evaluation includes feedback on the average appointment and treatment rates, waiting time, reduction in number of visits, queue time, and total patient waiting time. The consideration of patients' waiting time in this list of indicators seeks to promote the accurate appointment arrangements, reducing waiting time and improving patients' satisfaction. In the implementation of the performance evaluation of national tertiary public hospitals nationwide, patients' sense of achievement, sense of safety, and satisfaction are important criteria for evaluating the effectiveness of the reform (Economic Daily, 2019).

It should be noted that in April 2020, the Guangzhou Civil Aviation Hospital merged with the Guangdong Emergency Hospital. The head of the Guangdong Emergency Hospital, who is responsible for hospital performance evaluation, mentioned multiple times at hospital meetings that the merger of the Guangzhou Civil Aviation Hospital, a secondary hospital, into the Guangdong Emergency Hospital may affect the national assessment data of the hospital, especially in terms of operational efficiency. In Chapter 4, when answering research question 3, we will provide further explanation on this matter.

According to the notice on the improvement goals of national medical quality and safety

for 2023 issued by the General Office of the National Health Commission (2023), acute myocardial infarction is the leading cause of death among Chinese residents. Improving the reperfusion treatment rate of acute ST-segment elevation myocardial infarction is of great significance to reduce the mortality and death rate of such patients. The core strategy is for hospitals to strengthen multidisciplinary collaboration, optimize the out-of-hospital to in-hospital emergency linkage process, and continuously improve the emergency plans and operating procedures for these patients (National Health Commission, 2023). In addition, average length of stay is a key indicator reflecting the utilization of medical resources and is an important and sensitive indicator of hospital operational efficiency (J. Liu et al., 2022).

To collect evidence for each of these indicators, the researcher used two main methods: collection of documents and reports; survey evaluating patients' satisfaction with the reengineering of out-of-hospital emergency care (Secondary evidence). As the Chinese government's health regulatory authorities conduct annual surveys on patient satisfaction in emergency hospitals in Guangdong Province, and considering that these are among the most reliable satisfaction survey data in China and align with the research objectives, the researcher directly cited authoritative data published by the Chinese Ministry of Health. Table 3.4 summarizes the data sources adopted for answering each of the three research questions.

Table 3.4 Sources of Evidence

Research Questions:	**Sources of Evidence:**
How and why has Guangdong Provincial Emergency Hospital implemented the reengineering of out-of-hospital emergency care processes?	1. Interviews to managers and people in hospital that have been involved in the implementation of the reengineering process; 2. Written documents about the BPR project.
How do key actors (senior managers, operational managers, technical staff, doctors, nurses, other key people involved in the reengineering process) evaluate the readiness of Guangdong Provincial Emergency Hospital to the reengineering of the out-of-hospital emergency care?	Questionnaire (survey)
What is the impact of process reengineering in out-of-hospital emergency care on Guangdong Provincial Emergency Hospital?	1. Written documents; 2. Patients' survey.

The main interest of this study is to evaluate the changes in the process of improving the quality of out-of-hospital emergency care and process reengineering. In order to enhance the validity and reliability of the study, the author adopted Yin's (2018) recommendation of using different sources of data ('data triangulation') and different research methods (combining survey/questionnaires with case study). This ensures that different researchers if following similar steps and operations would obtain the same results and conclusions. The process of collecting data from multiple sources enhances the credibility and effectiveness of the study.

Rich sources of materials help researchers gain a profound understanding of the phenomena in the analysis (Yin, 2018).

The final step of this case study was the writing up (Yin, 2018). When writing up this thesis Yin's recommendations were followed. Thence, the researcher started drafting the paper early on, making subsequent improvements during the research process. Also, Yin's claim that the initial draft of the research report should be discussed with the main person in charge of the case organization was followed. This case study report has been read and evaluated by the researcher's advisor and senior management personnel from Guangdong Provincial Emergency Hospital. Through this process of revision, the accuracy of the case study has been improved, meeting the construct validity criteria.

Chapter 4: The Empirical Research

In this chapter, the researcher aims to provide evidence so that he can answer the three research questions formulated in this study. To achieve this end, a description of China's healthcare system and the empirical research subject, the Emergency Hospital in Guangdong province is provided.

4.1 Description of China's healthcare system

According to the General Office of the State Council on the issuance of the National Medical and Health Service System Planning Outline (2015-2020), after long-term development, China has established a medical and health service system covering both urban and rural areas, mainly including hospitals, primary medical and health care institutions, and specialized public health institutions (see Figure 4.1). Hospitals are divided into public hospitals and privately operated hospitals, with public hospitals being the mainstay of China's medical service system. Among them, public hospitals are further classified into government-run hospitals and other public hospitals. Government-run hospitals are mainly divided into county-operated hospitals, city-operated hospitals, provincial-operated hospitals, and department-operated hospitals based on their functional positioning. Other public hospitals mainly include military hospitals, as well as hospitals run by state-owned and collective enterprises and institutions. Institutions below the county level are considered as primary medical and health care institutions.

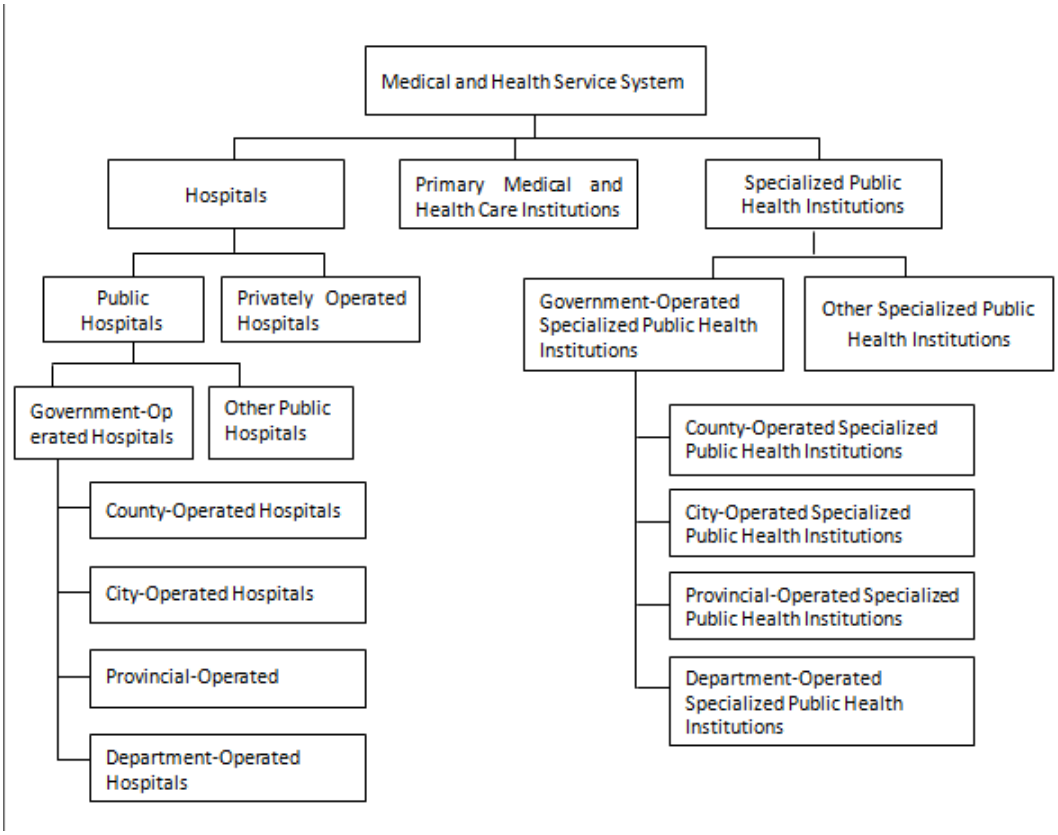

Figure 4.1 Chinese Medical and Health Service System

Source: Liu (2019)

County hospitals mainly undertake the diagnosis and treatment of common and prevalent diseases among residents in the county-level area, as well as the rescue of critical and severe cases, referral of difficult cases, corresponding public health services, and emergency medical rescue for sudden events. City hospitals mainly provide comprehensive or specialized medical services representing high levels within the local city-level area, accept referrals from lower-level hospitals, and undertake corresponding public health and emergency medical rescue tasks. Provincial hospitals mainly provide diagnosis and treatment for critical, severe, and difficult diseases, as well as specialized medical services for several cities within the provincial area, accept referrals from lower-level hospitals, and undertake corresponding public health and emergency medical rescue tasks. Departmental hospitals mainly provide diagnosis and treatment for difficult and critical illnesses and specialized medical services across provinces, accept referrals from lower-level hospitals, and undertake corresponding public health and emergency medical rescue tasks and technical support, driving regional development and overall improvement of medical services. Hospitals are classified into three levels: tertiary hospitals, secondary hospitals, and primary hospitals. Tertiary Grade A hospitals represent the highest level of hospital management in China.

According to the China Health and Health Development Public Report (National Health

Commission, 2022), as of the end of 2022, there were 36,976 hospitals in China, including 11,746 public hospitals and 25,230 privately-owned hospitals. Classified by level, there were 3,523 tertiary hospitals (including 1,716 Grade A tertiary hospitals), 11,145 secondary hospitals, 12,815 primary hospitals, and 9,493 hospitals with undetermined levels. There were a total of 9.75 million beds in medical and health institutions nationwide, with a bed density of 6.92 beds per 1,000 people. Public hospitals accounted for 70% of the total hospital beds, while private hospitals accounted for 30%.

According to the National Emergency Medical and Health Rescue Plan for Public Emergencies (The State Council, 2006), medical institutions at all levels are responsible for the medical and health rescue tasks in the event of public emergencies. In China, county, city, provincial, and departmental hospitals all have emergency departments and are the main force in the formation of the out-of-hospital medical emergency system. The construction of emergency medical and health rescue organizations and teams for public emergencies is an important part of the national system for the prevention and control of public health emergencies. Health administrative departments at all levels should follow the principle of "integrating peacetime and wartime, being prepared at all times" and build emergency medical and health rescue teams. Currently, China has established 59 national health emergency teams, including emergency medical rescue teams. After receiving rescue instructions, emergency medical and health rescue teams should promptly rush to the scene and carry out medical rescue work to the fullest extent according to the on-site situation. In order to timely and accurately grasp the on-site situation and carry out on-site medical and health rescue command work, an on-site medical and health rescue command center should be set up at the scene, with senior leadership directing the operations, reducing intermediate links, improving decision-making efficiency, and speeding up the rescue process.

China has developed five major models for out-of-hospital emergency medical services, as shown in Table 4.1. These are the administrative command model, pure pre-hospital emergency model, emergency center-based model, emergency linkage model, and combined emergency linkage and pre-hospital emergency model. Brief descriptions of the main characteristics and features of each out-of-hospital emergency medical service model are provided below.

Table 4.1 Characteristics and Features of China's Out-of-Hospital Emergency Medical Service Models

Types of pre-hospital first aid model	Representative	Features	Characteristics
Administrative command model	Guangzhou	Emergency center uniformly dispatches and arranges the emergency volume in the city. The center is purely a medical administrative department. According to the dispatching of the center, hospital first-aid groups are responsible for pre-hospital first aid and in-hospital medical rescue (Guangzhou, 2023).	To build this model, the only condition is to construct a first-aid center, which requires only a little investment. Based on the principle of proximity, this model makes full use of medical resources. In dispatching, however, there are difficulties in the dispatching between hospitals and the center.
Pure pre-hospital first-aid model	Shanghai	The emergency center sets up emergency stations and substations which are in charge of pre-hospital first aid. Hospitals are responsible for in-hospital medical care.	The pre-hospital first aid is reasonable and efficient. However, the pre-hospital rescue is a single business and it is difficult to raise the business ability, which is worrisome.
Emergency center-based model	Chongqing	Set up at an overall hospital, the emergency center is equipped with emergency devices and ambulances (Bao, 2011).	Although with a little investment, the emergency center is highly capable of pre-hospital rescue. However, it is difficult to realize command and control of rescue forces in the whole city and the center has poor command authority.
Joint emergency response model	Hong Kong, China	Through communication network, medical agency, fire department and police station are linked within a uniform system. They jointly provide rescue services. This model is of nonprofit nature (Cai, 2010).	The rescue is highly efficient. Different departments have clear division of responsibility. In the case of accidents, medical rescue teams, fire department and other agencies jointly take part in rescue. Fire department is also responsible for daily pre-hospital medical rescue.
Model of joint emergency response and pre-hospital first aid	Nanning	Hospitals, fire department and public security department uniformly receive alarm. After classification of incidents, the command center reasonably dispatches rescue forces.	Rescue is flexible, convenient and fast, and highly efficient.

Source: Cai (2010)

Regarding the Guangzhou model, it establishes an emergency command and dispatch center with "120" emergency medical services as the core. The emergency departments of various hospitals serve as emergency response stations in the emergency medical service network, with each region being managed separately. Out-of-hospital emergency medical services are unified and coordinated by 120, and emergency medical service institutions can share information from the transportation department. When necessary, fire, public security, and other departments can be mobilized to jointly participate in out-of-hospital emergency medical services. The emergency command and dispatch center follows the principles of centralized acceptance, unified command, and nearest emergency response, mobilizing the emergency medical service vehicles of the "120" network to arrive at the emergency call location in the shortest possible time to save the lives of patients. The main functions of the "120" emergency command and dispatch center are to handle the daily dispatch and command of out-of-hospital emergency medical services, train emergency medical service personnel, and maintain cooperation with the emergency departments of network hospitals.

The Shanghai Medical Emergency Center mainly undertakes the responsibilities of daily emergency care for urban residents and emergency medical response to sudden incidents. The center is divided into five sub-centers: East, West, North, Central, and South, each with several sub-stations. This has formed an independent pre-hospital medical emergency service model characterized by "unified command, decentralized deployment, classified first aid, on-site treatment, and rapid transfer".

In 1988, Chongqing City merged the original Chongqing Emergency Station with the Fourth People's Hospital of Chongqing City to establish the Chongqing Emergency Medical Center and the Fourth People's Hospital of Chongqing City. The hospital provides comprehensive medical services to the public while performing the public health rescue functions of Chongqing Municipal Government and the command dispatch for emergency medical services in the eight main urban districts and daily emergency care.

In Hong Kong, the Hong Kong Fire Services Department shoulders the responsibility of out-of-hospital emergency medical care, and the main force for out-of-hospital emergency care is the ambulance. On-site treatment is limited to simple measures to stabilize the patient, followed by prompt transfer to the hospital's emergency department for further treatment. The ambulance service is under the discipline of the military and the personnel undergo strict military training.

In Nanning, multiple fire and rescue brigades, traffic police units, and emergency stations have established mechanisms for information sharing, rescue cooperation, and work

coordination. By creating an information-sharing platform, they have achieved mutual communication of emergency rescue and law enforcement information. In the event of road congestion, the traffic police department promptly informs the fire department and emergency medical center, proposing the best passage plan.

Due to economic and regional constraints, it is challenging to have a unified plan for the existing models. Therefore, the various models should draw inspiration from each other, make up for each other's shortcomings, continually refine the rescue models, and enhance emergency response efficiency.

4.2 The Guangdong Provincial Emergency Hospital

The Guangdong Provincial Emergency Hospital is a large comprehensive tertiary A-level hospital under the direct management of the Guangdong Provincial Health Commission. It is the construction unit of high-level hospitals in Guangdong Province and the first provincial emergency hospital, internet hospital, smart hospital, AI health management platform, and all-scenario intelligent hospital in China. It is also the construction unit of the National Emergency Medical Rescue Team (Guangdong) and the World Health Organization-certified Chinese International Emergency Medical Team (Guangdong).

Currently, the hospital has 86 departments and 55 specialties, with a total of 2300 beds. In June 2004, the Guangdong provincial government approved the hospital as the "Guangdong Provincial Emergency Reserve Hospital" and invested 280 million yuan to promote the construction of emergency hospitals. In April 2011, the Guangdong Provincial Institutional Establishment Committee approved the hospital to carry the plaque of "Guangdong Provincial Health Emergency Hospital", undertaking the emergency medical rescue mission of Guangdong Province. About one year later, the Guangdong Provincial Emergency Hospital was completed and the emergency ward was officially put into use. During peacetime, it operates 800 surgical beds, which can quickly convert to 200 ICU beds during wartime. It played an important role in the fight against the COVID-19 pandemic in 2020. In 2020, the hospital completed the upgrade and transformation of the major epidemic rescue base, which is capable of centralized treatment of critically ill patients and stockpiling emergency supplies. Over the years, the national and provincial governments have attached great importance to the construction of the Guangdong Provincial Emergency Hospital and continuously nurtured and improved it. According to incomplete statistics, in recent years, a total investment of more than 200 million yuan has been made by the government, providing a guarantee for the

hospital's rapid development. Under careful cultivation at the national and provincial levels, the hospital has established the "three major brands" of emergency medicine nationwide. First is the National Emergency Medical Rescue Team (Guangdong). In 2010, the hospital was awarded the title of "National Emergency Medical Rescue Team (Guangdong)" by the National Health Commission, becoming one of the first six national-level emergency medical rescue teams in the country. It has a 13-year history of participating in drills and actual rescue operations. Secondly, it is the first "provincial emergency hospital" in the country. It is understood that among the 31 provinces (regions, municipalities) in the country, only Guangdong has established a provincial emergency hospital, which is a unique characteristic brand with a history of 13years. The third brand is the "International Emergency Medical Team (EMT)". In 2017, the hospital received certification from the World Health Organization (WHO) and became the 9th global and second national "International Emergency Medical Team (EMT)". It is known as the "flying hospital" with a history of 6 years. Under the leadership of the "three major brands", since 2018, the hospital has successively become the "Guangdong Provincial Emergency Medicine Rescue Guidance Center", undertaking the "Guangdong Provincial Emergency Medicine Rescue Backbone Training Program" and carrying out the "Guangdong Provincial Emergency Medicine Rescue Base Project Construction".

The emergency work of the hospital involves emergency response during peacetime and wartime. Over the years, the hospital has made a lot of efforts in terms of hardware construction, team building, and practical experience. The physical hospital, mobile hospital, and tent hospital have formed a "three-in-one" pattern, constructing the hardware facilities for these hospitals.

The physical hospital has quickly emptied 500 treatment beds. During the COVID-19 epidemic in 2020, the hospital became one of the three front-line hospitals in Guangzhou, with the front-line and second-line treatment beds accounting for half of the total beds in Guangzhou. In 2021, the emergency hospital in Guangdong Province accelerated the construction and officially launched the construction of a national major epidemic treatment base. The national government invested 150 million yuan to build facilities that can quickly empty 500 treatment beds within 6 hours, including a critical condition treatment unit with 200 intensive care beds.

The mobile hospital can start rescue operations within half an hour. As the main rescue platform of the "National Emergency Medical Rescue Team (Guangdong)", the mobile hospital is responsible for emergency medical rescue missions for major disasters in Southeast

Asia. The team has successfully prepared for international rescue missions such as the Japan tsunami, Philippine typhoon, and Ebola hemorrhagic fever. In 2015, they also participated in the fourth ASEAN Regional Forum disaster relief exercise as representatives of the Chinese government and were received by State Councilor Wang Yong. In February 2020, all members of the medical rescue team carried seven rescue vehicles and 30 tons of rescue materials to quickly go to Wuhan to participate in the treatment work of the makeshift hospitals. In 2011, the team pioneered the construction of mobile hospitals in the country, consisting of 10 vehicles including outpatient vehicles, operating vehicles, medical technology vehicles, pharmaceutical vehicles, command vehicles, water supply vehicles, power supply vehicles, and life support vehicles. The mobile hospital is fully adapted to the outdoor environment and can achieve complete self-sufficiency for 14 days to meet the treatment needs of injured patients in the field. The emergency medical rescue team can be ready within half an hour, cover the South China region within 12 hours relying on their own transportation capabilities, and start rescue operations within half an hour after arriving at the rescue site, providing more than 50 beds, reaching the level of a secondary hospital. They can handle an average of 110 injured patients per day. In 2021, the National Health Commission has invested special funds to upgrade all vehicles of the mobile hospital and added a P2+ mobile laboratory, greatly improving the hardware level and team strength for the treatment of batches of injured patients.

The tent hospital is capable of sustaining itself for 14 days. In response to the directive of the National Health Commission, the Guangdong Emergency Hospital was tasked with establishing the China International Emergency Medical Team. In May 2017, the medical team passed the assessment evaluation conducted by a group of experts from the WHO and received a certificate and flag from Dr. Margaret Chan, the then Director-General of WHO, at the 70^{th} World Health Assembly. This recognition placed the team among the nine international emergency medical teams worldwide, and they have since taken on the mission of international emergency medical rescue.

The team of the tent hospital comprises a total of 216 members with the ability to communicate in multiple languages, including English, German, and French. Once the tent hospital is operational, it can perform seven major surgeries or 15 minor surgeries per day, as well as provide outpatient services for more than 100 patients daily. The most prominent feature and advantage of the tent hospital lies in its intelligent capabilities. The Guangdong Emergency Hospital has developed and applied intelligent emergency command decision-making systems, emergency triage systems, individual emergency medical systems,

and emergency technology research. The rescue capabilities of the international emergency medical team at this hospital have also been highly praised in an article titled "This Hospital Can Fly" published in the *People's Daily* in May 2017.

This high-level team conducts regular drills throughout the year and stands ready for dispatch at any time. The spirit of emergency medical rescue at the Guangdong Emergency Hospital can trace its roots back to the wartime era. It has inherited the red genes and achieved three key aspects: regular drills, standardized criteria, and a unique culture. They have participated in 16 comprehensive exercises, joint military and civilian exercises, joint exercises in South China, and international field training activities from 2010 to 2020. Since 2012, the hospital has held the Guangdong-Guangxi Health Emergency Exercise every two years, totaling four events. In 2015, it represented the Chinese government in the fourth ASEAN Regional Forum Disaster Relief Exercise, marking the first large-scale cross-border deployment of emergency medical rescue equipment. In September 2017, the hospital was invited by the WHO to participate in the 2017 INSARAG (International Search and Rescue Advisory Group) Asia-Pacific Regional Exercise in Malaysia. In November of the same year, the hospital represented China at the Canberra Regional Meeting in Australia, where they held discussions on crisis preparedness, warning, and response. Due to its leadership position in the field of healthcare emergency response, the experience and practices of the Guangdong International Emergency Medical Team construction have been summarized by the National Health Commission as the "Guangdong Model of Emergency Medicine" and have been promoted and replicated nationwide.

The development of Guangdong Provincial Emergency Hospital has contributed for the improvement of emergency medical healthcare in different ways. First, it has served as a national project mentor. The emergency team of the institute was invited to serve as a mentor for the World Health Organization's EMT guidance team and as a project mentor for EMT certification and evaluation at Huaxi Hospital of Sichuan University. At the same time, it has served as a project mentor for the construction of national health emergency mobile disposal centers at Xiangya Hospital of Central South University, Hainan Province, Guizhou Province, and other places. The related construction specifications (434 standard operating procedures) and highly intelligent tent hospital rescue information system have become models for national health emergency disposal centers and international emergency medical teams at West China Hospital of Sichuan University, Xiangya Hospital of Hunan, and Tianjin People's Hospital. The tent hospital rescue information system has been highly praised by the World Health Organization expert group and is considered to be highly advanced and can be

recommended as a benchmark worldwide.

Second, Guangdong Provincial Emergency Hospital has become a provincial-level guidance center. In 2018, when designated "Guangdong Provincial Emergency Medical Rescue Guidance Center" by the Provincial Health Commission, it has become responsible for organizing the compilation of standardized operating procedures (SOP) related to the construction of emergency medical rescue teams. Since then it has provided guidance to the Eastern, Western, and Northern regions of Guangdong, as well as certain hospitals in Shenzhen and the Pearl River Delta, in the construction of regional emergency hospitals in Guangdong Province. It has guided the establishment of the first municipal emergency hospital in Shantou Second People's Hospital, established the Zhuhai detachment of the national (Guangdong) emergency medical rescue team, and is currently guiding the construction of municipal and county-level emergency medical rescue systems in Yangdong District of Yangjiang City, Sihui City of Zhaoqing City, and Yangshan County of Qingyuan City, in order to improve the emergency rescue capabilities of the province and provide protection for the lives and health of local people.

The hospital has represented China and Guangdong Province in several expeditions. Annex G summarizes the main medical rescue missions it has been involved in in response to national and provincial health commissions.

4.3 Redesigning the out-of-hospital emergency process

To address research question one, the researcher used a timeline and "state network display" to understand the processes and events followed by the emergency hospital in Guangdong province implementing Business Process Reengineering (BPR). Table 4.2 provides a description of the key events in the timeline.

Table 4.2 Description of Key Events in the Timeline

Time	Event	Content involved
2011.04	The Guangdong Provincial Emergency Hospital has been officially established.	The government has made it clear that the hospital's mission is to undertake emergency support for major public health emergencies in Guangdong Province and provide medical rescue for sudden incidents.
2020.01	The province has initiated a level one response to major public health emergencies.	It has been designated as a designated hospital for the treatment of COVID-19 infections in Guangdong Province.
2020.01	The hospital has issued a notice to all staff members.	All hospital staff are called upon to move forward bravely and stand firm on the front line of the fight against the epidemic.
2020.01	A notice has been issued regarding	The specific infectious disease treatment

Time	Event	Content involved
	the formation of a specific infectious disease treatment team in the hospital.	team consists of 188 members from 48 departments responsible for treatment, protection, and support, with clear job responsibilities.
2020.02	The leadership group for the prevention and control of COVID-19 infections has been further improved.	The highest decision-making body of the hospital has been established, along with the formation of relevant organizational structures and the establishment of work mechanisms.
2020.02	In response to the instructions from the National Health Commission, medical teams have been dispatched to Hubei Province to deal with the COVID-19 epidemic.	Teams and relevant organizational structures have been formed, and work mechanisms have been established.
2020.02	The hospital has pioneered the establishment of an infection control observer system.	Emergency medical safety is ensured: strict professional control, immediate and rapid response, and comprehensive management in place.
2021.09	The hospital successfully hosted the 2021 Guangdong-Guangxi Health Emergency Joint Exercise.	Unmanned aerial vehicles have been used for panoramic remote health rescue reconnaissance for the first time, as well as for the transportation of disaster site nucleic acid testing specimens. A mobile hospital composed of 10 emergency vehicles, more than 20 medical tents, logistics tents, and living tents have also been unveiled.
2022.07	Three batches of 80 members from the national emergency medical rescue team have been sent to support Hainan Province.	Teams and relevant organizational structures have been formed, and work mechanisms have been established.
2022.10	Medical teams have been deployed in Guangzhou to handle COVID-19 infections.	Teams and relevant organizational structures have been formed, and work mechanisms have been established.
2022.11	The Guangdong Provincial Government has required the emergency hospital to be converted into a designated medical facility for the treatment of COVID-19 infections.	The hospital is facing the most complex and severe task since the three-year fight against the epidemic began, with all hospital resources being focused on emergency medical work.
2022.11	Hold a hospital-wide mobilization meeting.	Unified thinking, clear responsibilities, and goals are emphasized.
2022.11	Further understand and grasp the specific requirements of the tasks.	Strengthening communication with the government, preparing teams, resources, and facilities.
2022.11	The hospital-wide mobilization has been conducted again.	Strengthening mobilization and communication to ensure that all hospital staff have unified thinking, clear responsibilities, and goals.
2022.11	The hospital leadership group and organizational structure have been adjusted.	Based on the problems identified in previous work, adjustments and reforms have been made to the organizational structure, personnel functions, technical support, and administrative management.
2022.11	The hospital adheres to a daily	Continuously communicate, provide

Time	Event	Content involved
	meeting mechanism, and meeting minutes are distributed to departments and key personnel involved in emergency medical work for implementation. Relevant departments and departments hold meetings to arrange work tasks assigned by the hospital.	feedback, observe, evaluate, and make timely decisions at the highest decision-making level, deploying for the next steps. Regular reinforcement is given for positive aspects, and changes are implemented for areas that need improvement.
2022.11	The national major epidemic treatment base has been put into use for the first time.	In 2020, the government designated Guangdong Provincial Emergency Hospital as a "National Major Epidemic Treatment Base" and invested 150 million yuan to upgrade the emergency area, adding 200 intensive care beds (ICU) to meet the requirement of opening 500 infectious disease treatment beds.
2022.11	The hospital has pioneered a regional emergency pre-check triage model for mass infectious diseases in the country.	Close coordination with Guangzhou Emergency Medical Center, "Yellow Code Hospitals", and field hospitals, utilizing P2+ emergency testing vehicles to speed up the reporting time of test results and ensure timely triage and treatment of critically ill patients.
2022.11	The setting of treatment areas has been dynamically adjusted.	Based on the actual conditions of patients receiving emergency treatment outside the hospital, dynamic adjustments have been made to ward settings and medical staff allocation.
2022.12	Some medical personnel from other hospitals have joined the emergency work.	As the hospital's emergency medical tasks are heavy, additional medical staff are needed from other hospitals for support.
2022.12	The hospital has entered a new stage of routine work.	The phased tasks of the hospital's emergency mobilization have been completed, and the hospital emphasizes the need for continuous optimization of business processes.

Based on the interview guide and key factors for process reengineering, respondents were asked a total of 8 types of questions. They include 3 questions about process change, 3 questions about activity change, 3 questions about management change, 2 questions about technology change, 2 questions about job change, 2 questions about organizational structure, 2 questions about cultural change, and 2 questions about impact generation, making a total of 19 questions. Analysis of the semi-structured interview data from 29 respondents are shown in Table 4.3.

Table 4.3 Results of semi-structured interview data analysis

Key factors	Questions	Content	Frequency
Process change	Why is process reengineering necessary?	The original process was not conducive to out-of-hospital emergency care	8
		Out-of-hospital emergency care varies in time and location	11

		requirements	
	What specific process reengineering initiatives were implemented?	It is beneficial to strengthen the development of the out-of-hospital emergency care system	6
		Emergency plans were formulated	4
		Adjustments were made to the original process	17
		New processes were developed	24
	What are the effects or impacts of process reengineering?	Efficiency was improved	24
	What changes occurred in the roles and responsibilities of the participants?	It is different from the usual workflow	13
Activity change	What activities were introduced or modified?	Additional work content was added	10
	What challenges or obstacles were encountered during the activity change process?	Training was intensified	9
		Limited on-site conditions	6
	What changes were made to the management system?	Roles and responsibilities in out-of-hospital emergency care were clarified	20
		Emphasis was placed on research and communication	22
Management change	How do these changes affect the decision-making process?	Efficiency was enhanced	27
	Were new tools or technologies introduced to support management decision-making?	Information communication platforms were established	16
		External resources were utilized	10
	What technologies or systems were adopted to support process reengineering?	New equipment and facilities were allocated	18
Technology change		Smart management systems were implemented	9
	How do these technologies or systems contribute to the improvement of out-of-hospital emergency medical care?	Efficiency was improved	19
	What is the impact of process reengineering on the work environment and tasks of healthcare professionals involved in out-of-hospital emergency care?	The out-of-hospital work environment led to additional tasks	13
Job change		The transition from routine to emergency situations resulted in new tasks	15
	How does process reengineering affect job satisfaction and performance of healthcare professionals?	Psychological pressure	13
		Work intensity	8
Organizational structure	Were any changes made to the organizational structure to support process reengineering?	A corresponding management organization was established	5
	What is the impact on	Efficiency was improved	4

	coordination and communication between different departments or units?	Effective management	4
Cultural change	Did process reengineering lead to changes in organizational culture and values?	Existing culture played a role	24
		Organizational culture and values were further reinforced	16
	How do these changes help align the hospital's culture with the redesigned processes?	Provided support for process reengineering	25
Impact generation	Are there any other important aspects or key factors that have influenced the success or failure of process reengineering in out-of-hospital emergency care?	Logistical support	8
		Emergency plans	17
		Transition mechanisms from routine to emergency situations	8
	Have any lessons learned or best practices been derived from this project?	Regular drills	14
		Emergency resource reserves were prepared	16
		The team was strengthened	17

From Table 4.3, it can be seen that the respondents mainly believe that the changes in the management system help to improve the efficiency of the decision-making process (27 times), play a role in the accumulation of organizational culture and values (24 times), and assist in process reengineering (25 times). In terms of process reengineering, the establishment of new processes (24 times) and the improvement of process reengineering efficiency (24 times) were mentioned. In addition, in terms of lessons learned, 4 respondents believe that there are deficiencies in emergency drills in hospitals.

In 2012, the Guangdong provincial government officially established the Guangdong Emergency Hospital, with a clear mission to undertake emergency support for sudden public health incidents and medical rescue work for emergencies in Guangdong Province. From the day of its establishment, the hospital's positioning and mission were established. The national and provincial governments increased their investment in emergency medical equipment and facilities for the hospital and also received strong support from the higher-level government in emergency medical research and skills training. The Chinese Ministry of Health allocated 10 million yuan to build a mobile hospital in the hospital, and the mobile hospital provides external emergency care equivalent to the level of a Level 2 hospital in disaster areas. In 2012, the Guangdong provincial government invested 300 million yuan to build a 20-story emergency backup ward, which was officially put into use. According to the above analysis, the Guangdong Provincial Emergency Hospital has upgraded and modified its emergency medical equipment and facilities to meet the new requirements of the external emergency care process. Based on semi-structured interview data from respondents, participant observation data, and collection and analysis of documents, the researcher conducted comprehensive research and analysis and further explored the connection between technical and process

changes. In the process of external process reengineering, technical changes have a connection and influence on process changes through medical business, inspection management, decision management, and information support. The connection between technical changes and process changes can be seen in Figure 4.2.

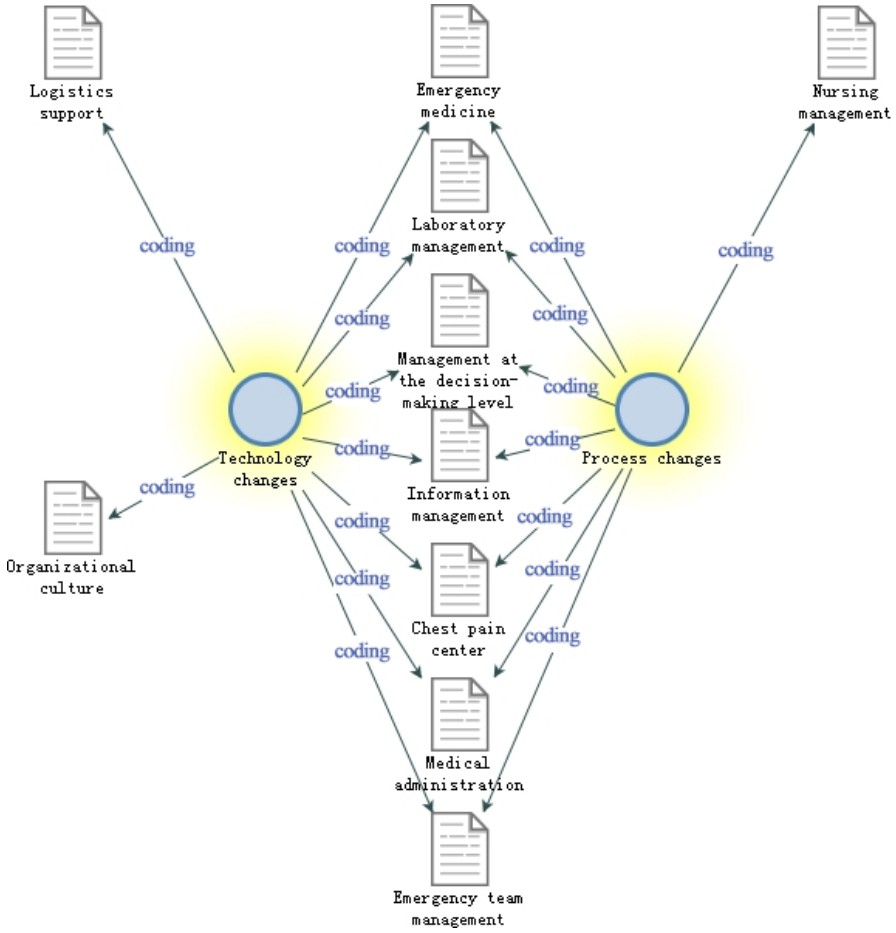

Figure 4.2 Comparative Relationship between Technological Changes and Process Changes

In 2013, the hospital became one of the first six national emergency medical rescue teams in China. After the establishment of the national emergency medical rescue team, regular training and exercises were conducted every year to continuously improve the team's assembly speed, on-site rescue deployment speed, level of technical equipment application, and on-site rescue capabilities. After each exercise, a summary was made, and any identified problems were gradually rectified, including upgrading and transforming the medical rescue equipment and adjusting the external emergency medical service processes. In one exercise in 2013, the emergency team members were unexpectedly notified to assemble and carry out a rescue mission in a remote location. After 2 hours of preparation, 35 team members, along with personal equipment, rescue devices, and medication, mobilized with 8 vehicles forming a mobile hospital, and rushed to a destination 50 kilometers away. At the rescue site, simulations of injury triage, emergency treatment, medical examinations, and emergency

surgeries were carried out. After the exercise, the hospital conducted an analysis and review of the rapid assembly, swift deployment, on-site emergency care, medical examinations, inspections, and logistical support processes. After analyzing the identified issues, the layout of the mobile hospital vehicles was optimized, and the division of labor for various groups was further clarified and detailed. In 2015, the Guangdong Emergency Rescue Volunteer Training Base was established at the hospital, establishing a mechanism for managing emergency rescue volunteer teams and conducting public emergency rescue training. In the same year, a 45-member emergency medical rescue team from the hospital participated in the fourth ASEAN regional forum disaster relief exercise in Malaysia. They completed rescue operations at disaster scenes such as traffic accidents and building collapses and set up a mobile hospital at the disaster site. The capability of digital information systems, mobile hospital equipment, rescue techniques, and organizational management was comprehensively tested during the 7-day exercise. The hospital optimized the equipment configuration for external emergency care, proposed improvements to the design of the medical inspection vehicle, and suggested a cooling and dehumidification plan for medical tents based on the problems identified in this international joint exercise. In 2016, the National Health Commission organized a preliminary assessment of the hospital's application for registering its national emergency medical rescue team as an international medical team. The expert group recommended that the emergency medical rescue team of the hospital, according to the relevant standards of the World Health Organization's International Emergency Medical Team, further supplement related professional equipment, strengthen international rescue training, and continue to improve the related business technical documents for emergency rescue processes, plans, and protocols. As one interviewee (p13) expressed, "external emergency care is a matter of life and death. One of the goals that the Guangdong Emergency Hospital must strive to achieve is how to optimize and enhance our external emergency care capabilities and how to improve our external emergency care system, including our process reengineering." After a year of continuous improvement work, the hospital's emergency medical team had two major support platforms: a mobile hospital and a mobile tent hospital, and all rescue work processes were standardized and institutionalized. In 2017, an expert group from the World Health Organization officially conducted an international certification assessment for the hospital's national emergency medical team (Guangdong). The expert group acknowledged the efforts and progress made by the hospital team in recent months and confirmed that the emergency medical team had implemented modular management and met the standards of an international emergency medical team in terms of emergency disaster

response, organizational operations, and self-protection capabilities.

In January 2020, Guangdong Province initiated a level one response to a major public health emergency. As an emergency hospital in Guangdong Province, the hospital issued a "Letter to All Staff" and a letter to the employees successively, aiming to unify the thoughts of the whole staff and achieve the common goal of fighting the epidemic, according to the positioning and responsibilities of the hospital. All employees were mobilized to strengthen their sense of responsibility and fully embody the good image of an emergency hospital in dealing with the COVID-19 epidemic. As interviewee p3 mentioned: “We started to build an emergency hospital in 2004 and conducted some training. At that time, we were unsure about the effectiveness of these efforts. However, we continued, and now we realize it is indeed necessary. Through 20 years of emergency rescue training, everyone instinctively knows that when it is time to conduct medical rescue, they need to follow the command. This is the accumulation of culture, and the accumulation of emergency culture is very helpful to emergency medical care."

In terms of organizational changes, the hospital implemented an emergency management mode and established the New Coronavirus Infection Treatment Leadership Group led by the highest decision-maker of the hospital. The leadership group set up 11 working groups, including comprehensive group, medical group, infection control management group, material support group, drug support group, logistics support group, information group, financial group, publicity (culture) group, research group, and psychological group. They clarified the responsibilities of each working group, mainly responsible for the daily work during the emergency rescue. In terms of the management mechanism, the hospital established a meeting system and held emergency rescue work meetings twice a day, in the morning and in the afternoon. The highest decision-maker of the hospital presided over the morning meeting to discuss administrative management issues, promptly convey the policy requirements of the higher-level government, address the existing problems in the emergency rescue process, and make timely adjustments and decisions. The deputy director in charge of medical business presided over the afternoon meeting to discuss medical technology issues, conduct discussions on difficult cases, and hold expert consultations for critical patients. Regarding changes in work implementation, the hospital prepared the "Guidance Manual for Diagnosis, Treatment, and Prevention of the Novel Coronavirus" based on the policy requirements of the higher-level government and the actual work of the hospital. The content includes process guidance and work requirements for diagnosis and treatment, nursing, prevention and control, inspection and testing, and logistics support, standardizing the medical process and specifying

the project route guidance diagram. The hospital distributed the manual to all staff, organized training on upcoming projects and business processes, and required everyone to implement the new work processes. As interviewee p5 mentioned: "We will establish a new system and process guidance. For example, work processes and systems, we prefer a simplified version, and then during the operation process, if there are any changes, we modify it while working. We have already formed a manual, which contains over 100 pages of various system and process guidance content." In terms of technical changes, the hospital established the New Coronavirus Prevention and Control Expert Group and formulated the "Specific Infectious Disease Rescue Team Formation Plan". The specific infectious disease rescue team is led by the highest decision-maker of the hospital as the head of the administrative management group and the heads of medical management, infectious diseases, respiratory, critical care, digestive, pediatric, and pharmaceutical departments, organizing a rescue expert group. The rescue, protection, and support team consists of 185 medical experts and administrative staff from 48 departments, including infection management, logistics, human resources, finance, information, equipment, respiratory, emergency, obstetrics, and cardiovascular, with specific responsibilities for personnel selection, unified deployment, training drill, and subsidy standards. They established response and coordination mechanisms for the treatment of new coronavirus infections and implemented a graded management approach for infected patients, specifying the medical teams responsible for critical, severe, and mild patients, and admitting patients to the corresponding areas based on the severity of their condition. The hospital also established an expert duty system, clearly defining responsibilities and consultation mechanisms.

The researcher described the changes in the organizational structure of the hospital over the past three years as the work tasks changed: Annex H is the organizational structure of the daily work of the Guangdong Provincial Emergency Hospital. Annex I is the updated organizational structure diagram of the Guangdong Provincial Emergency Hospital when the emergency medical management system was launched in February 2020. Annex J is the organizational structure diagram of the Guangdong Provincial Emergency Hospital adjusted again in November 2022 according to the needs of emergency medical projects. The hospital has established cross-department teams through organizational structure changes, involving the most loyal and willing personnel in the process reengineering work. To ensure the efficiency and quality of the process reengineering project, the hospital has defined positions and clearly allocated responsibilities for the new organizational structure as follows: The comprehensive coordination group, composed of the hospital office and organization

department, is mainly responsible for document communication, dissemination of important work information, and communication with higher-level government departments. The medical treatment group, composed of the medical affairs department, nursing department, and clinical medical experts, is mainly responsible for the allocation and formation of doctors, technical personnel, and nurses, as well as the development and implementation of emergency medical procedures, business management plans, and standardization of diagnosis and treatment plans. The financial material group, composed of the finance department, procurement department, and equipment department, is mainly responsible for the financial security, management, and use of emergency medical special work, as well as the procurement and distribution management of related materials. The subsidy and award group, composed of the human resources department, organization department, finance department, and performance management department, is responsible for the distribution of emergency medical special subsidies, and the implementation of a new award selection mechanism. The hospital requires the new organizational structure to further strengthen mutual cooperation, with each work leader taking on the overall responsibility, to form a joint effort. The hospital reviews the work quality and efficiency of each team every day, ensuring that every task of emergency medical special work is implemented. Of course, organizational structure changes also depend on support from other elements. After the organizational structure changes, the newly formed cross-department team members such as the emergency medicine department, laboratory management, and decision management, as shown in Figure 4.2, are carrying out process change-related work with the support and influence of technological changes.

In February 2020, while Guangdong Provincial Emergency Hospital in Guangzhou was coping with the new coronavirus epidemic, in accordance with the notifications issued by the National Health Commission and the Health Commission of Guangdong Province, the hospital's emergency medical team needed to go to Hubei Province to support the efforts to combat the epidemic. Based on the preliminary communication about the rescue needs, the emergency medical team was composed of 57 personnel, including 11 senior experts and 20 attending physicians. They were accompanied by 7 mobile hospital vehicles, carrying 31 tons of supplies including medicines, medical equipment, protective gear, and daily necessities. As mentioned by interviewee p4: "If we receive an emergency medical task, before our departure, from a management perspective, we first need to assess the type of disaster, the personnel and supplies that we need to bring. We must first ensure the guarantee of supplies and personnel in all aspects. Upon reaching the destination, the entire emergency team is a collaborative process. The emergency team must communicate very well with the local authorities in order

to ensure that we can calmly carry out treatment. This comes first. Secondly, there needs to be internal management responsibilities, and they are very detailed in their division of labor, including who is in charge of everyone's logistical life, how everyone can quickly start work at the rescue site. The management team is responsible for observing the site environment, including where to set up camp and how to make decisions." The hospital established the organizational structure of the emergency medical team according to their situation, with one team leader, one captain, and teams including doctors, nursing, medical technology, support, information, infection control, and pharmaceuticals. The emergency medical team initiated a daily meeting system to convey the policy requirements of the higher government departments, the latest treatment plans, and work processes. The respective team leaders reported on the work situation, and the head of the emergency medical team made timely analyses and decisions. The teams carried out the following business process reengineering work: The emergency medical team dispatched key personnel to communicate with the local government departments, jointly plan and improve the functional area settings of off-hospital emergency rescue sites, standardize and optimize the triage process, infection control measures, and related process flowcharts. As interviewee p20 mentioned: "In reality, the off-hospital emergency rescue process may be different every time because the on-site environmental conditions are also different." The doctors' group further improved the handover record system to avoid omissions in patient examinations and treatments based on local patient conditions. They also simplified the work processes. In order to improve the quality of diagnosis and treatment, the doctors' group fully developed previous emergency medical work experience, actively assisted in formulating treatment norms and work processes, trained new team members participating in emergency medical work, and promptly identified and adjusted the problems existing in the business processes through questionnaire surveys. The nursing group made changes to admission forms, discharge forms, and patient assessment forms according to the actual local conditions and further optimized the nursing work process. As interviewee p5 mentioned: "The reengineering of off-hospital emergency rescue processes needs to be adapted to the local conditions, and some need to be redefined, meaning that this is kind of work that we have not encountered in the hospital before. For example, admitting and discharging COVID-19 patients is different from our usual admission process". The medical technology group optimized the testing equipment calibration and usage processes through drills. The logistics group, in addition to undertaking ambulance dispatch tasks, also undertook the guarantee of traffic vehicles for the emergency medical team and the transportation guarantee for related items according to the actual local traffic

guarantee conditions. As interviewee p22 said: "When we dispatch an emergency medical team, we need to consider what to bring, how to transport it, how to respond, how to deploy, and how to guarantee? What materials and equipment are best suited for outdoor rescue? Regarding logistics support, we mainly focus on funding, diet, accommodation, transportation, items, equipment, communication, and security." The infection control team, combined with the personnel composition and actual work, pioneered the system of infection control observers nationwide. That is, during the process of medical staff entering and exiting the ward and donning and doffing protective clothing, observers provide observation guidance to avoid occupational exposure and the resulting infection risk. The pharmaceutical group reclassified the emergency medical drug storage and further optimized the dispensing-related processes. The characteristics of this emergency medical rescue mission are that it is time-sensitive and the task is heavy. Emergency medical teams have been deployed from several provinces across the country. As one of the international emergency medical teams, the hospital had previously started to build a team for emergency treatment of infectious diseases. As one of the earliest emergency medical teams to be stationed in Hubei Province, the hospital's emergency medical team has accumulated some experience in the treatment of this type of diseases. However, the emergency medical teams from several other provinces do not have experience in dealing with this type of disease. If they are directly involved in rescue work, it is easy to affect the quality and efficiency of emergency medical work. In order to ensure the quality and efficiency of emergency rescue work, the following is a description of the changes in the work process of the hospital's emergency medical team. First, the hospital took on the pre-job training of other teams, explained the key technologies and core processes, and mastered the relevant new technologies and processes before officially taking up their positions. Second, based on the actual conditions on site and previous practical experience, the hospital assisted local government departments in optimizing related processes, including: ward environment renovation, storage management processes, layout of emergency rooms, triage processes, hospital infection control processes, and other aspects. This effectively shortened the process of repeated research and verification, and accelerated the launch of emergency medical rescue. Third, senior emergency medical team members with high professional titles were dispatched to serve as "inpatient heads" in the emergency rescue area (usually, this position is held by junior doctors in routine medical care) because emergency rescue outside the hospital is different from routine medical work, and it requires experienced experts to coordinate work at this grassroots position to ensure the efficiency and quality of emergency rescue. Fourth, as in the emergency situation, batch patients need to be treated,

and one doctor needs to manage multiple patients at the same time, using only the medical record system to view the treatment status of patients and handover shift leads to efficiency issues. The hospital's emergency team innovatively adopted a standardized process management method of establishing a dedicated "diagnosis and treatment pathway" for each patient, reflecting the key conditions of the patient on their dedicated "diagnosis and treatment pathway", to clearly show where each patient's diagnosis and treatment is at and the stage of the patient's condition. This innovative management method effectively improves the efficiency of doctor handovers and ward rounds, and also reduces the occurrence of missed diagnoses of patients.

In 2021, Guangdong Provincial Emergency Hospital hosted the joint emergency drill for public health cooperation between Guangdong Province and the Guangxi Zhuang Autonomous Region. The drill simulated a location affected by a typhoon disaster resulting in severe damage to local public facilities. In conjunction with the COVID-19 pandemic prevention and control situation, emergency medical teams from the two provinces were dispatched to the disaster area to carry out urgent medical relief work. During the drill, the Guangdong Provincial Emergency Hospital deployed 72 emergency personnel, utilizing unmanned aerial vehicles for the first time for health rescue reconnaissance and transporting test samples. They also set up a mobile hospital consisting of 10 emergency vehicles and a tent hospital consisting of more than 20 tents with medical treatment, logistics support, inspection, and testing functions. Additionally, the drill involved the use of helicopters for transporting critically ill patients. The drill assessed the team's on-site medical treatment capabilities, emergency equipment carrying, medical psychological rescue, and logistical support capabilities. In 2022, in accordance with the notices from the National Health Commission and the Health Commission of Guangdong Province, the hospital sent 80 emergency medical team members to support Hainan Province in combating the epidemic. The 80 emergency medical team members formed two subgroups deployed to different locations in Hainan Province, each with a clear organizational structure comprising a team leader, medical group, nursing group, medical technology group, infection control group, and logistics group, each with specific job responsibilities. The emergency medical sub-teams adhered to a daily meeting system, where each work group reported on the day's work, reviewed the previous stage's work, and analyzed and deployed the next steps. The subgroup leaders primarily communicated with the local government to further obtain information on support needs and related support. The medical group, nursing group, medical technology group, infection control group, and logistics group, based on the original work plan,

restructured the relevant work processes in consideration of the local situation. As participant p28 mentioned, "In the temporary emergency medical area outside the hospital, dividing external treatment into several modules for management is better, and it is more organized in business process management. Establish a diagnosis area. If you feel unwell, come here to find a doctor, the doctor will prescribe medicine for you, and then go to the nurse station to get the medicine. Set up an area to receive food, and you can collect meals there every morning."

Starting from October 2022, the task of epidemic prevention and control in various areas of Guangzhou increased. The Emergency Hospital of Guangdong Province established several emergency teams to carry out emergency medical work in the corresponding areas. The working mechanism is to appoint a team leader for each team, and based on the task volume, a medical team and a nursing team can be set up. As mentioned by interviewee p1: "Outbound rescue requires team management, each team should reasonably match personnel, and this team can cooperate and work together effectively." After each emergency medical task is completed and the team returns to the hospital, the team leader is responsible for reporting the work situation to the hospital authorities. In November 2022, the area where the hospital is located, Guangzhou, faced the most severe situation of the epidemic in the past three years. According to the notices of the National Health Commission of China and the Health Commission of Guangdong Province, the hospital suspended its routine medical work and devoted all hospital resources to emergency rescue work. On the day when the hospital received the emergency medical rescue task, a mobilization meeting was immediately held, conveying the requirements of the higher government departments, clearly stating that the entire hospital's administrative departments and clinical departments have the responsibility to participate in emergency medical work, and to carry out process reengineering work in accordance with the overall deployment of the hospital to adapt to the epidemic treatment work, and to jointly overcome the most severe period of the past three years. After further communication and understanding the specific requirements of the task with the Guangzhou municipal government departments, the hospital firstly established a special working group such as the treatment expert group. Secondly, the emergency backup ward on the 20th floor was arranged as the first-phase treatment area, which is also the national major epidemic treatment base upgraded and renovated with an investment of 150 million yuan by the Chinese government in 2020. Thirdly, a phased and batched treatment plan for new coronavirus-infected patients was implemented, and fourthly, the relevant business management departments further improved the work processes and planned route maps to

make regional divisions according to the requirements of infectious disease treatment. On the day after receiving the emergency medical task, the hospital held another mobilization meeting to make everyone aware that the hospital is currently facing the most complex situation in the three-year fight against the epidemic, aiming to unify the thinking of all hospital staff, so as to quickly transition into the role of emergency medical work, assume the responsibility after process reengineering, and firmly believe in and target to eventually overcome the epidemic. As interviewee p13 said: "This transformation from routine medical care to emergency medical rescue is not just a transformation of work processes. More importantly, it is also a transformation of concept, organizational culture and thinking."

This study provided a summary and descriptive analysis of the main decision content related to BPR in the hospital's daily morning epidemic prevention and control work meetings. In the work meeting on November 15th, the hospital, according to the latest work task requirements from the higher government departments, specified that the hospital should make preparations for the deployment of 2000 medical staff and ensure accommodation. In terms of process changes, the meeting decided that the Medical Affairs Department would take the lead in overall coordination and scheduling of the admission area, aiming to quickly convey relevant work requirements, further clarify and standardize the process of admitting patients with COVID-19, and further specify the rotation of medical personnel and process management requirements. Regarding changes in activity execution, it was specified that the Intensive Care Medicine Department would take the lead in the rescue team's work, and the Respiratory and Infectious Diseases Departments would take the lead in the work of treating patients with COVID-19. At the work meeting on November 16th, the emphasis was on adjusting the focus of work and activities in a timely manner, actively responding to and complying with the latest requirements for emergency medical care, rechecking for existing gaps in epidemic prevention and control, and further refining the key processes for epidemic prevention and control. In terms of organizational structure changes, the meeting decided to establish a special team for the treatment of COVID-19-infected cases, led by the Emergency Department and Outpatient Department, to further standardize the admission and referral management process and secure the entry point. As interviewee p13 mentioned: "From this perspective, it is important to transition from being solely responsible for clinical emergency care to actively participating in epidemic treatment, rapidly identifying specific patients, conducting effective triage, and ultimately ensuring the seamless transfer of patients from external care to the wards. In a sense, this transition represents a shift from a simple rescuer role to operating a transfer platform, and the efficient operation of this platform is crucial."

The meeting decided that the vice president in charge of business would lead the establishment of the medical treatment group, with relevant department heads serving as group leaders for their respective specialties, and to formulate the medical treatment plan. In terms of process changes, the meeting decided that the vice president in charge would lead the revision of the "COVID-19 Infection Treatment and Infection Control Manual for Designated Hospitals" and distribute it to the entire hospital for implementation on November 17. As for cultural changes, the meeting decided that the vice president in charge of organizational culture would lead the reinforcement of organizational cultural development, and the public reporting and promotion of good deeds and individuals in the anti-epidemic work. As interviewee P24 said: "I think it's because the hospital has a tradition of emergency rescue, and the hospital has also established many models, which will become a benchmark for leading organizational culture. In the 20 years of emergency work in our hospital, the scientific rescue and spirit of sacrifice and dedication we have shown is the integration of various typical spirits we mentioned just now. In the face of such a major disaster, this kind of organizational cultural spirit is needed. When going into battle, you don't know if you will be injured, but at this time, a group of people is needed to take on this emergency rescue responsibility." At the November 17 work meeting, the decision was made for the Emergency Department to collaborate with the Guangzhou Emergency Center to create the first batch transmission disease emergency pre-triage mechanism in the country, applying the P2+ emergency testing vehicle to speed up the reporting time of test results, and striving to achieve timely triage and admission for critically ill patients. The hospital provided support for the implementation of these process changes in terms of organizational and technical adjustments. As interviewee P13 said: "In this situation, the Emergency Department is not just a matter of emergency care itself; it is more important to build a fast track between external and internal emergency care, which is actually to build an efficient and coordinated platform." Interviewee P26 also mentioned the impact of process reengineering on efficiency: "In the past, nucleic acid testing was a meticulous and slow process, and the average time for project reports was about three days. This time, due to the needs of epidemic prevention and control, support was provided at the national level for testing equipment and technology. Our hospital has carried out process optimization from sample collection to results reporting, and now it is all done in one go. Unlike before, where barcodes had to be affixed and samples accumulated until a certain quantity before processing, it is now done immediately, which has shortened the reporting time. Due to optimization of business processes from various aspects, rapid testing usually results in two hours."

The description of the work meeting decisions regarding the dynamic adjustment of the admission area settings are as follows: 1. November 18: Adding the 3rd floor of Building 3 for the admission of patients infected with the new coronavirus; referring asymptomatic and mild patients to the next level hospital; the Human Resources Department reassigning 25 employees to be responsible for the logistical support of the medical staff dormitory. 2. November 21: Taking the lead in formulating the plan to add Building 2 as an admission area; recalling hospital staff from other locations performing emergency medical tasks back to the main hospital. 3. December 4: Applying for specialized medical staff from other hospitals to support emergency medical work at this hospital. The description of the incentive mechanism adjustment is as follows: Late November: Employees' performance in carrying out the anti-epidemic work in emergency medical care will be linked to incentives such as salary increases, professional title reviews, job promotions, commendation rewards, and annual assessments. The description of the information technology support process changes is as follows: 1. Establish an information support group, responsible for utilizing the hospital's electronic information system to maintain and manage various information systems, as well as operating the internet hospital; 2. Establish a patient identification system and incorporate logistical support, catering distribution, patient management, and other processes into information management.

On December 9th, based on the notification from the higher government authorities and the actual work of the hospital, the hospital held its final work meeting for the emergency medical phase. The hospital has completed the stage tasks of emergency mobilization throughout the hospital and will transition to a new phase of daily work. The top management of the hospital has requested ongoing optimization of the business processes, with the main points as follows: Each department is to further optimize the medical processes, gradually restore routine inpatient and outpatient services, and meet the daily healthcare needs of residents. Each department should further optimize emergency plans to better respond to future sudden public health events, to ensure the orderly and safe healthcare of residents to the greatest extent possible. The Medical Affairs Department and Nursing Department are responsible for formulating plans for the resumption of routine medical services, further improving the pre-examination triage process, emergency procedures, outpatient procedures, and inpatient procedures. Summarize the experience of the previous emergency medical phase and, based on the hospital's upcoming work priorities, further refine relevant emergency plans and streamline related work processes. Establish an "Emergency Department - Intensive Care - Sub-Intensive Care - Rapid Recovery" four-tier closed-loop management system when

facing a large number of patients. Classify patients according to the severity of their condition and the characteristics of their specialties into: emergency and critical patients, critical care patients mainly from ICU and respiratory diseases, sub-critical patients mainly with internal medicine diseases, and regular rapid recovery patients. Establish a pre-examination triage area, implement zoning and hierarchical patient admission methods, establish an expert inspection process, initiate a new management system, and fully mobilize all staff to work together. This series of measures have played a positive role in this emergency medical phase. As mentioned by the interviewee on page 29: "After such a test, we have very good guidance for us to deal with large-scale group incidents, sudden group incidents, organizational management, emergency response, and specific operations. We have experienced this large-scale group incident, the outbreak of a large-scale infectious disease, especially in the Hai Zhu district with the most, most concentrated, and most dangerous cases. We completed the transition of different business processes in a short period of time, which is a great test of administrative capacity and execution. But we have withstood the test, and completed the emergency medical support and rescue tasks quite smoothly and outstandingly. If we encounter such large-scale rescue, we have laid a good foundation in practice and know how to respond, avoiding being flustered and confused."

Finally, the researcher conducted an analysis and research on the important carrier of emergency medical care outside hospitals in Guangdong Province – mobile vehicle-borne hospital equipment. Based on the original strategic vision and planning of the National Health Commission, the first batch of national emergency medical rescue teams focused on the construction of mobile hospitals. Annex Kprovides some pictures mobile hospitals in vehicles. After accepting the task of constructing the national health emergency medical team in 2010, the Emergency Hospital of Guangdong Province collaborated with professional vehicle modification factories, drawing on the equipment models of military and civilian field hospital facilities abroad, and selected and integrated civilian vehicle-mounted hospital equipment suitable for mobile emergency rescue within the region. By the end of 2011, it became the first emergency medical rescue team in the country to be equipped with this equipment.

After completing the off-site emergency medical tasks in 2020, the mobile hospitals in vehicles were upgraded again in 2021. The new generation of 5G intelligent mobile hospitals consists of 10 vehicles, including surgical vehicles, medical technology assurance vehicles, pharmaceutical and medical equipment vehicles, clean water storage vehicles, power supply vehicles, material transport vehicles, P2+ mobile monitoring vehicles, camping vehicles,

communication command vehicles, and catering trailers. For a detailed analysis of the functions and technical changes of these 10 vehicle-mounted mobile hospitals, please refer to Table 4.4.

Table 4.4 Analysis of Functionality and Technical Changes in the 10 Vehicle-Mounted Mobile Hospitals

Name	Function	Technological changes
Communication command vehicle	Consists of a loading platform, command communication system, and power distribution system. The command communication information subsystem includes 5G/4G transmission system, static center satellite communication system, audio and video system, and on-site broadband networking system. It has the ability to interconnect with rear command posts and other operating vehicles.	The loading platform is equipped with a chassis with off-road maneuverability and a carrier platform with installed equipment and facilities. It can conduct remote communication in the field, realize remote consultation, remote conferences, and medical record data transmission.
Surgical vehicle	Used for early surgical treatment and emergency surgeries. The surgical vehicle compartment is divided into a preoperative preparation area and a surgical area. The preoperative preparation area is mainly used for the washing and disinfection of surgical instruments and medical personnel. Equipped with equipment such as handwashing devices, rapid steam sterilizers, instrument tables, and work cabinets. The surgical area is equipped with observation lights, surgical lights, anesthesia ventilators, and surgical beds for the implementation of surgeries.	Compared to the old surgical vehicles, the compartment design is more reasonable, achieving proper separation between clean and dirty areas. The sterilizer in the preparation area allows for washing, disinfection, and sterilization of surgical instruments in the vehicle, directly supplying them for surgical use after sterilization.
Camping vehicle	Can accommodate 24 emergency team members to rest at the same time. It is capable of completing camping tasks for 24 individuals in harsh outdoor conditions, with functions such as rainproof sealing, lightproof sealing, insulation, soundproofing, air conditioning, lighting, heating, and ventilation.	Compared to previous camping vehicles that could only accommodate 8 team members, the number of beds has doubled. The interior of the vehicle has been optimized and improved, with each team member's resting area equipped with bedside lamps, sockets, bedside tables, and other user-friendly facilities. The vehicle is also equipped with air conditioning, television, and washbasin.
Supplies	Used for transporting tents and medical	The experience gained from

Name	Function	Technological changes
transport vehicle	equipment, with shelves installed on both sides of the vehicle. The rear of the vehicle is equipped with a hydraulic tailgate system for convenient loading and unloading of logistical supplies. As a logistical support vehicle, it has good maneuverability and can reach rescue sites, providing sufficient equipment and material support for rescue teams. The storage space inside the vehicle is designed with equipment shock absorption and fixation according to actual needs, ensuring the safe transport of equipment and meeting emergency rescue requirements.	the Wenchuan earthquake and Yushu earthquake shows that in addition to working in large makeshift tent hospitals, rescue teams often need to send small teams to remote villages for rescue operations. The supplies transport vehicle fulfills the needs of mobile medical teams for remote rescue missions.
Power supply vehicle	It meets the power supply and fuel supply needs of wilderness field operations. It has a distribution system and can transmit electricity to other vehicles of the mobile hospital through the distribution box, realizing self-sufficient power supply in disaster relief environments. The rated output power of the power supply vehicle is 200KW, with a maximum output power of 220KW. The fuel tank in the carriage can store up to 3500L of diesel.	To ensure that the noise emitted during operation does not disturb the rest of the patients, the power supply vehicle is also equipped with a noise reduction system. To enhance the guarantee capability, it is calculated that with a full tank of fuel, the power supply vehicle can meet the electricity demand for 60 hours of continuous work for 10 mobile hospital vehicles.
Water storage vehicle	It provides water source guarantee for the operation of the rescue equipment system and purifies surface water of Class III. The front of the carriage is equipped with a water purification machine, the middle part is equipped with a water tank, and the rear part is equipped with a shower room. The water tank has a capacity of 1000litres, and the water purification preparation time is approximately 1 hour. The water source for the water storage vehicle is preferably tap water. In areas without tap water sources or in emergency situations, surface water of Class III can be used as the water source.	The water purification system adopts the "pre-treatment + single-stage reverse osmosis" water treatment process to purify water using reverse osmosis technology.
Medication and Medical Equipment Vehicle	Used for the transportation, distribution, and storage of medication and medical equipment. The carriage is equipped with medicine cabinets, medical equipment cabinets, and a medicine refrigeration unit. The rear of the carriage is equipped with a medicine dispensing counter.	It is suitable for the long-distance transportation of medication that requires cold chain storage and light avoidance. It also enables better management and dispensing of anesthetics and psychotropic drugs required

Name	Function	Technological changes
Medical Technology Support Vehicle	Used for conducting blood routine tests, urine routine tests, biochemical tests, and X-ray examinations for injured patients. The expanded carriage is divided into three areas: the laboratory area, the staff operating area, and the X-ray examination area, separated by partitions. The vehicle is equipped with a mobile digital radiography (DR) system, a film printer, a portable color ultrasound machine, a blood cell analyzer, a fully automatic dry chemistry analyzer, a blood gas analyzer, a coagulation analyzer, a urine analyzer, a microscope, a centrifuge, a reagent refrigerator, a medical-grade water purifier and pure water tank, and a workstation, among other equipment and facilities.	during rescue operations. Through multiple drills and calculations, it has been determined that the vehicle can perform radiographic and color ultrasound examinations for 300 patients within 24 hours of continuous operation, fully meeting the testing workload of a secondary hospital. The vehicle's Picture Archiving and Communication System (PACS) allows for remote diagnosis. The carriage is fully lead-protected, ensuring that surrounding patients are not affected by radiation.
P2+ Mobile Testing Vehicle	Mainly used for pathogen testing of natural epidemic diseases. The laboratory design meets the requirements of the domestic "General Requirements for Laboratory Biosafety", "Technical Specifications for Bio-safety Laboratory Buildings", and "Medical Laboratory - Safety Requirements", as well as the international WHO "Laboratory Biosafety Manual". The carriage is divided into four parts: a buffer room (changing room), a laboratory area (core area), an air supply and conditioning room, and an exhaust purification room. The laboratory is equipped with biosafety cabinets, sterilizers, incubators, refrigerators, sinks, and testing equipment. The laboratory is equipped with laboratory benches, biosafety cabinets, CO2 incubators, high-pressure sterilizers, hydrogen peroxide disinfectors, portable fluorescence PCR instruments, fully automated nucleic acid extractors, real-time temperature fluorescence detectors, dark-field microscopes, low-temperature centrifuges, ELISA readers, plate washers, and more.	It meets the needs of pathogen testing for natural epidemic diseases, with on-site sample collection, 9-second on-machine testing, seamless integration with the back-end system, and outstanding advantages of safety, reliability, speed, flexibility, and high degree of automation. It can complete the testing of 1,300 individuals' nucleic acids within 24 hours.
Field Cooking Trailer	It is a specialized vehicle used by emergency teams to provide catering support in outdoor conditions. It is responsible for providing food support to mobile hospitals and mobile tent hospitals during simulation exercises, hygiene emergencies, and field conditions. The cooking trailer mainly uses diesel fuel and can also burn wood and coal, making it suitable for various scenarios in disaster	The cooking trailer only requires four emergency team members to operate, can be unfolded within 5 minutes, and can provide hot meals (rice with four dishes and one soup) for 150 people within 1 hour.

Name	Function	Technological changes
	relief operations.	

The "new generation" 5G intelligent mobile hospital not only supports the 24-hour operation of surgical and medical technology vehicles, but also ensures the 24-hour continuous operation of logistic support vehicles that meet the needs of clothing, food, shelter, and transportation. The surgical vehicle can perform a maximum of 7 major surgeries or 15 minor surgeries per day. The "medical technology support vehicle" has two major professional platforms - the inspection platform and the medical imaging platform. The inspection platform can simultaneously meet the professional testing needs of clinical inspection, biochemistry, immunology, microbiology, and blood transfusion, similar to most projects in the inspection department of traditional tertiary hospitals. The medical imaging platform can provide ultrasound and X-ray examinations, meeting and exceeding the inspection workload requirements of the World Health Organization's international emergency medical teams, and the medical equipment specifications are at the level of a tertiary hospital. Additionally, the logistical support has been comprehensively upgraded. It can simultaneously meet the needs of 24-person rest camping vehicles, water purification and storage vehicles that can store 1000L of clean water per hour, power supply vehicles that can meet the 60-hour continuous power demand of the mobile hospital when refilled with fuel once, and cooking trailers that can supply 4 dishes and 1 soup for 150 people within 1 hour. There are also material transport vehicles for transporting medical equipment and drugs to remote areas in disaster-stricken areas, which are important emergency support vehicles to ensure the self-sufficiency of emergency teams in disaster-stricken areas. The newly added P2+ mobile detection vehicle meets the needs of detecting natural epidemic diseases and provides strong technological support for emergency medical rescue in sudden public health events.

With the support of new technologies such as 5G and 4K, all information can be transmitted in real-time and dynamically, effectively achieving connectivity between the front line and the rear, making treatment more scientific and accurate. The emergency medical team on board can use the mobile medical equipment to complete a series of tests for the patients such as blood tests, electrocardiograms, and ultrasonography at the first time. Through the 5G network, a large amount of life information such as medical images, patient vital signs, and medical records can be transmitted back to the hospital in real-time for remote consultations with in-house experts. Upon understanding the patient's condition in a timely manner, the in-house multidisciplinary team will be able to formulate emergency treatment plans in advance and make preparations for various rescue work, realizing the closed-loop

management of emergency rescue outside the hospital and in-house treatment. If the patient's condition is severe, the rescue doctor can perform various emergency surgeries in the mobile hospital, and through high-definition cameras, realize "5G+4K" remote surgical guidance, as if multidisciplinary experts from the hospital were at the disaster rescue site in person, so that the mobile hospital can play a greater role in emergency rescue outside the hospital, and better safeguard the lives and health of the injured. As interviewee p20 said: "Now we are following the model of entering the hospital directly upon boarding the ambulance, using information technology to support this model. Our ambulance is actually part of the hospital, and when the patient gets on the ambulance, it is equivalent to arriving at the hospital. The ambulance is equipped with portable equipment, and through some 5G networks, we can establish data interfaces, and transmit all this information, including patient information, vital signs, and emergency test results performed on the ambulance, directly to our hospital. When the patient arrives at the hospital, the hospital has already made arrangements in advance. Through this model, we strive to save time for patients in need of emergency treatment." Interviewee p6 also mentioned the supporting role of information technology in emergency rescue outside the hospital: "We have developed a Diandi doctor emergency APP, and the information input about the patients on the ambulance's iPad is already connected to the hospital's background system. Unlike before, where you have to register and go through other procedures after arriving at the hospital. All the information of the patients receiving emergency treatment outside the hospital is in our hospital system, including subsequent blood sampling or other tests, effectively shortening the procedure."

The researcher analyzed the key factors for the successful improvement of the workflow and conducted an analysis of the emergency medical data outside the hospital for this project.

The analysis results are shown in Table 4.5.

Table 4.5 Results of Process Reengineering for the Out-of-Hospital Emergency Project

Project	Content
	According to the SOP document, when a region experiences a major or severe sudden-onset event, the emergency medical rescue response mechanism should be promptly activated. From the directive issued by the National Health Commission to the arrival of the emergency medical rescue team in the affected area, the health and family planning commissions and relevant units of the provinces should promptly engage in travel coordination management, organization of rescue teams, preparation of rescue materials, handling of travel procedures, preparation for air transportation, pre-departure education and training, deployment mobilization ceremonies, and initial negotiations with external parties. Information collection and assessment should be conducted, including gathering information about the affected area such as the event's severity, nature, and degree; health conditions and medical rescue capabilities; economic and living conditions, social security, geographical environment, cultural customs, and weather conditions, as well as monitoring the development trends of the disaster situation. Feasibility of implementing cross-regional emergency medical rescue should be assessed. After receiving the task instructions, all preparations for emergency medical rescue should be completed within 12 hours, and the conditions for deploying to the affected areas to carry out emergency medical rescue work should be met.
Management system changes	Initial consultation in the disaster area: Upon the rescue team's arrival in the affected area, immediate coordination work should be carried out to determine the information obtained in the early stage and the matters discussed, in order to further clarify relevant issues related to the rescue work. Emergency management mode activation: In terms of management mechanisms, a meeting system should be established, and emergency rescue work meetings should be held every morning and afternoon. The highest decision-maker of the hospital should chair the morning meeting, mainly focusing on administrative management issues, timely conveying the policy requirements of the higher-level government, addressing issues in the emergency rescue work process, and making timely adjustments and decisions. The deputy dean in charge of medical services should chair the afternoon meeting, focusing mainly on medical technology issues, conducting discussions on difficult medical cases, and organizing consultations for critically ill patients by experts. On-site rescue preparation: After completing the aforementioned tasks, on-site rescue preparation should be immediately conducted. On-site rescue work in the disaster area mainly includes camp construction, on-site assessment, camp disinfection, medical treatment, publicity and reporting, cooperation and communication, and situation reporting. According to the work plan of the National Emergency Medical Rescue Team of Guangdong Emergency Hospital, all members of the logistics team of the National Emergency Medical Rescue Team planned ahead and took the initiative. At the beginning of the outbreak, they were the first to

Project	Content
	complete tasks including emergency vehicle maintenance, trial operation and maintenance of water and power supply equipment, inventory replenishment of camping and living guarantee materials, and inventory of modular materials for tent hospitals, effectively ensuring the assembly was completed within 2 hours after receiving the departure notice and achieving overnight departure with fully equipped materials. The command and information teams of the National Emergency Medical Rescue Team of Guangdong Emergency Hospital played a major role in coordinating and communicating during the epidemic.
Organizational structure changes	Establish an emergency medical rescue leadership group led by the highest decision-maker of the hospital. The leadership group will have several functional work groups including the comprehensive group, medical group, infection control group, material support group, pharmaceutical support group, logistics support group, information group, finance group, publicity (cultural) group, research group, psychological group, each with clear responsibilities, primarily responsible for the daily work during the emergency rescue period. The national emergency medical rescue team (Guangdong) medical team will have one team leader, one captain, and will include clinical group, nursing group, command group, support group, and information group, among others. The clinical and nursing groups will carry out treatment tasks based on the routine diagnosis and treatment protocols and the external emergency medical work guidelines. In the field of emergency medical treatment outside the hospital, this medical team pays great attention to integrating local practical situations, continuously optimizing workflow, and establishing sound work norms. They actively propose multiple rationalization suggestions to the command and collaborate closely with other units to jointly explore efficient and safe treatment routes. In order to ensure the treatment of patients, they have established core emergency medical systems such as "Job Responsibilities for Doctors in Cabin Hospitals (Guangdong)", "Job Responsibilities for Inpatient Chief Physicians in Cabin Hospitals (Guangdong)", and "Nursing Work Manual for Cabin Hospitals (EMT)", providing specific and standardized guidance for medical work.
Process changes	In terms of infectious disease treatment, this medical team attaches great importance to the personal protection of medical staff. In order to reduce the risk of infection, they have proposed and successfully implemented the "Infection Control Observer" system, incorporating it into the relevant guidelines for the donning and doffing of protective equipment, making it a core component of the infection control system for cabin hospitals and promoting it in other medical teams. In addition, to meet the special infection control requirements of cabin hospitals, they have also introduced the "Safety Observer" system to ensure comprehensive infection control. In addition to focusing on the prevention and control of infectious diseases, this medical team also highly values the internal management of medical team members. They have formulated detailed "Health Protection Management Measures for National Emergency Medical Rescue Teams (Guangdong)", which cover specific regulations for medical staff shift handovers, skills training, material distribution, daily living, personal

Project	Content
	hygiene, and have established safety observers to supervise the rigorous implementation by all team members. In accordance with the policy requirements of the higher government and the practical aspects of hospital work, a "Emergency Medical Rescue Handbook" has been developed, covering guidelines and requirements for processes such as diagnosis, treatment, nursing, prevention and control, inspection and testing, as well as logistical support. The handbook aims to standardize medical procedures and provide clear guidance on project routes. Based on the disease symptoms of mass casualties, the medical team has established inspection teams composed of relevant specialist doctors to conduct joint rounds for emergency medical admissions and facilitate multidisciplinary consultations.
Activity execution changes	Pharmacists have been assigned front-line shifts to conduct pharmaceutical rounds, provide guidance on rational drug use in clinical practice, and offer pharmaceutical services. Clinical pharmacists have established a drug supply catalog for the emergency medical area outside the hospital and are fully responsible for dispensing long-term medications for patients receiving medical rescue outside the hospital. Members of the medical technology group have undertaken the task of conducting mobile CT scans for emergency medical rescue patients. They are involved throughout the entire process, from hardware testing and image transmission to operating room disinfection, continuously exploring scanning methods, optimizing scanning procedures, and improving the plan for uploading medical images. In addition, medical technologists also utilize wireless handheld ultrasound for abdominal and pulmonary ultrasound examinations for patients in need, promptly providing feedback on changes in the patient's condition to clinical doctors. They have taken the initiative to fulfill the role of the national team in "mentoring and supporting", voluntarily taking on the responsibility for conducting pre-admission training for medical teams from other provinces. Additionally, they have assumed the role of the chief physician in the cabin hospital, responsible for assessing the condition of patients in the cabin hospital, coordinating patient transfers and discharges, and handling emergency situations. These initiatives have received unanimous praise from other medical teams.
Work and activity changes	In addition to carrying out routine preliminary triage, management coordination, and ward management work, the nursing team has focused on communication and psychological support tailored to the characteristics of local patients. They have effectively helped patients alleviate anxiety and improve sleep quality. Due to the presence of anxiety and restlessness in many patients, the nursing team has successfully alleviated anxiety and insomnia in many patients through therapeutic education and the organization of activities such as "Five Animal Frolics" and "Eight Brocades". Faced with a large number of patients, they established a preliminary triage area and implemented a method of patient admission through zoning,

Project	Content
Technology changes	classification, and grading. They have implemented a four-tier closed-loop management system for "emergency treatment, critical illness, subcritical illness, and rapid recovery", subdividing patients based on the severity of their conditions and the characteristics of specialist symptoms, including emergency treatment for critical patients, specialized treatment for severe patients predominantly in the ICU and respiratory departments, subcritical illness primarily in the internal medicine department, and common rapid recovery patients. The mobile medical unit has been upgraded again. The "new generation" 5G-intelligent mobile clinic consists of 10 vehicles, including surgical vehicle, medical technology assurance vehicle, pharmaceutical equipment vehicle, clean water storage vehicle, power supply vehicle, material transport vehicle, P2+ mobile monitoring vehicle, accommodation vehicle, communication command vehicle, and catering trailer. This "new generation" 5G-intelligent mobile clinic not only supports the operation of surgical and medical technology vehicles 24 hours a day, but also ensures that logistical support vehicles for clothing, food, shelter, and transportation are operational around the clock. With the support of new technologies such as 5G and 4K, all information can be transmitted in real time and dynamically, effectively connecting the front line with the rear, leading to more scientific and accurate treatment. In fact, an ambulance is essentially an extension of the hospital, so when a patient is in an ambulance, it is equivalent to being in the hospital. At the national level, support has been provided for inspection equipment and technology, and the efficiency of obtaining inspection results has been accelerated through optimization of business processes in all aspects.
Organizational culture changes	Before the start of emergency medical rescue operations, an organizational mobilization meeting is held to ensure unified thinking and clear responsibilities and goals. The National Emergency Medical Rescue Team of Guangdong Emergency Hospital frequently maintains communication, conducts joint drills, and operates with clear division of labor. Through this harmonious cooperation and clear division of responsibilities, the team can quickly reach a consensus upon arrival at the rescue site, orderly and efficiently carry out their work, and strive to secure valuable time for rescue operations. At the front-line of emergency medical rescue, the medical team fully leverages the advantages of having a complete team of professionals in medicine, nursing, pharmacy, technology, and logistics. Physicians, nurses, medical technologists, pharmacists, administrators, drivers, and other personnel actively participate in the entire process of emergency medical rescue outside the hospital, working together to effectively treat patients.

Annex L to R present additional evidence of the reengineering changes introduced in the hospital (see Table 4.6 for a brief description of the contents of each Annex).

Table 4.6 The Hospital's Achieved Process Reengineering Situation

NO.	Content
Annex L	Emergency supplies warehouse layout at the Emergency Hospital in Guangdong Province
Annex M	Outdoor emergency medical information platform layout at the Emergency Hospital in Guangdong Province
Annex N	Layout of the field hospital at the Emergency Hospital in Guangdong Province, including tent arrangements
Annex O	Work guidelines for the China International Emergency Medical Team (Guangdong) (Table of Contents)
Annex P	Medical quality and safety management and continuous improvement manual (Table of Contents)
Annex Q	COVID-19 infection medical treatment work manual for the Emergency Hospital in Guangdong Province (Table of Contents)
Annex R	Compilation of emergency plans for the Emergency Hospital in Guangdong Province (Table of Contents)

4.4 Evaluation of Guangdong Emergency Hospital to the BPR initiative

To answer Research Question 2 (How do key actors evaluate the readiness of Guangdong Provincial Emergency Hospital to the reengineering of the out-of-hospital emergency care), the researcher proceeded with data entry, organization, and statistical analysis after completing the distribution and collection of survey questionnaires. The internal consistency of the scale, as referred to by Abdolvand (2008), was calculated using Cronbach's α coefficient. The results of the internal reliability analysis of the questionnaire are presented in Table 4.7.

Table 4.7 Internal Reliability Analysis Results of the Questionnaire

Groups	**No. of items**	**Cronbach's α**
Egalitarian leadership	4	0.918
Collaborative working environment	5	0.879
Top management commitment	3	0.907
Supportive management	4	0.903
Use of information technology	3	0.928
Resistance to change	4	0.923
Overall	23	0.893

The overall Cronbach's α coefficient for the formal questionnaire is 0.893, and the Cronbach's α coefficients for the six dimensions range from 0.879 to 0.928. According to Abdolvand et al. (2008), a Cronbach's α of 0.70 or higher is considered acceptable. All of the Cronbach's α results shown in Table 4.7 are higher than 0.70, indicating that both the overall scale and each dimension of the questionnaire have very high internal consistency. This means that the questionnaire used in this study is reliable. To analyze the internal validity of the questionnaire, this study conducted the Kaiser-Meyer-Olkin (KMO) test and Bartlett's sphere test. The results of the analysis are presented in Table 4.8.

Table 4.8 Internal Validity Analysis Results of the Questionnaire

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.906
Bartlett's Test of Sphericity	Approximate Chi-Square	2955.752
	Df	253
	P-value	< 0.001

The KMO test coefficient for this study is 0.906, indicating that the data structure is excellent. The P-value for Bartlett's test is smaller than 0.001, rejecting the null hypothesis and suggesting that there is a correlation between variables. This implies that the research data can undergo principal component extraction. The results of the analysis of the total variance explained by the components are presented in Annex S, and the rotated component matrix from the principal component analysis is shown in Annex T.

Factor analysis was conducted using the principal component method to extract factors, and the factors were then rotated using the maximum variance method. A total of four factors were extracted, with a cumulative variance explained of 75.545%.

Among the factors extracted, Factor 1 includes the question types of top management commitment, supportive management, and use of information technology. Factor 2 includes the question type of egalitarian leadership. Factor 3 includes the question type of resistance to change. Factor 4 includes the question type of collaborative working environment.

Following the analysis methods used by Abdolvand et al. (2008), this study confirms the significant correlation among all indicators, indicating the highest level of correlation. The researcher used statistical calculations referred to in Abdolvand et al. to assess the indicators. The results of the statistical analysis for the assessment of indicators are presented in Table 4.9.

Table 4.9 Description Analysis Results for Survey Indicators

Indicators	N (Qs)	N	Mean	SD
IN_1	4	134	3.40	0.67
IN_2	5	134	3.54	0.52
IN_3	3	134	3.43	0.66
IN_4	4	134	3.10	0.74
IN_5	3	134	3.35	0.70
IN_6	4	134	1.43	0.98
Valid N (list-wise)	23	134		

In the above text, IN1 refers to egalitarian leadership (Q1-Q4). IN2 refers to a collaborative working environment (Q5-Q9). IN3 refers to top management commitment (Q10-Q12), IN4 refers to supportive management (Q13-Q16). IN5 refers to the application of information technology (Q17-Q19). IN6 refers to resistance to change (Q20-Q23).

According to Table 4.8, the positive indicators IN1 to IN5 are all at the prepared or fully prepared level, while the negative indicator IN6 has a higher standard deviation than the other

indicators. This indicates that the Guangdong Emergency Hospital is well prepared for the project of reengineering the out-of-hospital emergency process, but also suggests differing opinions regarding "resistance to change" (IN6). From the indicator values, it can be seen that the corresponding employees of the Guangdong Provincial Emergency Hospital have significantly less resistance to the reengineering of the out-of-hospital emergency process.

The distribution of survey levels for each indicator under each situation regarding the preparedness data of the Guangdong Provincial Emergency Hospital for the project of reengineering the out-of-hospital emergency process can be seen in Table 4.10, where the first and second highest responses correspond to the fully prepared level.

Table 4.10 Distribution of Data on the Preparation Indicators of the Guangdong Emergency Provincial Hospital for the Reengineering of the Out-of-Hospital Emergency Process

	Indicator											
	$\sum IN_1$		$\sum IN_2$		$\sum IN_3$		$\sum IN_4$		$\sum IN_5$		$\sum IN_6$	
Rank	Frequency	Per.	Frequency	Per.	Frequency	Per.	Frequency	Per.	Frequency	Per.	Frequency	Per.
Total unready	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	0.7%	28	20.9%
Unready	2	1.5%	0	0.0%	2	1.5%	3	2.2%	2	1.5%	52	38.8%
Moderate	18	13.4%	4	3.0%	10	7.5%	29	21.7%	10	7.5%	41	30.6%
Ready	48	35.8%	47	35.1%	50	37.3%	60	47%	56	41.8%	8	6.0%
Absolutely ready	66	49.3%	83	61.9%	72	53.7%	42	29.1%	65	48.5%	5	3.7%
Total(percent)	134	100%	134	100%	134	100%	134	100%	134	100%	134	100%

In Figure 4.3, a diamond model is depicted, highlighting the spatial position of the Guangdong Provincial Emergency Hospital in the preparedness status of BPR. The diamond model is a hexagon, with each vertex representing an indicator. The higher the resistance to change, the closer the mean line will be to the IN6 vertex. In the best case scenario, the mean lines of IN1 to IN5 should be displayed at the maximum level, while the mean line of IN6 should be positioned at the center of the hexagon.

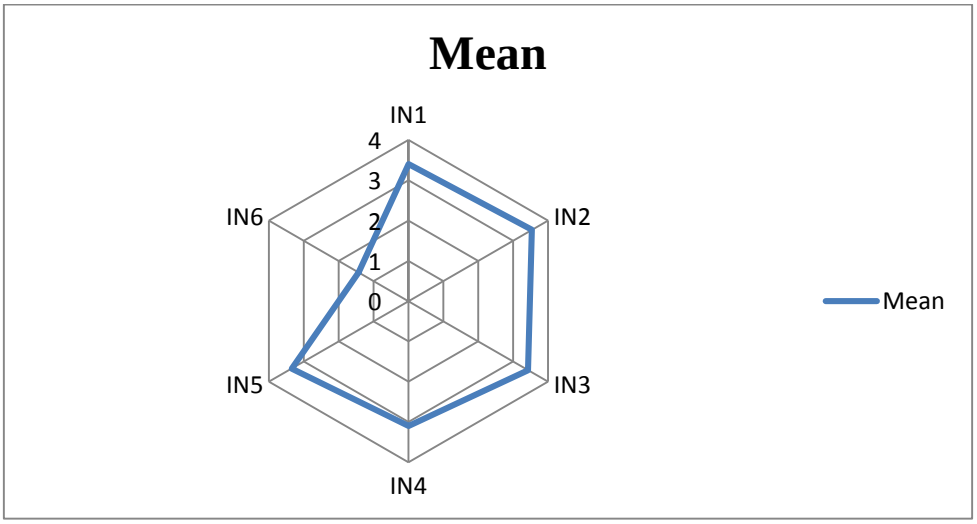

Figure 4.3 State Diagram of the Preparedness of the Guangdong Provincial Emergency Hospital for the Reengineering of the Out-of-Hospital Emergency Process

The results of the Guangdong Provincial Emergency Hospital's project of reengineering the out-of-hospital emergency process show that one indicator achieved the highest result at the fully prepared level, which is a collaborative working environment (IN2). Four indicators achieved a prepared level, namely top management commitment (IN3), egalitarian leadership (IN1), the application of information technology (IN5), and supportive management (IN4). Additionally, one indicator achieved the lowest result at the unprepared level, which is resistance to change (IN6). Therefore, the Guangdong Emergency Provincial Hospital has a low level of resistance to change, and the values of other positive indicators are at the prepared level or higher. This enables the Guangdong Emergency Provincial Hospital to accept improvements and changes, thus being prepared for the project of reengineering the out-of-hospital emergency process. However, it should be noted that a BPR project is considered to have high risks, as described in the previous chapters of this study, and is influenced by a series of critical success factors. Therefore, the hospital still needs to steadily promote business process reengineering within a well-planned and detailed deployment plan.

4.5 Impact of process reengineering initiative in out-of-hospital emergency care

To answer Research Question 3 (What is the impact of process reengineering in out-of-hospital emergency care on Guangdong Provincial Emergency Hospital), the researcher utilized his advantage of working in the case study unit and collected data from the official performance evaluation system published by the National Health Commission of China. The data included a total of 55 (subordinate) indicators in dimensions such as medical quality, operational efficiency, sustainable development, and satisfaction assessment. Additionally, the researcher drawn on government-mandated task indicators, namely on indicators evaluating the level of emergency rescue and medical support. These dimensions corresponded to the evaluation dimensions proposed by the researcher for assessing the BPR initiative. The researcher conducted a comparison and analysis of the indicator data one by one. If a decrease was found, the researcher explored the available documentation, consulted colleagues responsible for performance assessment, and reviewed records from performance assessment thematic analysis meetings to obtain comparative analysis results. The data analysis results for 2019 and 2021 are shown in Table 4.11.

Table 4.11 Analysis of Performance Evaluation Indicators for Tertiary Public Hospitals

Primary indicators	Secondary indicators	Tertiary indicators	2019	2021	Formula of calculation
1. Medical quality	(1) Functional positioning	1. Ratio of outpatient visits to hospital discharges	10	0	Outpatient visits/Number of discharged patients in the same period
		2. Number of transferred patients (outpatient and inpatient)	0	20	Number of patients transferred from the emergency department + Number of patients transferred from the inpatient department
		3. Proportion of day surgeries to elective surgeries	20	20	(Day surgery cases/Total elective surgery cases of discharged patients in the same period) * 100%
		4. Percentage of discharged patients who underwent surgeries	49	42	(Number of surgical procedures for discharged patients/Total number of discharged patients in the same period) * 100%
		5. Percentage of discharged patients who underwent minimally invasive surgeries	5.6	7.2	(Number of minimally invasive surgical procedures for discharged patients/Number of surgical procedures for discharged patients in the same period) * 100%
		6. Proportion of discharged patients who underwent fourth-level surgeries	35	30	(Number of level-four surgical procedures for discharged patients/Number of surgical procedures for discharged patients in the same period) * 100%
		7. Percentage of specialized medical services	20	14	{Volume (or income) of special medical services/Total volume (or income) of medical services in the same period} * 100%
		8. Incidence rate of complications in surgical patients	24.5	21	(Number of complications in surgical patients/Number of surgical patients discharged in the same period) * 100%
		9. Surgical site infection rate for Class I incisions	35	35	(Number of infections in Class I surgical incisions/Number of Class I surgical procedures in the same period) * 100%
	(2) Quality and safety	10. Quality control of specific diseases	13	15	Formula 1: Number of cases of a certain disease = Sum of the number of discharged patients with the specified disease meeting the inclusion criteria. Formula 2: Average length of stay = Total patient days occupied by discharged patients with the specified disease/Number of cases of the specified disease in the same period. Formula 3: Average cost per case = Total cost of discharged patients with the specified disease/Number of cases of the specified disease in the same period. Formula 4: Mortality rate = (Number of deaths from a certain disease/Number of cases of the specified disease in the same period) * 100%

Primary indicators	Secondary indicators	Tertiary indicators	2019	2021	Formula of calculation
		11. Positivity rate of examinations with large medical equipment	20	4	(Positive findings from large medical equipment examinations/Total number of examinations with large medical equipment in the same period) * 100%
		12. Maintenance, repair, and quality control management of large medical equipment	10	15	The hospital provides the corresponding supporting materials for the assessment year (current year).
		13. Number of clinical laboratory tests evaluated through national inter-laboratory quality assessment	29	30	Number of inter-laboratory quality evaluation projects organized by the National Health Commission's clinical laboratory center in the hospital's clinical test items.
		14. Mortality rate for low-risk group cases	35	35	(Number of deaths in the low-risk group/Number of cases in the low-risk group) * 100%
		15. Coverage rate of high-quality nursing services in wards	20	20	(Number of wards providing high-quality nursing services in the entire hospital/Total number of hospital wards) * 100%
		16. Proportion of prescription review to total number of prescriptions	18	12	Formula 1: Proportion of reviewed prescriptions to total prescriptions = (Number of reviewed prescriptions/Total number of prescriptions) * 100% Formula 2: Proportion of reviewed discharge patient orders = (Number of reviewed inpatient order at discharge/Number of discharged patients in the same period) * 100%
	(3) Rational drug use	17. Antimicrobial drug use intensity (DDDs)	6.25	25	{Consumption of antibacterial drugs in hospitalized patients (accumulated DDD) / Number of patient-days of admitted patients in the same period} * 100%
		18. Proportion of essential drug prescriptions for outpatient patients	20	12	Formula 1: Proportion of basic drug prescriptions in outpatient visits = (Number of times basic drugs were used in outpatient visits/Total number of outpatient visits in the same period) * 100% Formula 2: Proportion of use of basic drug prescriptions by outpatient patients = (Number of different basic drugs used in outpatient visits/Total number of different drugs used in outpatient visits in the same period) * 100%
		19. Utilization rate of essential drugs in hospitalized patients	20	4	Formula 1: Utilization rate of basic drugs in hospitalized patients = (Total number of times basic drugs were used by

Primary indicators	Secondary indicators	Tertiary indicators	2019	2021	Formula of calculation
					discharged patients/Total number of discharged patients in the same period) * 100% Formula 2: Proportion of use of basic drug prescriptions by inpatients = (Number of different basic drugs used by discharged patients/Total number of different drugs used in the hospital in the same period) * 100%
		20. Proportion of procurement varieties for essential drugs	16	16	Formula 1: Proportion of varieties of basic drugs purchased = (Number of varieties of basic drugs purchased by the hospital/Total number of drug varieties purchased by the hospital in the same period) * 100% Formula 2: Proportion of national basic drug allocation usage amount = (Total amount of basic drug allocation used by the hospital/Total amount of all drug allocation used by the hospital in the same period) * 100%
		21. Proportion of drugs awarded through national centralized drug procurement	4	20	(Quantity of usage of awarded drugs/Total quantity of the same drugs used) * 100%
		22. Average appointment and treatment rate for outpatient patients	10	20	(Number of appointments for medical treatment/Total number of medical treatment appointments) * 100%
		23. Average waiting time after appointment for outpatient patients	20	20	Σ{ The clock time when entering the examination room for treatment minus the clock time of arrival at the triage desk or check-in through the information system (self-service kiosk and app)}/Number of medical treatment appointments
	(4) Service process	24. Graded functional level of electronic medical record application	15	21	Evaluation based on the grading standard for the application level of electronic medical records set by the National Health Commission: The specific calculation method involves meeting the requirements for basic and optional items, with the effective application range of basic items exceeding 80%, and a data quality index of over 0.5. The effective application range of optional items exceeds 50%, with a data quality index of over 0.5. Meeting all the requirements above as well as those of the preceding level qualifies for reaching that level.

Primary indicators	Secondary indicators	Tertiary indicators	2019	2021	Formula of calculation
2. Operational efficiency	(5) Resource efficiency	25. Average daily workload per practicing physician	20	10	1: Each practicing physician's average daily inpatient workload = {Total bed days actually occupied throughout the year / Hospital's average number of practicing (assistant) physicians} / 365. 2: Hospital's average number of practicing (assistant) physicians = (Current year's number + Previous year's number) / 2.
		26. Number of pharmacists per hundred beds	10	10	{Total number of hospital pharmacists (including pharmacists and clinical pharmacists) / Actual open bed capacity of the hospital} * 100.
	(6) Income and expenditure structure	27. Proportion of outpatient revenue to total medical revenue	20	18	(Outpatient revenue / Medical revenue) * 100%.
		28. Proportion of outpatient revenue from medical insurance funds	0	18	(Revenue from medical insurance funds in outpatient revenue / Outpatient revenue) * 100%.
		29. Proportion of inpatient revenue to total medical revenue	20	16	(Inpatient revenue / Medical revenue) * 100%.
		30. Proportion of inpatient revenue from medical insurance funds	20	20	(Revenue from medical insurance funds in inpatient revenue / Inpatient revenue) * 100%.
		31. Proportion of healthcare service revenue (excluding drugs, consumables, and examination fees) to total medical revenue	30	30	(Medical service revenue / Medical revenue) * 100%.
		32. Proportion of revenue from auxiliary medication	20	20	(Auxiliary drug revenue / Total drug revenue) * 100%.
		33. Ratio of personnel expenses to operational expenses	30	30	(Personnel expenses / Medical activity expenses) * 100%.
		34. Energy consumption expenditure per million yuan of revenue	20	19	(Total energy consumption for the year / Total income for the year) * 10000.
		35. Surplus/deficit balance	50	50	Medical profit margin = (Medical profit / Medical activity revenue) * 100%.

Primary indicators	Secondary indicators	Tertiary indicators	2019	2021	Formula of calculation
		36. Asset-liability ratio	30	30	(Total liabilities / Total assets) * 100%.
		37. Growth rate of medical revenue	0	14	{(Current year's medical revenue - Previous year's medical revenue) / Previous year's medical revenue} * 100%.
		38. Growth rate of average outpatient cost per visit	30	30	{(Current year's average medical expenses per outpatient visit - Previous year's average medical expenses per outpatient visit) / Previous year's average medical expenses per outpatient visit} * 100%.
	(7) Cost control	39. Growth rate of average outpatient drug cost per visit	20	20	{(Current year's average drug expenses per outpatient visit - Previous year's average drug expenses per outpatient visit) / Previous year's average drug expenses per outpatient visit} * 100%.
		40. Growth rate of average inpatient cost per admission	40	40	{(Current year's average medical expenses per discharged patient - Previous year's average medical expenses per discharged patient) / Previous year's average medical expenses per discharged patient} * 100%.
		41. Growth rate of average inpatient drug cost per admission	20	20	{(Current year's average drug expenses per discharged patient - Previous year's average drug expenses per discharged patient) / Previous year's average drug expenses per discharged patient} * 100%.
	(8) Economic management	42. Comprehensive budget management	20	20	Review documentation. Provide supporting evidence for hospitals implementing comprehensive budget management.
		43. Standardized establishment of Chief Accountant	10	10	Review documentation. Provide supporting evidence for hospitals setting up a chief accountant.
		44. The title structure of sanitation technicians.	16	20	(Number of medical staff with senior professional titles in the hospital / Total number of medical staff in the hospital) * 100%.
3. Sustainable development	(9) Personnel structure	45. The proportion of anesthesia, pediatrics, critical care, pathology, and traditional Chinese medicine physicians	11.2	11.6	Formula 1: Anesthesiologist ratio = (Number of registered anesthesiologists on duty in the hospital / Total number of medical staff in the hospital) * 100%. Formula 2: Pediatrician ratio = (Number of registered pediatricians on duty in the hospital / Total number of medical staff in the hospital) * 100%. Formula 3: Intensive care physician ratio = (Number of registered intensive care physicians on duty in the hospital /

Primary indicators	Secondary indicators	Tertiary indicators	2019	2021	Formula of calculation
					Total number of medical staff in the hospital) * 100%. Formula 4: Pathologist ratio = (Number of registered pathologists on duty in the hospital / Total number of medical staff in the hospital) * 100%. Formula 5: Traditional Chinese medicine physician ratio = (Number of registered traditional Chinese medicine practitioners on duty in the hospital / Total number of medical staff in the hospital) * 100%.
		46. The nurse-to-patient ratio	20	20	Total number of registered physicians in the hospital / Total number of registered nurses in the hospital at the same period.
		47. The proportion of hospital staff who have undergone training in other hospitals (especially supporting hospitals and hospitals within medical consortiums) and returned to work independently in their original hospital	20	20	(Number of hospital personnel who accepted training for more than six months in other hospitals and returned to work independently / Total number of trainees recruited by the hospital during the same period) * 100%.
	(10) Talent development	47. The pass rate of hospital resident doctors in their first participation in the physician qualification examination	33	32	(Number of first-time successful candidates for physician qualification examination among resident physicians in the current year / Total number of resident physicians participating in the physician qualification examination during the same period) * 100%.
		49. The effectiveness of the hospital's efforts in cultivating medical talents	14.4	13.82	Formula 1: Proportion of hospital's investment in medical talent training = {(Teaching expenses for medical education in universities + postgraduate medical education expenses + continuing medical education expenses) / Hospital's total expenses for the year} * 100%. Formula 2: Proportion of clinical teaching instructors and preceptors receiving educational training = (Number of clinical teaching instructors and preceptors receiving provincial-level and above educational training and obtaining training qualification certificates / Number of clinical teaching

Primary indicators	Secondary indicators	Tertiary indicators	2019	2021	Formula of calculation
					instructors and preceptors) * 100%. Formula 3: Ratio of full-time administrative personnel for medical education in the hospital to the number of trainees in medical education and training = (Number of full-time administrative personnel for medical education in universities + postgraduate medical education + continuing medical education) / Number of trainees in medical education and training during the same period. Formula 4: Ratio of published teaching articles to the number of healthcare technical personnel = Number of teaching articles published in the current year / Total number of healthcare technical personnel during the same period.
	(11) Discipline construction	50. Research project funding per hundred sanitation technicians	50	50	(Total amount of research project funding approved in the current year / Total number of healthcare technical personnel during the same period) * 100.
		51. The amount of research achievements transformation per hundred sanitation technicians	20	10	(Total amount of technology transfer in the current year / Total number of healthcare technical personnel in the hospital during the same period) * 100.
	(12) Credit construction	52. Comprehensive evaluation grade for public credit	20	17.4	Evaluation in accordance with the comprehensive credit evaluation criteria.
4. Satisfaction evaluation	(13) Patient satisfaction	53. Outpatient satisfaction	34	40	Outpatient satisfaction survey score.
		54. Inpatient satisfaction	40	40	Inpatient satisfaction survey score.
	(14) Medical staff satisfaction	55. Satisfaction of medical staff	40	40	Medical staff satisfaction survey score.
5. Government -mandated task indicators	Emergency rescue and medical support		20	20	Review documentation. Provide supporting evidence.

The overall value of the national monitoring indicators for Guangdong Emergency Provincial Hospital in 2021, as shown in Table 4.12 and Table 4.11, has improved compared to 2019.

Table 4.12 Analysis of Primary Indicators in National Monitoring

	Medical Quality	Operational Efficiency	Sustainable Development	Satisfaction	Total Score
2019	247.35	270	114.2	114	745.55
2021	261.2	269	113.6	120	763.80

Source: The National Health Commission (2022)

Among the four primary indicators in the performance assessment of tertiary public hospitals, the medical quality and satisfaction indicators in 2021 have also shown improvement compared to 2019. However, the operational efficiency and sustainable development indicators have slightly declined in 2021 compared to 2019, with a decrease of about one point for both indicators. During the thematic analysis meeting of the hospital's performance assessment, the hospital's senior leaders and the department responsible for this work acknowledged that the 2021 national monitoring data were affected by the merger of the new hospital district. The former Civil Aviation Guangzhou Hospital was a secondary-level hospital with significant gaps in technical level, management operations, and development capabilities compared to a tertiary hospital. In early 2020, the Civil Aviation Guangzhou Hospital merged into Guangdong Emergency Hospital, and when the national performance assessment of tertiary public hospitals was conducted in 2021, the data from the Civil Aviation Guangzhou Hospital was extracted and merged into Guangdong Emergency Hospital. In this context, while the overall national monitoring indicators of Guangdong Emergency Provincial Hospital in 2021 improved, there was only a slight fluctuation in two indicators. The focus of this study, namely medical quality and satisfaction, also achieved certain improvements. In summary, when implementing the process reengineering project, Guangdong Provincial Emergency Hospital has ensured the quality of medical care and satisfaction, and achieved positive and favorable outcomes. The comparison of the primary indicators in the national monitoring between 2021 and 2019 is shown in Annex U.

Chapter 5: Discussion of Findings

This thesis conducted an empirical research on the process reengineering project of emergency hospitals in Guangdong Province. In this chapter, the researcher gathered and analyzed data from interviews, questionnaire surveys, document collection, participatory observation, and combined the key factors of process reengineering and theoretical models to discuss the empirical findings.

Figure 5.1 summarizes the three most frequently mentioned words (patient, process, and time) in interviews carried out with key participants involved in the reengineering of emergency medical processes outside the hospital in the institution. This reflects that in the process of reengineering processes, the main focus consisted of placing the patient at the center, conducting process reengineering, and reducing patient waiting time or the time required for emergency medical care.

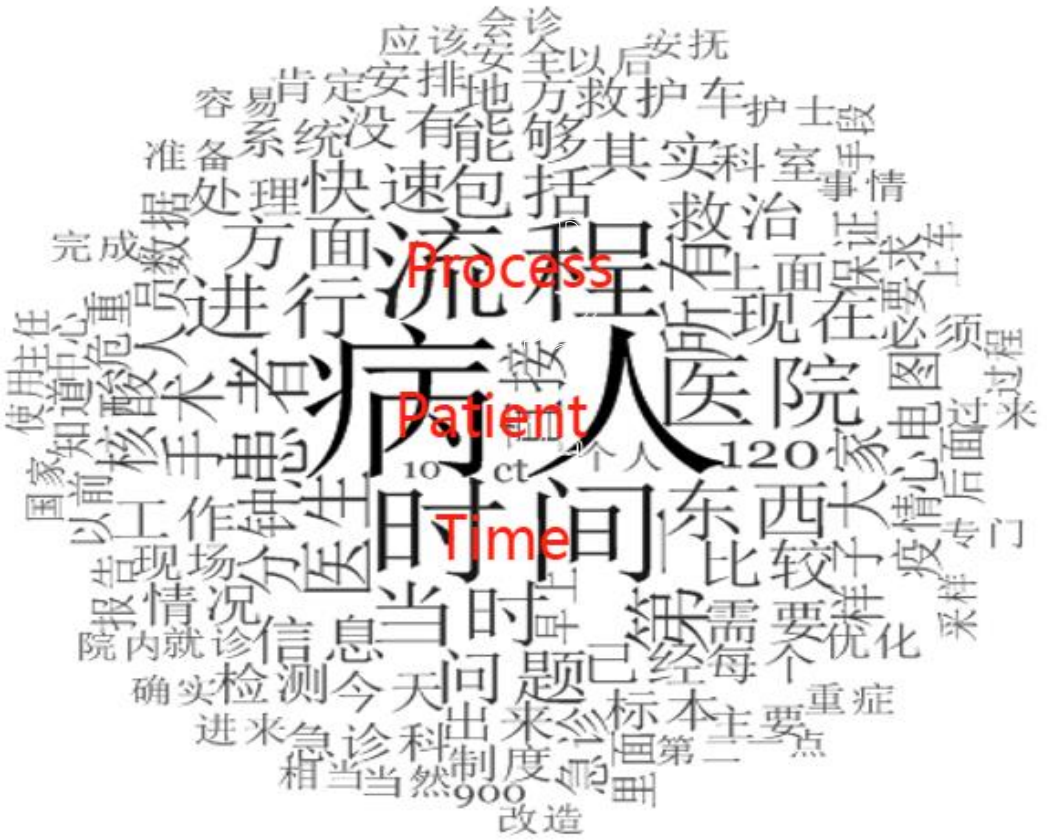

Figure 5.1 Word Cloud Image of Interview Data on Process Changes

Despite the importance attributed to these core aspects of a successful project of BPR, at

the beginning stage of the hospital's overall transition to emergency medical care in 2022, there were several problems affecting the change initiative. The main emphasis was on restructuring physical processes, with little attention given to factors such as hospital staff, organizational structure, and organizational culture. This mainly manifested in inadequate communication between departments of the hospital, with the participants in the process reengineering decision-making meetings mainly being medical, nursing, and logistics personnel. This makes it difficult for BPR projects to consolidate and expand as expected. These findings are aligned with prevailing literature on business process reengineering, which notes that a successful implementation not only requires focus on process design, organizational structure, and technical support, but also on human resources management. While cultural change is considered difficult to improve, creating an effective organizational culture is a decisive factor in successfully implementing BPR (Hammer, 1990). If there is excessive focus on the process itself and neglect of other equally important factors such as communication, structure, and culture, this can lead to a decrease in successful BPR as it happens in the case reported in this thesis.

Moreover, in November 2022, empirical findings revealed that there were signs of further narrowing down the participants in the meetings, with functional departments such as human resources, administrative management, and organizational culture not participating. Literature states that BPR projects are high-risk because they bring about fundamental changes by implementing reforms across multiple domains (Crowe et al., 2002). Each department and function of an organization are interrelated and interdependent, thus initiating changes in one dimension triggers the need for changes in other areas (Habib, 2013). Also, the researcher found that the caliber and channels of communication of BPR-related content notices issued by the business management department were not consistent, with rapid and even contradictory changes in related content. From the perspective of key success factors, there were deficiencies in egalitarian leadership, collaborative work environment, senior management commitment, and management system change. The main reason for the lack of these factors was the lack of communication, resulting in a growing sense of distrust toward the responsible departments for business process reengineering, from the administrative department to the clinical departments. The lack of group emotion was becoming more and more obvious, with increasing expressions of anxiety and increased psychological pressure. This led to the emergence of different personal viewpoints and an increase in individualism. As a result, internal conflict developed, and BPR faced harsh criticism and doubt.

This goes in hand with BPR literature that highlights the importance of organizations

understanding the values and management processes of the newly designed processes. BPR requires changing the culture and behavior of people at every level of the organization, enabling them to have a full understanding of both current and future business processes (Al-Mashari & Zairi, 1999). A clear vision of the future needs to be clearly communicated to employees, motivating and encouraging their active participation. When employees are resilient to change, sharing a vision and common goals helps them to remain focused, organized, and proactive in uncertain environments.

This study also verified through data analysis of interviews with key participants from the hospital that were involved in the reengineering project that process changes cannot exist independently; they are inseparable from personnel and organizational management factors. This is confirmed by the researcher who categorized the interview subjects into 11 special folders based on the positions of the interview subjects, including logistics support, nursing management, emergency medicine, laboratory management, and decision-making level management. To facilitate data analysis, the researcher conducted a third round of coding on the interview content based on the second round of coding, resulting in nine codes: organizational structure, cultural change, process change, technological change, activity change, management change, work change, impact generation, and change requirements. As shown in Figure 5.2, while in the process reengineering, each type of position is connected to several coding contents and each of these contents is also related to several types of positions. It was found that no position or change could exist independently without being related to other elements. Indeed, BPR is a process that requires support from various elements, including process design, personnel factors, and cultural factors.

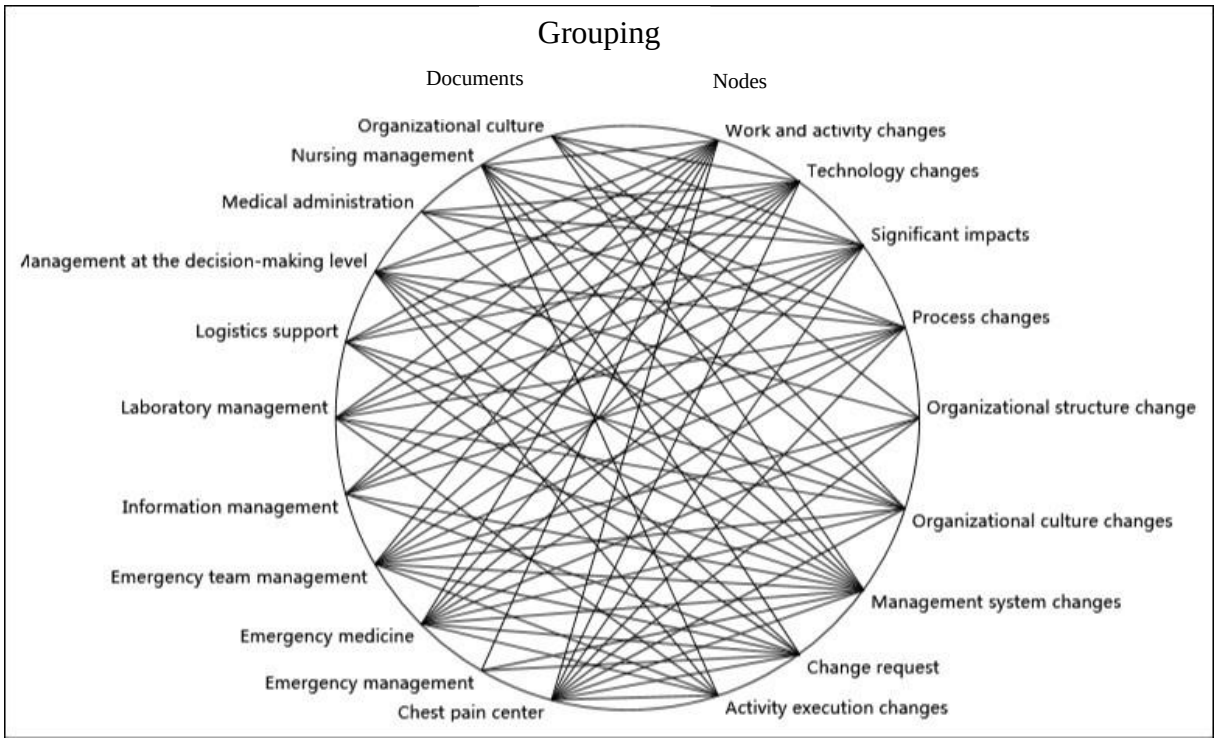

Figure 5.2 Relationship between Interview Content Coding and Thematic Document Grouping Query

After the development of the internal conflict mentioned above was observed, in late November 2022, relevant personnel (the member of the Emergency Medical Leadership Office, responsible for organizing risk assessments and situation analysis) hared their concerns with the highest decision-makers of the hospital. This feedback provided the impetus to top managers to decide revise the organizational structure, job responsibilities, and work mechanisms, in order to enhance the current emergency medical tasks. Management system changes started with the highest decision-maker of the hospital (the head of the hospital) serving as the leader of the emergency medical task leading group. Under the leadership group, there were 18 working groups including comprehensive coordination, medical treatment, infection control, "red zone" closed-loop management, hospital transfer and dispatch, inspection and examination, financial and material support, pharmaceutical guarantee, logistical support, information support, human resources, patient care, publicity and reporting, doctor-patient communication, voluntary services, scientific research management, supervision and audit, and subsidies and rewards. The responsibilities of each working group became clearly defined as part of the strategy of enhancing working groups' accountability and involvement in implementing BPR. The working groups implemented a system where the group leader was responsible and designated the department and members of the group, reflecting the authorization of the highest management level of the hospital, which was conducive to the formation of a collaborative work environment for each working

group. During the fieldwork the researcher explored the relationship between organizational structure changes and management system changes, as well as the link between organizational structure changes and process changes. In the context of process reengineering, organizational structure changes have connections and impacts on process changes through aspects such as emergency management and decision management. The relationship between organizational structure changes and process changes can be seen in Figure 5.3. Organizational structure changes have connections and impacts on management system changes through aspects such as emergency management, decision management, and organizational culture. The relationship between organizational structure changes and management system changes can be seen in Figure 5.4.

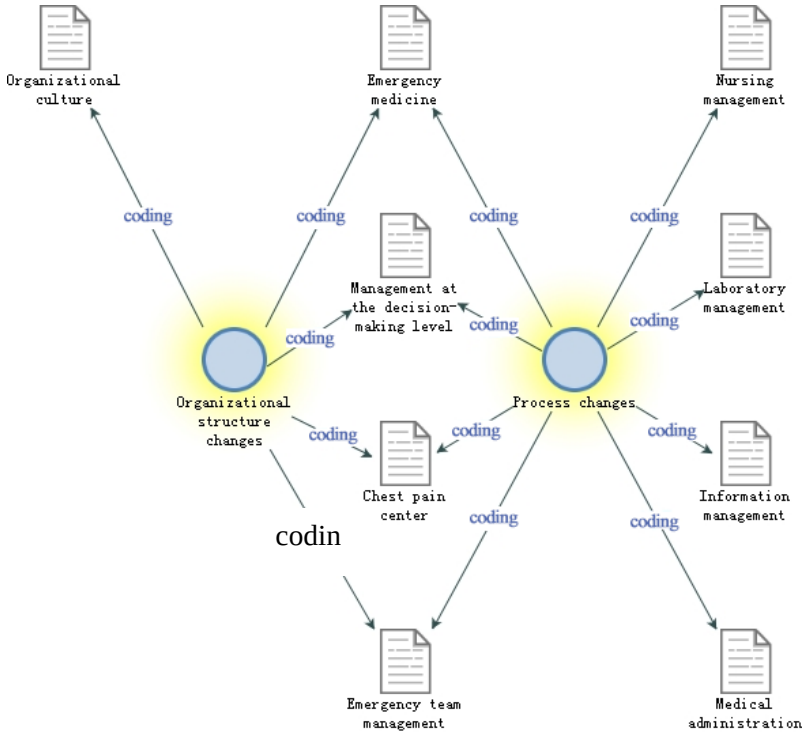

Figure 5.3 Comparative Diagram of the Relationship between Organizational Structure Changes and Process Changes

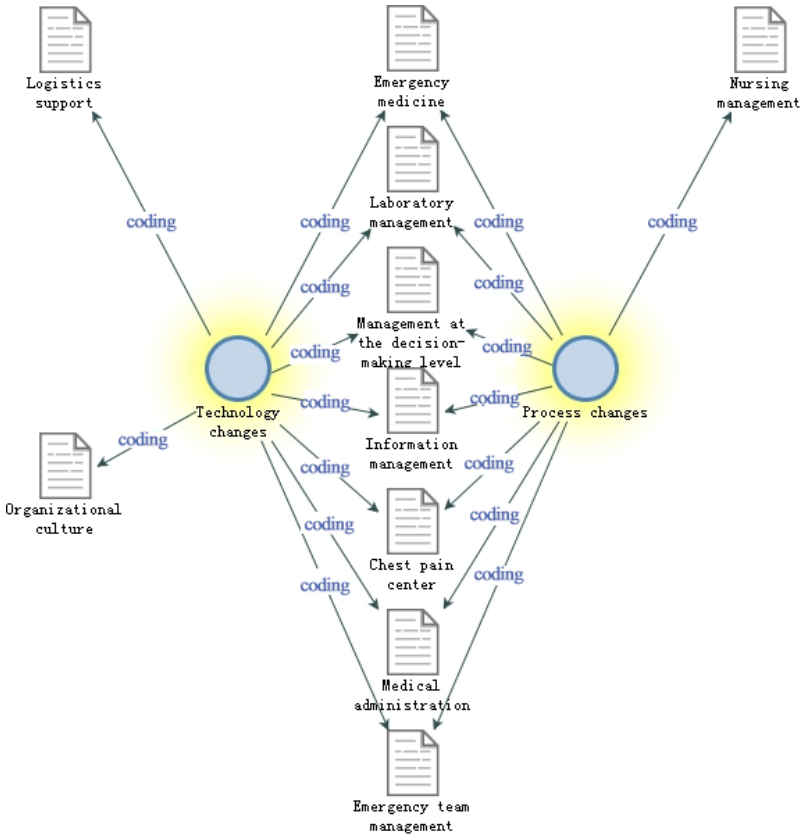

Figure 5.4 Comparative Diagram of the Relationship between Organizational Structure Changes and Management System Changes

As interviewee p28 said: "The management system needs to be clear, and every time there is an emergency, the whole hospital forms a relatively smooth management mechanism from top to bottom." The emergency medical leadership group clearly established the work mechanism: first, establishing a meeting system, with the highest decision-maker of the hospital presiding over the prevention and control work meeting every morning, where the leaders and core members of each working group participate. The meeting mainly listened to the progress of the work of each group, the need for decision-making matters, and the implementation of hospital work, and discussed and solved problems and difficulties in the work progress. It also reported the requirements of documents from the higher administrative departments and communication information with the local government departments, and deployed the hospital's next work tasks. Also interviewee p29 said: "I think it is quite good. First of all, it is analysis and judgment. Every day, the highest decision-maker of the hospital presides over the analysis and judgment meeting, adjusting policies and arranging work, conducting comprehensive and overall deployment. Holding this work meeting every day greatly strengthens the work direction of our administrative staff and the entire hospital's medical staff, provides timely feedback on key issues, and makes timely adjustments. We hold

meetings every day, solve coordination and problems on the same day, execute efficiently, and the management is very in place. Then each department holds small meetings and refines the management to each person in each department. This mechanism makes our response speed very fast and the execution is very strong." The hospital's vice president in charge of business operations convened a case discussion meeting every afternoon, with members of the medical expert group participating. Minutes were prepared for both meetings, and the meeting minutes were sent to all relevant departments and offices of the hospital for dissemination and implementation on the same day, establishing a tracking and implementation mechanism to ensure that the decisions made at the meetings were implemented in a timely manner. Next was to strengthen work linkage, with each working group taking the initiative to carry out communication and liaison work, enhancing mutual coordination, and the leading department of each task taking overall responsibility. The departments involved were required to actively cooperate and support to form a combined work force. Another important aspect in improving BPR implementation consisted of efforts to improve information systems between departments. As a result of this, a data information system was developed, and decisions were made on information sharing channels, methods, time, and responsible persons, ensuring smooth information linkage and streamlining the administrative management process. Along these changes there was the concern of introducing the objective of continuous improvement in order that where, in case of problems encountered during the work execution, they could be directly reported to the highest leadership level, and adjustments could be made in a timely manner based on the actual situation. Further exploring the relationship between management system changes and process changes, the researcher found that in the process reengineering, management system changes have connections and impacts on process changes through aspects such as emergency management, business management, and decision management. The relationship between management system changes and process changes is shown in Figure 5.5.

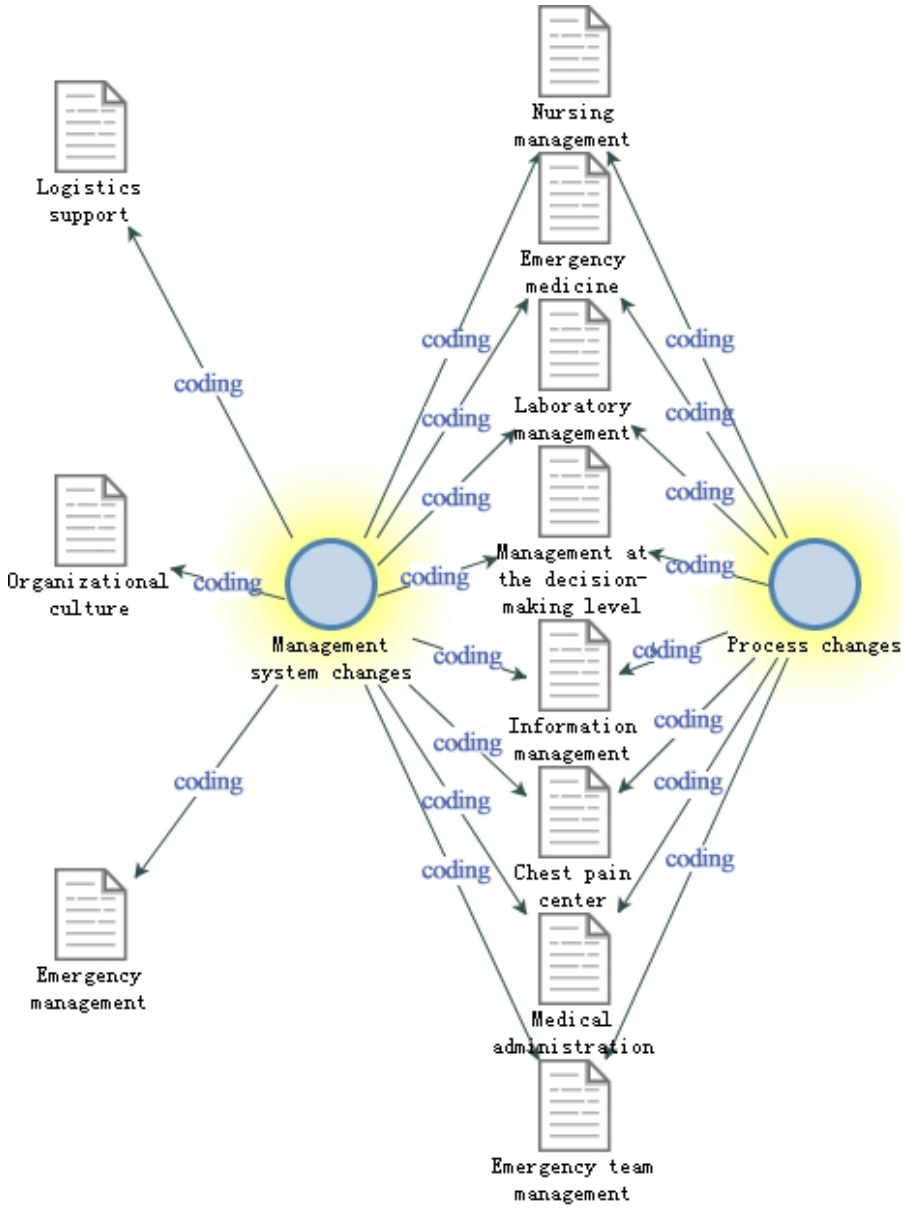

Figure 5.5 Comparative Connection Diagram of Management System Changes and Process Changes

The stable success requires attention to the issues that arise during the process reengineering. Therefore, if internal conflicts are discovered during the continuous observation, evaluation, and feedback process, it is necessary to promptly improve the encountered difficulties. BPR involves fundamental changes in multiple aspects, and continuous evaluation of risks is necessary during the implementation process. The foresight and timeliness of risk management are crucial to ensure the success of process reengineering. Habib (2013) believed that Total Quality Management (TQM) focuses on behavioral and attitudinal changes, can create a supportive environment for BPR implementation. Moad (1993) suggests that BPR is a process that requires analysis and management, and the integration and synergy of TQM and BPR concepts will lead to more improvement effects. As mentioned earlier, BPR is a high-risk operation, and TQM can help address internal issues,

providing crucial support for the continuous implementation of BPR. The Emergency Hospital of Guangdong Province has taken a series of measures in quality management, as described below: Firstly, the hospital established the medical quality director system in 2018, implementing a two-tier quality management responsibility system for the hospital and departments. The main responsibilities of the medical quality director include formulating the hospital's medical quality management system and organizing its implementation, formulating continuous improvement plans for medical quality, and organizing activities such as medical quality monitoring, early warning, analysis, assessment, and feedback. Secondly, in 2020, the hospital adjusted the members of the Hospital Medical Quality and Safety Management Committee according to the actual work situation. The president of the hospital serves as the committee's director, and the committee's work responsibilities and system were clearly defined. Thirdly, in 2020, the hospital revised the assessment and implementation rules for the quality of functional department work based on the actual work situation, conducting quarterly assessments of the work quality of each functional department. The quarterly assessment results are an important part of the annual assessment results for the heads of functional departments. Fourthly, in 2021, the hospital launched a special annual action plan for improving medical quality and safety, formulated an annual work plan for medical quality and safety management, and implemented 24 work responsibilities in the respective departments. Finally, in 2023, the hospital implemented a new medical quality management plan, implementing comprehensive quality and safety management throughout the entire process. This includes a comprehensive quality management system, comprehensive quality and safety control processes, clearly integrating comprehensive quality control management into the hospital's daily work. Departments and departments have established goals for quality and safety management, clarified management organizational structure, personnel, and responsibilities, and the hospital combines dynamic monitoring and regular assessments of quality and safety management. Furthermore, the hospital has developed a special corrective action plan for prominent issues in the high-quality development of the hospital in 2023, adhering to a problem-oriented approach and implementing review mechanisms and corrective actions for prominent issues in disciplines, medical work, talent team construction, organizational culture construction, and high-quality services. The aim is to continuously improve residents' satisfaction and perception of medical treatment, improve work efficiency, and extend the benefits of the hospital's high-quality development to more patients.

The aforementioned incidents in the hospital's process reengineering are related to management style and decision-making capabilities encountered during the implementation

process. Abdolvand et al. (2008) advocate that management performance is crucial for the success of BPR. Creating an open communication and interactive environment in process reengineering and promoting accurate performance evaluations can help reduce risks and increase the success rate. In the initial stages of the hospital's 2022 process reengineering project, the specific management personnel responsible for the project lacked basic BPR concepts. The neglect of team building, effective communication, and organizational structure in designing business processes without proper restructuring was the main cause of the internal conflicts that have developed. In order to support process reengineering, the hospital's top decision-making body promptly established cross-functional and efficient teams, such as the finance and material group, comprising members from departments such as finance, equipment, and procurement, achieving a flattened hierarchical structure. While eliminating functional boundaries, appropriate definitions of work and responsibility assignments were made, with each team having its own mission. The hospital shifted from a functional structure to a process-based functional and process responsibility matrix. The functional structure of the hospital is shown in Figure 4.3. However, due to the fact that the responsibility for emergency medical processes crosses the existing organizational structure, in order to better meet the needs of emergency medical processes, the hospital has created a new responsibility matrix based on processes as shown in Annex I and Annex J, in response to the changing business process needs.

Davenport and Short (1990) believe that traditional sources of authority may be of no use in ensuring successful process management, and senior management needs to develop influence and impact, learning to persuade rather than just instruct and command. In the reengineering project reported in this thesis, the hospital implemented a brief decision-making process, changing the previous weekly meeting system to a daily briefing system, rapidly resolving issues encountered in process reengineering. Each department and division promptly conveyed the hospital's meeting decisions through their own meetings, and this high-intensity decision communication mechanism played a positive role in the smooth progress of process reengineering as well as reducing resistance to change.

In the literature review in Chapter 2, the key success factors of process reengineering are divided into five groups: egalitarian leadership, collaborative work environment, senior management commitment, supportive management, and the use of information technology. The key failure factors are resistance to change. These six groups of key factors constitute the theoretical model of the out-of-hospital emergency process reengineering in this study. In the empirical study in Chapter 4, the research applied Abdolvand et al.'s (2008) questionnaire

based on the key success factors and failure factors to assess the readiness for process reengineering in emergency hospitals in Guangdong Province. Based on the theoretical model and combined with the semi-structured interview data of the interviewees, participation in observational data, and the collection and analysis of documents, the researcher conducted a comprehensive research analysis of the hospital's readiness for process reengineering.

As literature suggests, the organizational decision-makers should focus more on long-term orientation rather than short-term goals for BPR. The transformation should be aligned with the organization's strategy, not just the operational processes. The assessment for BPR readiness is of significant importance. (Adigun, 2003) believes that the high-risk nature of BPR leads to an inclination to evaluate the critical success and failure factors. Only when adequately prepared, the BPR project should be initiated to ensure its success. Otherwise, it should be postponed to optimize the relevant indicators.

To fully leverage the traditional cultural advantages of the emergency medical services in the hospital, young people are encouraged to join the emergency medical teams or participate in training related to emergency medical services. Regular off-site practical drills or cultural training are organized annually to promote structural changes subtly. Zinser et al., (1998) suggests that one should not underestimate the persistence of organizational culture, as many reengineering projects fail due to employee resistance. Drawing on the evidence gathered the researcher further explored the connection between organizational culture change and process change. In business process reengineering, organizational culture change has connections and influences on process change through emergency management, business management, decision management, and so on. The comparison of the connection between organizational culture change and process change can be seen in Figure 5.6.

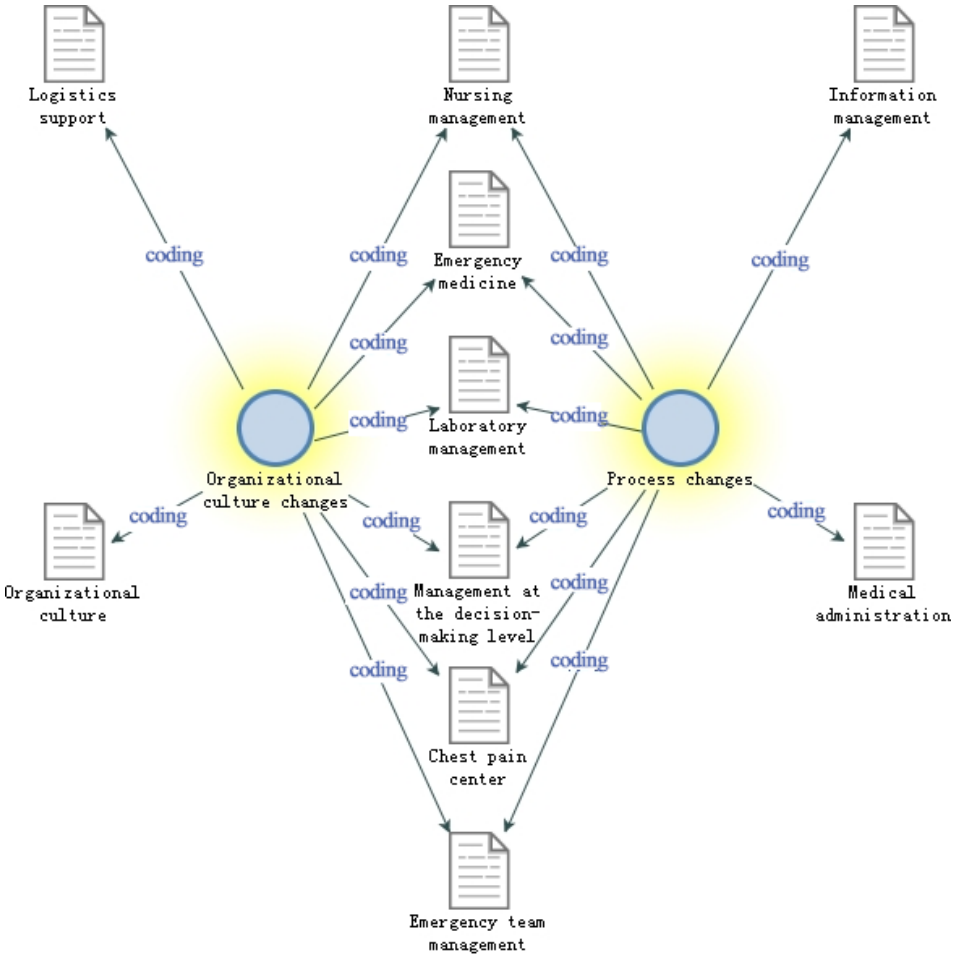

Figure 5.6 Comparison of the Connection between Organizational Culture Change and Process Change

To further enhance collaboration and communication, interactive collaboration should be encouraged in the workplace to promote team trust building. One way of achieving communication and collaboration consists of organizing scientific research exchanges or work seminars in a friendly and interesting manner between different departments, where information can be shared, increasing trust and creativity. Furthermore, other potential strategies encompass developing small-scale interdisciplinary emergency cooperation exercises during working hours, establishing adequate reward measurement systems, as well as involving a wide range of employees in training courses to improve work efficiency. Also, a good level of business process communication can be achieved through the use of modern emergency information and communication technology. All hospital staff can engage in open communication and real-time information, facilitating work interaction if they access to this platform to. The Emergency Hospital of Guangdong Province has adopted various strategies to improve communication and collaboration, including establishing an office automation system, utilizing modern communication tools, encouraging employee communication

activities, and establishing various work communication and coordination mechanisms. Firstly, the hospital established an office automation system and upgraded it in 2019 to facilitate real-time communication and work coordination for employees through smartphones. Employees can use the system to view document contents, send emails, post activity notifications on the notice board, and participate in employee forums. Additionally, the system has established commonly used business handling processes to facilitate employee viewing of colleagues' progress and opinions. Secondly, the hospital fully utilizes modern communication tools such as WeChat to create communication groups based on different work themes and departments, enabling employees to share information in real-time and engage in themed discussions. Furthermore, the hospital encourages employees to have lunch together and engage in informal communication during lunchtime to promote communication among employees. Additionally, the hospital organizes diverse organizational cultural training and exchange activities, such as employee outings, union training, middle-level backbone training meetings, emergency field drills, and flower arranging competitions, to enhance cohesion among different departments and employees. Finally, the hospital has established various work communication and coordination mechanisms, including hospital administrative meetings, departmental shift handover meetings, administrative rounds, special coordination meetings, and weekly meetings, to ensure the transmission of information and work coordination.

The ultimate goal of hospital process reengineering is to increase the benefit and satisfaction of patients. Shuai et al. (2020) believe that the most important indicator of hospital medical management level is medical quality. The researcher used a set of performance evaluation indicators released by the Chinese government to evaluate the dimensions related to the BPR project. The existence of a performance evaluation system is crucial for this study, as it includes dimensions such as medical quality, operational efficiency, sustainable development, and satisfaction assessment, which correspond to the dimensions proposed by the researcher for evaluating the BPR initiative. According to the data description and analysis results in Chapter 4, the performance evaluation of Guangdong Provincial Emergency Hospital based on 56 (sub) indicators showed an overall improvement in the national monitoring indicators in 2021, especially in the medical quality and satisfaction indicators. Overall, this study mainly found that Guangdong Provincial Emergency Hospital has achieved positive and active effects in aspects such as medical quality and satisfaction in the implementation of the off-site emergency medical process reengineering project.

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Chapter 6: Conclusion

This chapter presents a summary of the study carried out by the researcher, discussing its contribution to the literature and practice, limitations and suggestions for further investigation.

6.1 Summary of the research

This study conducted an empirical research on the outpatient process reengineering of Guangdong Emergency Hospital, based on the perspective of selecting insightful cases according to Yin (2018). Different data sources ("triangulation of data") and different research methods (combining surveys/questionnaires with case studies) were adopted to answer the research questions that form the backbone of this study. The rich sources of data helped the researcher to gain in-depth understanding of the phenomena being studied (Yin, 2018). To answer research question one ("How and why has Guangdong Provincial Emergency Hospital implemented the reengineering of out-of-hospital emergency care processes"), the researcher conducted semi-structured interviews with key personnel, collected and analyzed documents and additionally draw on observation. The adoption of these multiple sources of data allowed the researcher to get rich and insightful information on changes introduced not just in activities and processes but also on technology job functions organizational structure and cultural aspects related to the BPR project. In so doing, the researcher could analyze why and how the emergency hospital in Guangdong Province has implemented the reengineering of outpatient emergency processes. The study evidenced that the hospital's emergency medical expertise and the advantages of the international and national emergency medical team in restructuring its operations of emergency medical rescue. Secondly, the process and events that the hospital experienced in implementing the reengineering of outpatient emergency processes were consistent with the key success factors of the theoretical model of outpatient emergency process reengineering described in the literature review.

The key interrelated factors in business process reengineering have an impact on the transformation. According to Habib (2013), each department and function of an organization is interconnected and interdependent. Initiating a change in one dimension triggers the need for change in other dimensions. Over-focusing on the process itself while neglecting other

equally important factors such as communication, structure, and culture can lead to a reduction in successful BPR cases in practice. Grant (2002) suggests that all key factors should be considered as equal participants in BPR. This study explores the interconnections between technical changes and process changes, organizational culture changes and process changes, organizational structure changes and management system changes, and management system changes and process changes. In the empirical study of the business process reengineering project at the Emergency Hospital in Guangdong Province from 2020 to 2022, the top management has been actively leading the project. After over a year of business process reengineering work, at a certain stage in 2022, the top management handed over the actual reengineering work to their middle-level backbone. BPR managers focused solely on process changes while neglecting other key factors, leading to the development of internal conflicts. As Alghamdi et al. (2014) pointed out, in BPR, an organization needs to prepare a comprehensive plan and exert intensive management efforts during implementation. In conjunction with this case, the status network and empirical research of the hospital's off-site emergency process in Guangdong Province indicate that if an organization does not put in more efforts to prepare for change, even for ongoing business process reengineering, it needs to go back to the drawing board, identify the root of the problem, and ensure that the elements of organizational structure, cultural change, technological change, and management change are ready. The study found that the theoretical model described in this study encompasses these elements and provides a solution to the common problem in BPR: easily overlooking other elements. The status network described in this study serves as a roadmap for the hospital to achieve the goal of business process reengineering. Having successful BPR practice experience will guide the prospects of later BPR projects (Alghamdi et al., 2014).

No perfect solution can be provided for any organization to entirely replicate at any time. The theoretical model described in this study is based on a review of the literature, combined with the characteristics of the healthcare industry and the actual situation of the emergency hospital in Guangdong Province, which gives it a more specific and richer connotation. The theoretical model exhibits similarities in many fields, but it has different characteristics and features. For business process reengineering, a universally accepted model and a universally applicable method are needed (Bhaskar, 2018). The BPR theoretical model makes it easier for everyone to carry out organizational restructuring, management system changes, and other element modifications and can guide them to more likely succeed in process reengineering. The top management of the organization should understand that BPR is a customized tool for change, and they should not simply replicate what others are doing, otherwise, it is likely to

fail (Habib, 2013).We need to use various methods to address the dynamic changes between different types of organizational change (Habib, 2013). The key factors in the theoretical model of this study have been previously applied by researchers in other fields. This study represents the practical validation of this theoretical model in the field of out-of-hospital emergency care in the healthcare industry, considering industry characteristics and case features.

In this study, in order to answer research question two (How do key actors evaluate the readiness of Guangdong Provincial Emergency Hospital to the reengineering of the out-of-hospital emergency care), a questionnaire based on key success factors and failure factors by Abdolvand et al. (2008) was used to assess the readiness of the emergency hospital in Guangdong Province for the reengineering of processes. This survey represents a part of the evaluation survey of the questionnaire in healthcare institutions. To gain a deeper understanding of how six indicators - egalitarian leadership, cooperative work environment, senior management commitment, supportive management, application of information technology, and resistance to change - affect and relate to the readiness of the hospital, the researchers discussed the survey results for key stakeholders in business process reengineering. The study found that the values for the five positive indicators in Guangdong Provincial Emergency Hospital were at a fully prepared or prepared level, while the values for the negative indicators were at an unprepared level. The hospital has good preparation for the out-of-hospital emergency care process reengineering project, and employees have significantly less resistance to the BPR project. In fact, the researcher verified these survey results based on the theoretical model, combining semi-structured interview data from respondents, participatory observation data, and the collection and analysis of documents.

Finally, this study utilized 56 (subordinate) indicators of the performance evaluation of the emergency hospital in Guangdong Province by the Chinese government. The study found that when carrying out the project for reengineering the out-of-hospital emergency care processes, the hospital had achieved positive and favorable effects in terms of healthcare quality and satisfaction.

6.2 Contributions of the research for literature and practice

This study offers several contributions to literature and practice.

Concerning contributions to prevailing literature, this investigation covers the application of important concepts of BPR in the field of healthcare management, as well as the study of

key success and failure factors in the area of out-of-hospital emergency care. Based on the review of key success and failure factors proposed by researchers, this study tests the applicability of conceptual factors to a specific case of BPR that involved out-of-hospital emergency care. Results of the study indicate that Abdolvand et al.'s (2008) theoretical model is consistent with the BPR practices for out-of-hospital emergency care at the emergency hospital in Guangdong province. Implementing BPR successfully involves significant changes in processes, activities, management, technology, work, organizational structure, and cultural changes that the Abdolvand et al.'s model captured well. The study evidenced that substantial understanding of BPR is required before implementing the project, and that conceptual models such as that adopted in the investigation are important to ease BPR implementation. BPR projects are demanding and involve high risks, and thus when organizations are preparing to implement changes, all factors and aspects of the project need to be carefully considered.

This research contributes to enlarge understanding on how BPR should be implemented in practice. The study employs a questionnaire developed by Abdolvand et al., which identifies equal leadership, collaborative work environment, senior management commitment, management system change, and the application of information technology as key success factors for BPR, while resistance to change is considered as a failure factor. This questionnaire was used to collect the views of key stakeholders on the hospital's level of readiness to redesign out-of-hospital emergency care processes in Guangdong province, and analyze the hospital's level of preparedness for the reengineering of out-of-hospital emergency care processes. According to previous authors, most existing BPR models are not based on an assessment of current practices and successful practical experience (Habib, 2013; Hussein et al., 2013). This study fills this gap and provides a valuable complement and enrichment to the literature and practice in the field of BPR.

Furthermore, the study critically describes and analyzes why and how the hospital implements the reengineering of the out-of-hospital emergency care processes. Processes and events followed by the emergency hospital in Guangdong province during the implementation of BPR are detailed. This has practical significance as it provides a blueprint to practitioners for achieving similar results if similar steps and procedures are followed.

Yang et al. (2022) believe that in the face of disaster challenges, promoting the integrated development of disaster medical assistance and emergency medical assistance outside the hospital is an urgent issue to be addressed in China. In this study, the Emergency Hospital of Guangdong Province has practiced the integration of disaster medical assistance and

emergency medical assistance outside the hospital, further applying the reengineering of the hospital's emergency medical assistance process to meet the development needs of emergency medical assistance in Guangdong Province. This is of relevance and represents an additional contribution to healthcare management practitioners as well as policy makers.

Lastly, according to Yang et al. (2022), disaster rescue medicine is an emerging discipline in China. The fusion of disaster medicine rescue with out-of-hospital emergency care is important, but the development of this integration is still in its early stages. This study's empirical research was conducted during the period when the World Health Organization declared the COVID-19 pandemic a "public health emergency of international concern". The emergency hospital in Guangdong province played a significant role in the emergency rescue operations during the COVID-19 pandemic in China and Guangdong province from 2020 to 2022. The study explores the deep integration of medical rescue and out-of-hospital emergency care at the hospital, aiming to better understand the impact of business processes and their key factors on out-of-hospital emergency care, analyze which business processes need to be redesigned to improve the efficiency of out-of-hospital emergency care without compromising the quality of medical services. Therefore, this study provides important insights for the Chinese government and hospitals in promoting the integration of disaster medical rescue and out-of-hospital emergency care, guiding research, practice, and management decisions in this field.

6.3 Limitations of the study and suggestions for further investigation

This study aimed to conduct innovative research on the reengineering of the emergency medical assistance process outside of emergency hospital in Guangdong Province, but the study holds several limitations. Firstly, the researcher selected 29 experts and managers who have long been involved in frontline emergency medical assistance for semi-structured interviews. In the selection of interviewees, the researcher used its personal and professional contacts (not the 'snowball technique'), which eventually might prevented him to get other perspectives than those he had obtained in interviews. To counter this limitation, the researcher has drawn on other sources of data rather than interviews, and challenged interviewees to share different perspectives and ideas on BPR project with him. Another limitation results of the fact that the researcher although fully benefiting from working in the same hospital where he conducted the investigation, due to time and resource constraints it was not possible to cover all aspects, resulting in inevitable omissions. Before 2020, the

hospital also carried out a reengineering of the external emergency rescue process while conducting emergency rescue for natural disasters and accidents, but this study did not cover detailed research on this aspect. A final limitation consisted of the questionnaire's response rate which was relatively low. The researcher invited approximately 550 key participants who were involved in the reengineering of emergency medical assistance processes outside the hospital from 2020 to 2022 to answer the questionnaire. However, in order to ensure that the respondents could voluntarily and freely express themselves, and to enhance the accuracy and timeliness of their responses, the response rate was lower that initially anticipated.

Conducting this research triggered different perspectives for further research. A suggestion of future research consists of conducting additional case studies of BPR implementation in hospitals of different scales and regions in China and elsewhere, and to compare the results of BPR implementation in these other hospitals with the results obtained by the researcher in Guangdong Provincial Emergency Hospital. The Emergency Hospital of Guangdong Province is the guiding center of emergency medical assistance in Guangdong Province. As such, the hospital is expected guide the development of emergency medical assistance teams in other hospitals in China. In particular, Guangdong Emergency Hospital is required by the medical and health administrative department of Guangdong Province to help the secondary and higher-level public comprehensive hospitals across the province to gradually improve their emergency medical assistance capabilities in dealing with public health emergencies. It is of special interest to evaluate the process of BPR implementation and the readiness of each of these hospitals to reengineering its activities. If an assessment reveals that the organization is not prepared for change, specific issues should be identified and results compared with findings of previous studies in BPR. Another possible avenue for further investigation consists of conducting research on how the reengineering of emergency medical assistance processes outside the hospital can be applied to different types of disasters. Disasters are mainly divided into natural disasters, accidents and disasters, sudden public health emergencies, and social security incidents. This study mainly focuses on the reengineering of emergency medical processes for sudden public health emergencies. Although it is about the integrated development of disaster medical assistance and emergency medical assistance outside the hospital, there are differences in the specific content of the theoretical model of reengineering the emergency medical assistance process outside the hospital, such as changes in processes, activities, management, technology, work, organizational structure, and cultural changes. How to apply BPR to different types of disasters requires further research.

A final suggestion for additional research is exploring how to use information technology to enhance the intelligent response levels of emergency medical assistance outside the hospital to different types of disasters. While the role of IT in BPR can be considered as "disruptive technology" (Presley, 2006), as it involves shared databases and integrated systems states IT might aid organizations in making good decisions based on knowledge systems (Hendriks, 1999). IT can be an important device to automate and accelerate processes in BPR (Harmon, 2003). Attaran (2004) suggests that IT tools can facilitate the collection and analysis of information, process mapping, and evaluation analysis, then the IT can facilitate decision management steps by providing modeling and process simulation, documenting business processes, analyzing survey data, and performing structural evaluations (Eftekhari & Akhavan, 2013). Therefore, it is of relevance to analyze how the adoption of latest technology and IT tools to design integrated information systems can impact on the reengineering processes for different types of disasters. Calls are made for studying how relevant process modules could ultimately lead to the rapid re-design of emergency medical assistance processes for different types of disasters.

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Annex A: Interview Guide to Help the Researcher Answering Research Question 1

"How and why has Guangdong Provincial Emergency Hospital implemented the reengineering of out-of-hospital emergency care processes?"

This interview is part of a doctoral research that aims to study the impact of reengineering of out-of-hospital emergency care processes at the Guangdong Provincial Emergency Hospital. All the information provided to the researcher is confidential and the interviewee's name will not be disclosed in the research.

Here are the questions that researcher plan to ask the interviewee:

Changes in processes that have been adopted (2020-2023): Can you provide an overview of the specific changes made to the out-of-hospital emergency care processes at Guangdong Provincial Emergency Hospital? How were these changes identified and implemented? How have these changes improved or impacted the efficiency and effectiveness of the emergency care processes?

Changes in activities performed: How have the roles and responsibilities evolved for healthcare professionals involved in out-of-hospital emergency care? Have any new activities been introduced or existing activities modified? If so, please provide details. Have there been any challenges or obstacles encountered during the implementation of these changes in activities?

Changes in management systems: Have there been any changes made to the management systems to support the reengineering of out-of-hospital emergency care processes? How has the decision-making process been affected by these changes? Have any new tools or techniques been introduced to assist with management decision-making?

Changes in technology: Has there been any adoption of new technologies to support the reengineered processes? Are there any specific technologies or systems that have been implemented? If yes, how have they contributed to enhancing out-of-hospital emergency care?

Changes implemented in people's work and activities they perform: Has there been any impact on the work environment and job tasks of the healthcare professionals involved in

out-of-hospital emergency care? How have the reengineering efforts influenced the job satisfaction and job performance of the healthcare professionals?

Changes implemented in the organizational structures of the hospital: Have there been any changes made to the organizational structures at Guangdong Provincial Emergency Hospital to support the reengineering process? How have these changes affected the coordination and communication between different departments or units?

Changes in the organizational culture and values: Have there been any shifts in the organizational culture and values as a result of the reengineering initiative? How have these changes helped to align the hospital's culture with the reengineered processes?

Other aspects you think are important to provide a good description of the implementation of the reengineering process initiative: Are there any other important aspects or key factors that have influenced the success or failure of the reengineering process in out-of-hospital emergency care? Are there any lessons learned or best practices that have emerged from this initiative?

Annex B: Survey for Answering Research Question 2

"How do key actors (senior managers, operational managers, technical staff, doctors, nurses, other key people involved in the reengineering process) evaluate the readiness of Guangdong Provincial Emergency Hospital to the reengineering of the out-of-hospital emergency care?

In the past three years, Guangdong Emergency Hospital has been fight against the COVID-19 pandemic. The hospital experienced "hospital treatment, support to Hubei, deployment to airports, assistance to Beijing, and defense of Hong Kong" in five different areas. Based on your understanding and experience in the reengineering of out-of-hospital emergency medical processes at Guangdong Emergency Hospital from 2020 to 2023, please answer the questions presented below. Your answers are confidential and the questionnaire's responses will be kept anonymous.

Part A-Egalitarian Leadership

1- Managers share vision and information with their subordinates.

☐always	☐more	☐moderately	☐less	☐never

2- There is open communication between supervisors and their subordinates.

☐always	☐more	☐moderately	☐less	☐never

3- Managers place confidence between supervisors and their subordinates.

☐always	☐more	☐moderately	☐less	☐never

4- Managers constructively use their subordinates' idea.

☐always	☐more	☐moderately	☐less	☐never

Part B-Cooperative Working Environment

1- There are friendly interactions between co-workers.

☐always	☐more	☐moderately	☐less	☐never

2- Co-workers have confidence in and trust each other.

☐always	☐more	☐moderately	☐less	☐never

3- Teamwork is the typical way to solve problems.

☐always	☐more	☐moderately	☐less	☐never

4- Co-workers feel as if they are working in a cooperative environment.

☐always	☐more	☐moderately	☐less	☐never

5- There is performance recognition among coworkers.

☐always	☐more	☐moderately	☐less	☐never

Part C- Top Management Commitment

1- Top management generally has realistic expectation of the projects.

☐always	☐more	☐moderately	☐less	☐never

2- Top management usually has sufficient knowledge about the projects.

☐always	☐more	☐moderately	☐less	☐never

3- Top management frequently communicates with project team and users.

☐always	☐more	☐moderately	☐less	☐never

Part D-Supportive Management

1- The reward system adjusts to serves the employees after the changes.

☐always	☐more	☐moderately	☐less	☐never

2- The performance measurement adequately corresponds to the changes.

☐always	☐more	☐moderately	☐less	☐never

3- The employees are empowered to make decisions.

☐always	☐more	☐moderately	☐less	☐never

4- There are training and/or educational programs to update employees' skilled.

☐always	☐more	☐moderately	☐less	☐never

Part E- Use of Information Technology

1- Information technology is integrated in business plan of the organization.

☐always	☐more	☐moderately	☐less	☐never

2- The organization extensively uses the information systems.

☐always	☐more	☐moderately	☐less	☐never

3- There is efficient communication channel in transferring information.

☐always	☐more	☐moderately	☐less	☐never

Part F- Resistance to change

1- Managers are anxious about losing their authority after the changes.

☐always	☐more	☐moderately	☐less	☐never

2- Employees are worried about losing their job after the changes

☐always	☐more	☐moderately	☐less	☐never

3- There is skepticism among employees about the results of the projects.

☐always	☐more	☐moderately	☐less	☐never

4- Employees feel uncomfortable with the new environment.

☐always	☐more	☐moderately	☐less	☐never

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Annex C: Survey for Answering Research Question 3

"What is the impact of process reengineering in out-of-hospital emergency care on Guangdong Provincial Emergency Hospital?"

On January 30, 2019, during a regular policy briefing by the Chinese State Council, the representative of the National Health Commission announced the launch of the performance assessment of tertiary public hospitals nationwide in 2019, in accordance with the "Opinions on Strengthening the Performance Assessment of Tertiary Public Hospitals" issued by the General Office of the State Council in 2019. The assessment aims to establish a scientific system of assessment indicators, a unified support system, and standardized assessment procedures. The assessment indicators include medical quality, operational efficiency, sustainable development, and satisfaction evaluation, totaling 55 specific indicators, to ensure the objectivity and authority of the assessment. The goal is to promote the standardization of internal management in public hospitals and guide the effective improvement of medical service quality and efficiency.

How do patients evaluate their medical experience? The representative of the Medical Administration Bureau of the National Health Commission mentioned during the briefing that patients can use their smartphones to scan QR codes and access the National Health Commission's satisfaction survey platform, where they can select and answer questions about their medical experiences. The assessment includes average appointment and treatment rates, waiting times, reduced hospital visits, queue times, and total waiting times for patients. Particularly, the waiting time of patients with scheduled appointments is taken into consideration to promote precise appointment scheduling, reduce patient waiting times, and enhance patient satisfaction. The representative emphasized that in the nationwide implementation of the performance assessment of tertiary public hospitals, the sense of gain, safety, and satisfaction of patients are important criteria for evaluating the effectiveness of the reform.

Therefore, this research will adopt the patient satisfaction assessment data of the emergency departments in Guangdong Province for the years 2019, 2020, and 2021, which were released based on the requirements set during the aforementioned meetings by the

National Health Commission and the Chinese government. The aim of this research is to measure the consistency between user satisfaction and the original intent of the assessment indicators set by the Chinese government and its competent departments, and to establish the objectivity and authority of the research.

Annex D: Data Coding

NO.	First round of coding	Second round of coding
1	Basic information of the GDPEH	Case management system and culture
2	Construction of mobile hospitals	
3	Situation of emergency drill	BPR program management factor
4	Situation of actual combat	
5	IT construction	
6	Construction of commanding center	IT infrastructure factor
7	Development process of GDPEH and phased comparison	
8	Process improvement and improvement in quality and efficiency	Management ability factor
9	Certification assessment	
10	Role of expert consultants	
11	Organizational restructuring situation	
12	Questionnaire	Organizational structure factor
13	Suggestion on work improvement	
14	Collection of information on hospital meetings, and other materials	Key influencing factors

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Annex E: Evidence Collected in the Study and Brief Explanation

Document	Name Of Document	Brief Description Of The Document
1	Emergency Response Law of the People's Republic of China (2021)	The "Emergency Response Law of the People's Republic of China" focuses on streamlining the leadership and management system for emergency response, facilitating information reporting and dissemination, improving emergency support systems, enhancing emergency response management capabilities, leveraging the role of social forces, and safeguarding the legitimate rights and interests of all parties in society.
2	Fourteenth Five-Year Plan for Emergency Medical Rescues by the National Health Commission (2023)	The "Fourteenth Five-Year Plan for Emergency Medical Rescues" by the National Health Commission discusses the foundation and current situation of emergency medical rescues in China, along with the main tasks and measures to be implemented.
3	Thirteenth Five-Year Plan for Emergency Medical Rescues (2016-2020)	
4	Provisional Measures for the Management of National Health Emergency Teams (2010)	The "Provisional Measures for the Management of National Health Emergency Teams" aims to strengthen and standardize the construction and management of national health emergency teams, enhancing their emergency response capabilities.
5	Notice on the Standardization of Pre-hospital Medical Emergency Management (2014)	The "Notice on the Standardization of Pre-hospital Medical Emergency Management" focuses on regulating the behavior of pre-hospital medical emergency services and considering it as an important aspect of overall medical quality and safety management.
6	Notice on the Issuance of Further Improving the Guidance on Pre-hospital Medical Emergency Services by the National Health Commission (2020)	The "Notice on the Issuance of Further Improving the Guidance on Pre-hospital Medical Emergency Services" emphasizes the importance of pre-hospital medical emergency services in

		healthcare, major event support, and emergency response to public incidents, emphasizing the need to improve the service capabilities.
7	Notice on the Issuance of National Medical Quality and Safety Improvement Goals for 2023 by the General Office of the National Health Commission (2023)	The "Notice on the Issuance of National Medical Quality and Safety Improvement Goals for 2023" guides industry professionals to carry out targeted improvement work based on the changes and weaknesses in medical quality and safety, aiming to raise the overall level of medical quality and safety.
8	Opinions of the General Office of the State Council on Strengthening the Performance Assessment of Tier Three Public Hospitals (2019)	The aim of the notice on strengthening the performance assessment of Tier Three public hospitals is to establish a scientific assessment indicator system and standardized assessment procedures, including evaluating medical quality, operational efficiency, sustainable development, and satisfaction, ensuring the objectivity and authority of the assessment.
9	Notice on the Issuance of the Fourteenth Five-Year Plan for Emergency Management in Guangdong Province by the People's Government of Guangdong Province (2021)	The "Notice on the Issuance of the Fourteenth Five-Year Plan for Emergency Management in Guangdong Province" provides guidance on the guiding ideology, basic principles, development goals, implementation strategies, and construction plans for emergency management in Guangdong Province during the fourteenth.
10	Main Goals and Division of Tasks for the Fourteenth Five-Year Plan for Emergency Management in Guangdong Province (2022)	
11	Emergency Medical and Health Rescue Emergency Plan for Sudden Incidents in Guangdong Province (Draft for Soliciting Comments) (2023)	This introduces the effective improvement of emergency response capabilities and medical health rescue levels in dealing with sudden incidents, ensuring timely, efficient, scientific, and orderly treatment of the injured and minimizing casualties and health hazards caused by sudden incidents, ensuring public health and safety.
12	Guangdong Province Emergency Management Assessment Measures (Trial Implementation) (2011)	It introduces emergency preparedness and response, including emergency system construction planning, emergency management organization system construction, emergency plans

		and drills, emergency monitoring and early warning, emergency support, public education and training, response speed, command coordination, information disclosure, and response effectiveness.
13	Guangdong Province Emergency Medical Rescue and Health Emergency Team Construction and Management Work Plan (2018)	It introduces the promotion of standardized development of medical and health institutions' emergency response in Guangdong Province, further enhancing the level of emergency medical rescue during sudden incidents.
14	Guangdong Province Emergency Volunteer Management Measures (Trial Implementation) (2010)	It introduces the organization and mobilization of emergency volunteer services, participation in emergency knowledge, skills training, and related drills according to regulations, and the ability to participate in emergency rescue and related emergency management work as required
15	Guangdong Province Emergency Management Department Notification on Issuing the Management Measures for the Participation of Social Emergency Forces in Accident and Disaster Emergency Rescue (2022)	It introduces the encouragement, guidance, and regulation of the participation of social emergency forces in accident and disaster emergency rescue work, fully leveraging the auxiliary role of social emergency forces in emergency rescue.
16	Guangdong Province Development and Reform Commission's Reply on the Preliminary Design Estimate of the Emergency Ward Renovation Project (Medical Equipment and Information Technology) of Guangdong Second People's Hospital (2020)	It introduces the investment of the Guangdong Provincial government in the upgrade and improvement of emergency treatment infrastructure and the development of medical equipment and informatization in Guangdong Provincial Emergency Hospital.
17	Guangdong Province Development and Reform Commission's Reply on the Feasibility Study Report of the Emergency Ward Renovation Project of Guangdong Second People's Hospital (2020)	
18	Guangdong Province Health Commission Office's Reply on Approving the First-Phase Project of the Guangdong Provincial Emergency Medical Rescue Base (Civil Aviation Campus) (2021)	
19	In 2021, the emergency hospital in Guangdong Province was built and became a national key medical base for major epidemic treatment.	
20	Compilation of the History of Guangdong	It provides a historical overview

	Province Emergency Hospital from 1947 to 2021 (2022)	of the hospital's 75 years of development, particularly highlighting major events and representative incidents.
21	Guangdong Provincial Emergency Hospital 2019 Work Report, 2020 Work Report, 2021 Work Report, 2022 Work Report	This is an introduction to the main work situation and work plans of the hospital from 2019 to 2022, as well as the record of major annual events.
22	Minutes of the Director's Office Meeting of Guangdong Provincial Emergency Hospital from 2020 to 2023	The minutes of the Director's Office Meeting serve as the highest decision-making body for administrative affairs in the hospital. They record important decisions on administrative affairs at the hospital level over the past three years.
23	Minutes of the Special Meeting on COVID-19 Prevention and Control (from 2020 to 2022)	The special meetings on prevention and control were held during the epidemic to study the emergency treatment-related situations at the hospital. Corresponding work decisions were made based on the issues that arose at the time.
24	Minutes of the COVID-19 Prevention and Control Work Conference at Guangdong Second People's Hospital (2022)	The COVID-19 prevention and control work conferences, chaired by the hospital's top leaders and attended by group leaders, are the highest decision-making meetings for emergency medical treatment both inside and outside the hospital. They analyze issues on a regular basis and make decisions to optimize processes.
25	In January 2020, Guangdong Provincial Emergency Hospital was designated as a provincial-level designated hospital for COVID-19 treatment in Guangdong Province.	The record includes the Guangdong Provincial Emergency Hospital's efforts in conducting medical rescues outside the hospital during the epidemic, including in Hubei, Hong Kong, Hainan, Beijing, Guangzhou, and airports.
26	In February 2020, the National Emergency Medical Rescue Team (Guangdong) was dispatched to support Wuhan.	
27	In March 2022, Guangdong Provincial Emergency Hospital sent a medical support team to Hong Kong for epidemic control.	
28	In August 2022, the National Emergency Medical Rescue Team (Guangdong) supported the fight against the epidemic in Hainan.	
29	In October 2022, Guangdong Provincial Emergency Hospital became a designated hospital for the treatment of severe and critical COVID-19 cases in Guangzhou.	

30	Notification from the Guangzhou Municipal Health Commission on the establishment of the "Emergency Pre-Triage Area outside Guangdong Provincial Emergency Hospital" (2022)	
31	Notice on ensuring emergency medical support outside Pazhou Hospital (2022)	
32	Notice on the establishment of the Emergency Department of Emergency Medicine Research Office, Jinan University (2014)	These records document the updates in organizational structure related to the representative discipline development and process reengineering of the daily out-of-hospital emergency rescues conducted by Guangdong Provincial Emergency Hospital. For example, based on the actual needs of project process reengineering and to enhance the comprehensive emergency capabilities for critical patients, the main responsibilities of the Department of Emergency Medicine were adjusted to include pre-triage of all emergency patients, emergency treatment for critical patients, diagnosis and treatment of routine emergency patients, treatment of sudden public incidents and acute trauma, and integrating resources to create a comprehensive emergency platform. In order to achieve a more professional, high-quality, and efficient approach, the five cardiovascular disciplines with loose management and inadequate settings were integrated, and the Cardiovascular Hospital was established to optimize processes and achieve unified management.
33	Notice on the establishment of the Department of Emergency Medicine (2021)	
34	Notice on the adjustment of major responsibilities of the Department of Emergency Medicine (2022)	
35	Reply from the Guangdong Provincial Health Commission approving the optimization and establishment of the Cardiovascular Hospital of Guangdong Second People's Hospital (2021)	
36	Notice on the establishment of the Institute of Cerebrovascular Diseases at Guangdong Second People's Hospital (2021)	
37	Notice on the twelfth batch of on-site inspections of the Guangdong Chest Pain Center (2020)	
38	Notice on holding the China Chest Pain Center Award Ceremony (2023)	
39	Notice from the National Health Commission Stroke Prevention and Control Engineering Committee on the proposed awarding of the first and second batch of Advanced Stroke Center Units and Advanced Stroke Center Construction Units in 2020 (2020)	
40	Introduction to the wearing and doffing points of personal protective equipment for staff at Jianghan Fangcang Hospital (First Edition, 2020)	These introduce the management system for emergency medical teams dispatched by hospitals, training and exercise systems, material reserves systems, public training systems, rapid response systems, and specific procedures for emergency rescue in certain areas.
41	Health Protection Management Measures for National Emergency Medical Rescue Teams (Guangdong) during the Support to Hubei Period (2020)	
42	Regulations for Emergency Medical Rescue Teams in Guangdong Emergency Hospitals (2020)	
43	Emergency Plan for Guangdong Emergency Hospitals	They also introduce the command response systems for emergency

		medical rescue in response to natural disasters, accidents and disasters, public health emergencies, social security incidents, and joint military-civilian emergency medical rescue during wartime.
44	Technical Regulations for Guangdong Emergency Hospitals	They include 210 work standard procedures, such as critical patient resuscitation procedures, critical results reporting procedures, clinical blood management procedures, and radiological examination workflow.
45	434 Standard Operating Procedures (SOP) for Guangdong Emergency Hospitals	They cover the standard operating procedures for out-of-hospital emergency treatments, including team deployment and assembly procedures, food supply procedures, information communication and liaison procedures, medical waste disposal procedures, and standards for intravenous therapy nursing techniques. These 434 standard operating procedures (SOP) are the standards followed by international emergency medical teams during rescue missions.
46	Notice on the Establishment of the Leading Group for the Treatment of Novel Coronavirus Pneumonia and the Expert Group for Prevention and Control (2020)	The documents also outline the dynamic adjustments in organizational structure, personnel responsibilities, and communication mechanisms in response to different periods and project-specific needs for handling unexpected public health events in Guangdong Emergency Hospitals.
47	Notice on Adjustments to the Leading Group for Prevention and Control of Novel Coronavirus Outbreak in Guangdong Second People's Hospital (2020)	
48	Notice on Further Strengthening the Leading Group for Prevention and Control of Novel Coronavirus Outbreak in Guangdong Second People's Hospital (2020)	
49	Notice on Adjustments to the Leading Group for Prevention and Control of Novel Coronavirus Outbreak in Guangdong Second People's Hospital (2021)	
50	Notice on the Establishment of the Leading Group for the Treatment of COVID-19 Cases in Designated Hospitals at Guangdong Second People's Hospital (2022)	
51	Guangdong Provincial Emergency Hospital	The publications include the diary

	"Emergency Vanguard Battle Diary" (2021)	of the employees' participation in the project process reconstruction work to combat the epidemic in the Guangdong Provincial Emergency Hospital in 2020, including the work content and the employees' feelings towards the organizational culture.
52	Guangdong Provincial Emergency Hospital "Fighting against COVID-19 Brochure" (2021)	The main focus is on the content and outcomes of the project process reconstruction work to combat the epidemic in the Guangdong Provincial Emergency Hospital in 2020, as well as mainstream media reports on organizational culture, including special reports on emergency rescue situations outside the hospital and the achievements of participants such as managers, doctors, nurses, and technicians.
53	Guangdong Provincial Emergency Hospital "Emergency Vanguard" Photo Album (2022)	The main focus is on the project process reconstruction work to combat the epidemic in the Guangdong Provincial Emergency Hospital in 2020, including records of medical rescue operations outside the hospital in different locations and the role of advanced information systems and organizational culture in the process reconstruction work.
54	Records of the Guangdong Provincial Emergency Hospital's official website from 2020 to 2023	The records cover the work-related information of the Guangdong Provincial Emergency Hospital from 2020 to 2023.
55	Scrapbook of the Guangdong Provincial Emergency Hospital from 2020 to 2023	The records cover the media coverage received by the Guangdong Provincial Emergency Hospital from 2020 to 2023.
56	In March 2012, the Emergency Medical Rescue Team of the Guangdong Provincial Emergency Hospital conducted mobile hospital operation training and skills demonstration in Panyu, Guangzhou.	The records document the participation of the Guangdong Provincial Emergency Hospital in external emergency medical drills in recent years, which have evolved from scripted exercises to practical exercises, from the participation of only doctors and nurses to the inclusion of technicians, administrators, and
57	In April 2012, the Guangdong Provincial Emergency Hospital and other units conducted the 2012 Guangdong Health Emergency Drills in Meizhou City.	
58	In May 2013, the Guangdong Provincial	

	Emergency Hospital quickly assembled 35 members of the National Emergency Medical Rescue Team (Guangdong) within 2 hours to go to Conghua for disaster relief drills.	logistics support personnel in recent years. It also reflects the development from simple medical equipment to the deployment of mobile hospitals, tent hospitals, and helicopters. This demonstrates the continuous improvement in the content, methods, and process reconstruction of the hospital's drills.
59	In March 2014, the Guangdong Provincial Emergency Hospital's mobile hospitals were deployed successively to Conghua, Zhanjiang, Taishan, Meizhou, and other places for fatigue training.	
60	In October 2014, the National Emergency Rescue Team from the Guangdong Provincial Emergency Hospital participated in the comprehensive drill for the emergency response and disposal of Ebola Hemorrhagic Fever in Guangdong Province.	
61	In December 2014, the Guangdong Provincial Emergency Hospital participated in the 2014 Guangdong-Guangxi Health Emergency Joint Drill in Wuzhou, Guangxi Zhuang Autonomous Region.	
62	In May 2015, the National Emergency Medical Rescue Team from the Guangdong Provincial Emergency Hospital represented China in the fourth ASEAN Regional Forum Disaster Relief Exercises held in Malaysia.	
63	In September 2017, the Guangdong Provincial Emergency Hospital participated in the INSARAG (International Search and Rescue Advisory Group) Asia-Pacific Regional Joint Exercise in Malaysia.	
64	In November 2019, the tent hospital and mobile hospital of China's International Emergency Medical Team (Guangdong) from the Guangdong Provincial Emergency Hospital participated in a large-scale comprehensive field combat exercise in the province.	
65	In November 2021, the 2021 Guangdong-Guangxi Health Emergency Joint Drill hosted by the Guangdong Provincial Emergency Hospital was held in Dongguan.	
66	In March 2011, Guangdong Provincial Emergency Hospital organized the "Expert Symposium on Equipment Configuration Plan for Guangdong Provincial National Emergency Medical Rescue Team" in Guangzhou.	These records document the recent academic conferences and industry review meetings that Guangdong Provincial Emergency Hospital has organized or participated in related to emergency medical
67	In May 2012, the National Health	

	Commission of China conducted supervision and acceptance of the construction project of the national emergency medical rescue team at Guangdong Provincial Emergency Hospital, and successfully passed the review.	rescue. The Guangdong Provincial government relies on Guangdong Provincial Emergency Hospital to establish an emergency medical rescue guidance center and undertake research, training, guidance, and management work related to emergency medical rescue in Guangdong Province. This reflects the hospital's hardware, software, and academic development process.
68	In May 2012, Guangdong Provincial Emergency Hospital held a seminar on the construction of the regional emergency medical rescue system in Guangzhou.	
69	In October 2012, participated in the Central and South Six Provinces and Hong Kong, Macao Hospital Presidents Summit Meeting in Hainan, and listened to academic reports such as "Establishing Regional Medical Rescue Centers to Improve Emergency Response Capacity."	
70	In May 2013, participated in the establishment of the Emergency (Disaster) Medicine Branch of the Guangdong Medical Association and the 10th Anniversary Summit Forum on Fighting Against SARS in Guangzhou.	
71	In November 2013, after participating in the International Emergency Medicine Symposium, international emergency medical experts, including K. Harald Drager, Chairman of the International Emergency Management Association, and Dr. James C. Hagen, Chairman of the North American Region of the International Emergency Management Association, visited Guangdong Provincial Emergency Hospital to investigate the construction of emergency medical disciplines.	
72	In March 2014, the 2nd International Symposium on Emergency Medicine was held in Guangzhou. International authoritative experts in emergency medicine from the United States, Germany, the United Kingdom, Israel, and China Taiwan, visited Guangdong Provincial Emergency Hospital to investigate the development of emergency medical disciplines.	
73	In November 2014, participated in the 2nd Emergency (Disaster) Medicine Academic Conference of the Guangdong Medical Association and the 3rd Zhongshan International Emergency and Disaster Medicine Forum in Guangzhou.	
74	In November 2015, participated in the 3rd	

	Emergency (Disaster) Medicine Academic Conference of the Guangdong Medical Association in Guangzhou.	
75	In December 2016, participated in the 4th Emergency (Disaster) Medicine Academic Conference of the Guangdong Medical Association in Guangzhou.	
76	In December 2016, the National Health Commission conducted a pre-assessment of the application for the registration of the international emergency medical team of Guangdong Provincial Emergency Hospital.	
77	In March 2017, the World Health Organization's pre-assessment of the international emergency medical team was held in Guangzhou, Guangdong. The national emergency medical rescue team of Guangdong Provincial Emergency Hospital successfully passed the pre-assessment of the World Health Organization's expert group.	
78	In June 2017, the national emergency medical rescue team of Guangdong Provincial Emergency Hospital successfully passed the evaluation of the expert group of the World Health Organization.	
79	In November 2017, representatives from Guangdong Provincial Emergency Hospital went to Canberra, Australia to participate in the "Western Pacific Regional Conference" and discuss crisis emergency preparedness, alerts, and responses.	
80	Notice from the Office of the Guangdong Provincial Health Commission on the establishment of the Guangdong Provincial Emergency Medical Rescue Guidance Center (2018)	
81	In June 2018, Guangdong Provincial Emergency Hospital provided guidance to the Second People's Hospital of Shantou City to establish the first prefecture-level emergency hospital in the province.	
82	In October 2018, provided guidance for the establishment of the Zhuhai detachment of the national (Guangdong) emergency medical rescue team.	
83	Since 2021, provided guidance for the construction of city and county-level emergency medical rescue systems in Yangdong District of Yangjiang City, Sihui City of Zhaoqing City, and Yangshan County of Qingyuan City.	

84	In October 2020, Guangdong Provincial Emergency Hospital organized the "Expert Symposium on National Health Emergency Team Capacity Enhancement" and "National Major Epidemic Treatment Base" projects.	
85	In November 2021, Guangdong Provincial Emergency Hospital organized the Expert Symposium on the High-Quality Development and Construction Plan of the National Emergency Medical Rescue Team (Guangdong).	
86	The hospital has developed or configured "5G+" emergency medical rescue, vehicle-mounted emergency management systems, "5G+" remote monitoring, field vehicle-mounted hospital equipment, and field tent hospital equipment.	The article introduces the convenient equipment of Guangdong Province Emergency Hospital based on years of emergency culture in the process reengineering of out-of-hospital emergency rescue, as well as the system-building of vehicle-mounted hospitals, tent hospitals, and other large-scale out-of-hospital emergency rescue equipment.
87	In regards to a request for the Guangdong Second People's Hospital to be equipped with a vehicle-mounted CT vehicle (2023)	
88	Analysis report on the national monitoring indicators for the performance assessment of the Guangdong Province Emergency Hospital as a tertiary public hospital for the years 2019, 2020, and 2021	The national version of the performance assessment results for tertiary public hospitals is regularly fed back and published on the national performance assessment platform, including scores for medical quality, operating efficiency, sustainable development, and satisfaction evaluation of each hospital.
89	Notice on the issuance of the Interim Measures for the Provision of Temporary Work Subsidies for the Prevention and Control of COVID-19 at the Guangdong Second People's Hospital (2022)	The main incentive is to encourage employees of Guangdong Province Emergency Hospital to actively participate in the hospital's anti-epidemic projects and fight on the front line of epidemic prevention and control.
90	Notice on the issuance of a work plan for motivating employees to take responsibility in the epidemic prevention and control work in Guangzhou (2022)	Furthermore, it aims to further motivate and guide employees to take the initiative in the front line of the epidemic prevention and control battle, shoulder heavy responsibilities, and strive for victory through scientific prevention and control. It also links the quantitative assessment of their performance in the anti-epidemic work to incentives such as internal enrollment, professional title evaluation

		(including reappointment), job promotion, commendation and rewards, and annual evaluation.
91	Notice regarding the CPR training in 2023	The articles also introduce the skills education and training provided to employees of Guangdong Province Emergency Hospital in the process reengineering project.
92	Notice on conducting special training and examination on perioperative related systems in 2023	
93	Notice on conducting training and assessment of knowledge related to the prevention and treatment of venous thromboembolism (VTE) in 2023	
94	Notice on optimizing the risk assessment process for venous thromboembolism (VTE) in 2022	
95	Notice on organizing training for newborn emergency drills in 2023	
96	Notice on conducting training for the use of non-invasive ventilators in 2022	
97	Notice on conducting training for infection prevention and control for logistics support staff in 2022	
98	Notice on conducting training for the treatment of COVID-19 infected patients in 2022	
99	Notice on organizing online training for the handling of occupational exposure to COVID-19 (2022)	
100	Notice on conducting training for bedside discharge settlement in 2022	
101	Notice on conducting training for infection prevention and control for fever clinic staff in 2022	
102	Notice on conducting training and assessment for fever clinic staff on the donning and doffing of personal protective equipment in 2022	
103	Notice on organizing coaching training for the PDCA case competition in 2021	
104	Notice on holding a training meeting on the prevention and control of the COVID-19 epidemic in 2021	
105	Notice on organizing the Fifty-third session of COVID-19 infection control expert classroom activities in 2021	

Annex F: Performance Evaluation Indicators for Tertiary Public Hospitals

Primary indicators	Secondary indicators	Tertiary indicators
1. Medical quality	(1)Functional positioning	1.Ratio of outpatient visits to hospital discharges 2.Number of transferred patients (outpatient and inpatient) 3.Proportion of day surgeries to elective surgeries 4.Percentage of discharged patients who underwent surgeries 5.Percentage of discharged patients who underwent minimally invasive surgeries 6.Proportion of discharged patients who underwent fourth-level surgeries 7.Percentage of specialized medical services
	(2) Quality and safety	8.Incidence rate of complications in surgical patients 9.Surgical site infection rate for Class I incisions 10.Quality control of specific diseases 11.Positivity rate of examinations with large medical equipment 12.Maintenance, repair, and quality control management of large medical equipment 13.Number of clinical laboratory tests evaluated through national inter-laboratory quality assessment 14.Mortality rate for low-risk group cases 15.Coverage rate of high-quality nursing services in wards
	(3) Rational drug use	16.Proportion of prescription review to total number of prescriptions 17.Antimicrobial drug use intensity (DDDs) 18.Proportion of essential drug prescriptions for outpatient patients 19.Utilization rate of essential drugs in hospitalized patients 20.Proportion of procurement varieties for essential drugs 21.Proportion of drugs awarded through national centralized drug procurement
	(4) Service process	22.Average appointment and treatment rate for outpatient patients 23.Average waiting time after appointment for outpatient patients 24.Graded functional level of electronic medical record application
2. Operational efficiency	(5) Resource efficiency	25.Average daily workload per practicing physician 26.Number of pharmacists per hundred beds
	(6) Income and expenditure structure	27.Proportion of outpatient revenue to total medical revenue 28.Proportion of outpatient revenue from medical insurance funds 29.Proportion of inpatient revenue to total medical revenue 30.Proportion of inpatient revenue from medical insurance funds

	(7) Cost control	31.Proportion of healthcare service revenue (excluding drugs, consumables, and examination fees) to total medical revenue 32.Proportion of revenue from auxiliary medication 33.Ratio of personnel expenses to operational expenses 34.Energy consumption expenditure per million yuan of revenue 35.Surplus/deficit balance 36.Asset-liability ratio 37.Growth rate of medical revenue 38.Growth rate of average outpatient cost per visit 39.Growth rate of average outpatient drug cost per visit 40.Growth rate of average inpatient cost per admission 41.Growth rate of average inpatient drug cost per admission
	(8) Economic management	42.Comprehensive budget management 43.Standardized establishment of Chief Accountant
	(9) Personnel structure	44.The title structure of sanitation technicians. 45.The proportion of anesthesia, pediatrics, critical care, pathology, and traditional Chinese medicine physicians. 46.The nurse-to-patient ratio.
3. Sustainable development	(10) Talent development	47.The proportion of hospital staff who have undergone training in other hospitals (especially supporting hospitals and hospitals within medical consortiums) and returned to work independently in their original hospital. 48.The pass rate of hospital resident doctors in their first participation in the physician qualification examination. 49.The effectiveness of the hospital's efforts in cultivating medical talents.
	(11) Discipline construction	50.Research project funding per hundred sanitation technicians. 51.The amount of research achievements transformation per hundred sanitation technicians.
	(12) Credit construction	52.Comprehensive evaluation grade for public credit.
4. Satisfaction evaluation	(13) Patient satisfaction	53.Outpatient satisfaction. 54.Inpatient satisfaction.
	(14) Medical staff satisfaction	55.Satisfaction of medical staff.

Annex G: Major Medical Rescue Missions of National and Provincial Health Administrative **Departments**

Time	Missions
2011	Preparation for tsunami rescue in Japan for 3 days
2013	Preparation for earthquake rescue in Ya'an for 3 days
2013	Preparation for typhoon rescue in the Philippines for 10 days
2013	Actively involved as a designated hospital in H7N9 prevention and control in Guangdong
2014	Completion of emergency medical rescue work for the 7.15 bus explosion in Guangzhou
2014	Actively involved in dengue fever prevention and control in Guangzhou
2014	Admission and observation of 6 patients with Ebola hemorrhagic fever from African epidemic areas and actively participated in Ebola hemorrhagic fever prevention and drill in Guangdong province
2015	Participation in the rescue operation of the landslide at Hengtaiyu Industrial Park in Fenghuang Community, Guangming New District, Shenzhen
2015	Participation in the 4th ASEAN joint disaster relief exercise in Malaysia
2016	Carrying out medical visits in the Pacific island countries
2020	Successive support to Hubei, Beijing, and Hong Kong in the fight against epidemics
2021	Participation in epidemic prevention and control work in Guangdong province
2022	Supporting the fight against the epidemic in Hainan
2022	Designated hospital for the treatment of patients infected with the novel coronavirus in Guangdong province

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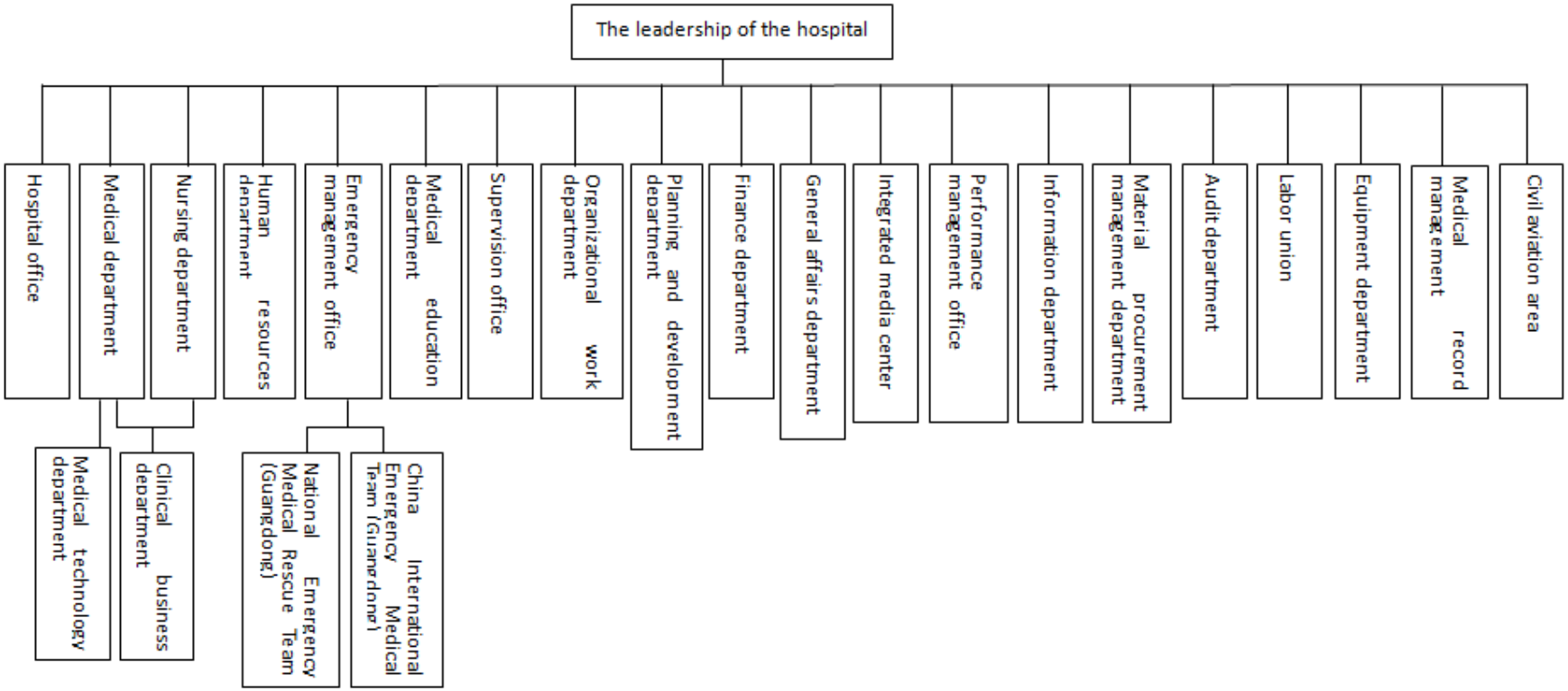
Annex H: Organizational Structure Chart of the Daily Work of Guangdong Provincial Emergency Hospital



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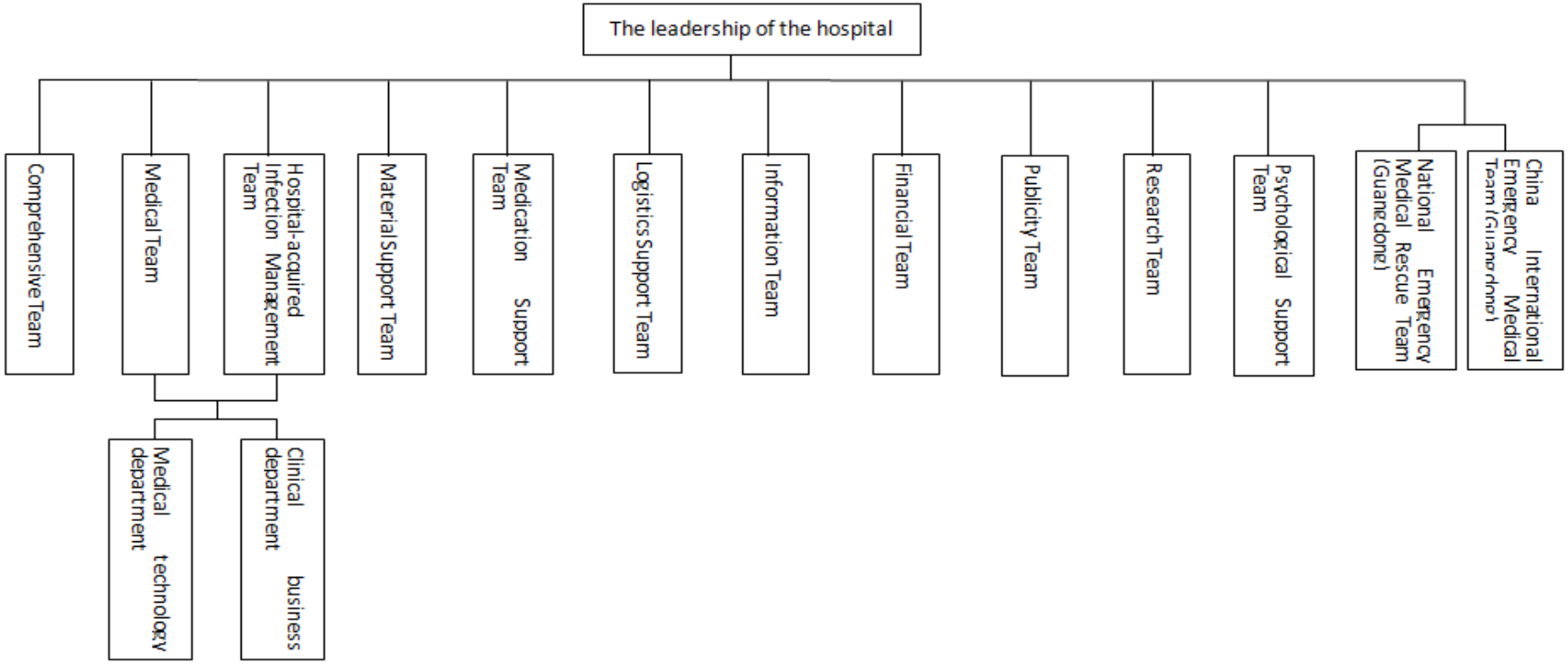
Annex I: Organizational Structure of Guangdong Provincial Emergency Hospital Updated When the Emergency Medical Management System was Launched in February 2020



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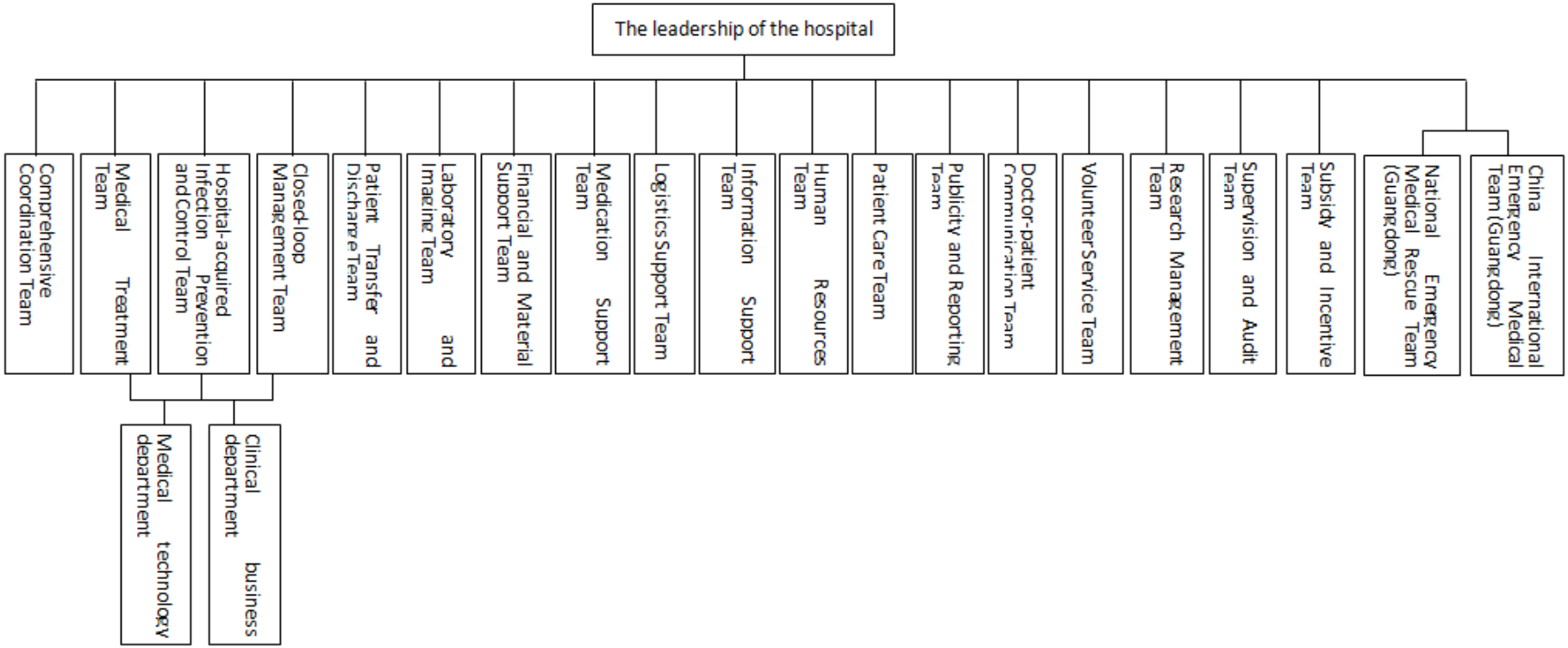
Annex J: Organizational Structure Chart of Guangdong Provincial Emergency Hospital Adjusted Again in November 2022



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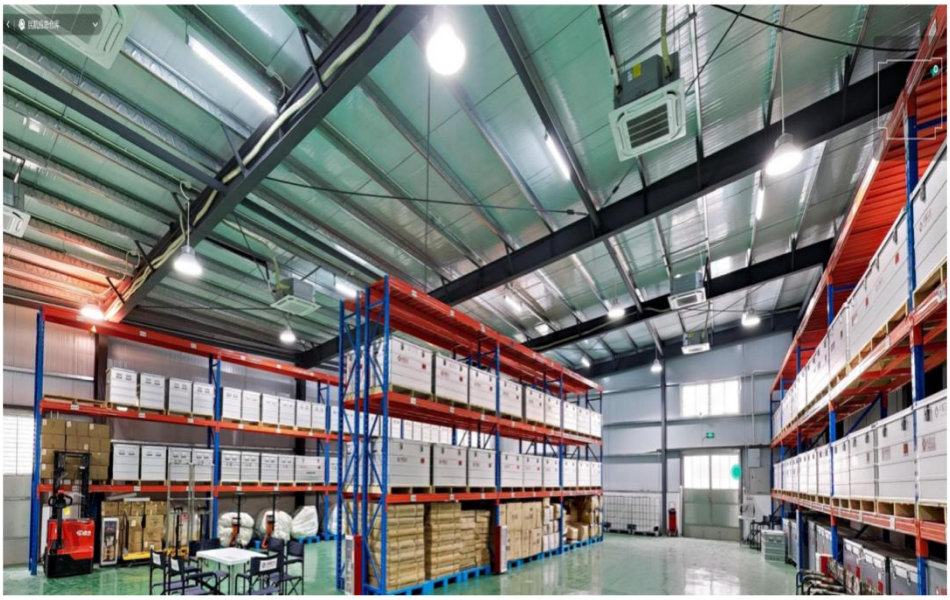
Annex K: Mobile Hospital in a Vehicle

Work Scene of P2+ Mobile Testing Vehicle

Annex L: Emergency Materials Warehouse Layout of Guangdong Provincial Emergency Hospital




第二层
第一层
呼吸机管路
呼吸机管路

Source: Guangdong Provincial Emergency Hospital (2022)

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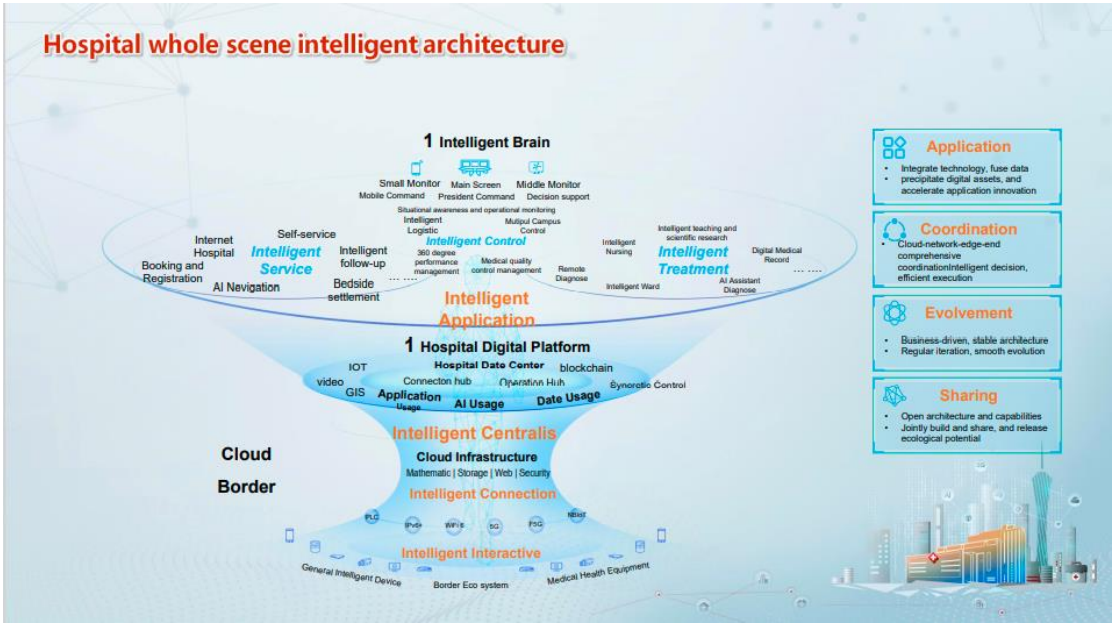
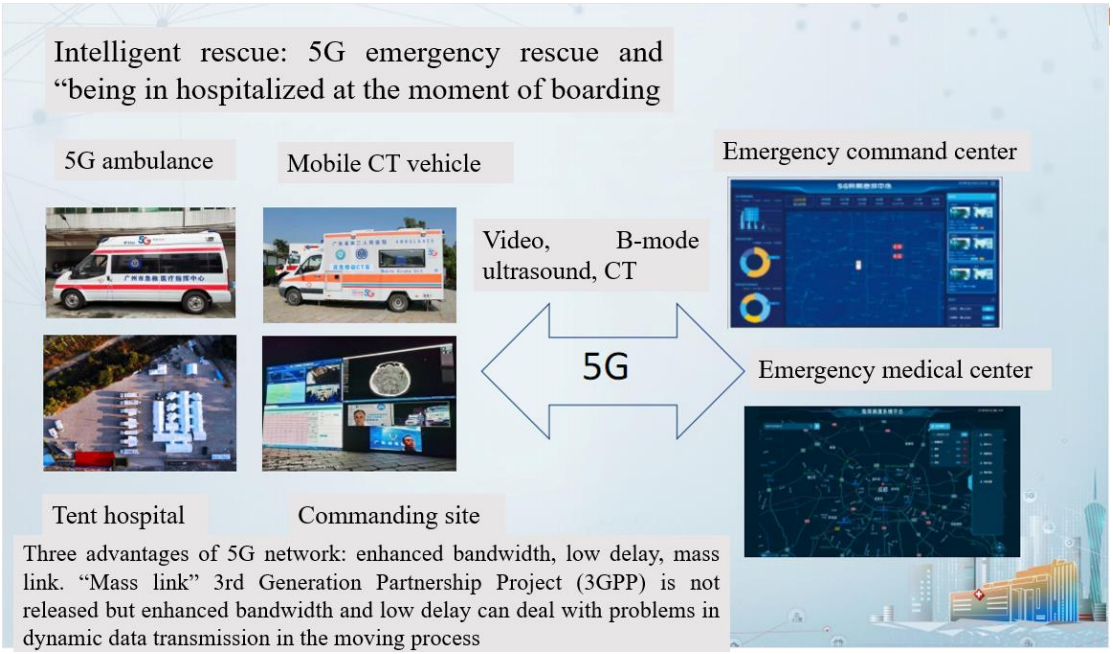
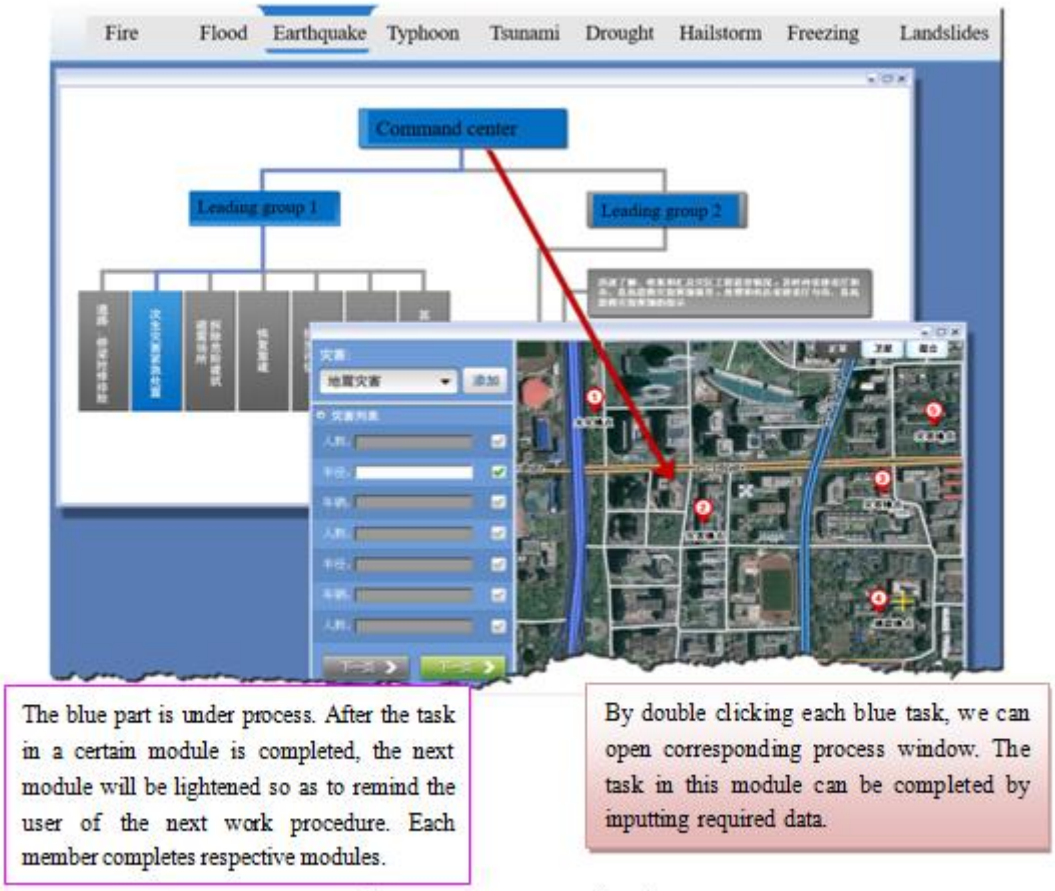
Annex M: Diagram of the External Emergency Information Platform of Guangdong Provincial Emergency Hospital





5G Emergency Rescue and Being in Hospitalized at the Moment of Boarding



Emergency command system

Source: Guangdong Provincial Emergency Hospital (2022)

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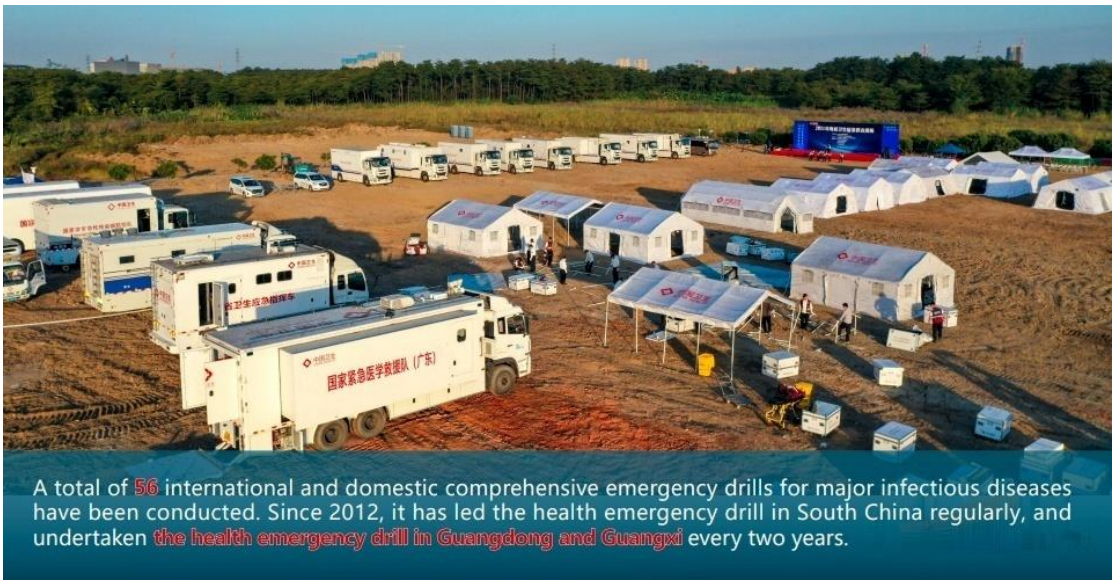
Annex N: Site Layout Diagram of the Tent Hospital at Guangdong Provincial Emergency Hospital



Source: Guangdong Provincial Emergency Hospital (2022)

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Annex O: Work Guidelines of the China International Emergency Medical Team (Guangdong) (Table of Contents)

28. Course of Treatment Records (Chinese)
29. Critical Illness Notification Letter (Chinese)
30. Discharge Summary Template (Chinese)
31. Prescription
32. Long-term Medical Order Template
33. Temporary Medical Order Template
34. Standard Operation Procedure for Intra and Inter-hospital Transfer
35. Referral Example
36. List of All Team Members
37. Practicing Qualification Materials of All Team Members
38. Professional Title Qualification Materials of All Team Members
39. Passport Materials of All Team Members
40. Review and Recording Process for Clinical Qualifications of Rescue Team Members
41. Emergency Medical Team News Release SOP
42. Personnel Status Update SOP
43. Emergency Team Backup Personnel List
44. Job Responsibilities
45. Training Plan
46. Training Management System
47. Training PowerPoint Presentation
48. Duty Roster
49. Training Sign-in Form
50. Training Assessment Form
51. Assessment Test Paper
52. List of Medications
53. Medication Customs Declaration Process
54. Layout Plan
55. Internal Layout Plan of Each Tent
56. List of Survival Supplies for Rescue Team
57. Inventory Allocation
58. Standard for Food Allocation
59. Food List
60. List of Clinical Consumables
61. Overall Inventory List

62. Distribution Map of Water, Toilets, and Shower Rooms
63. Water Quality Inspection
64. Excreta Management
65. Medical Waste Management
66. Common Liquid Disinfectant Usage
67. Putting on and Taking off Personal Protective Equipment
68. Reporting Mechanism for Infectious Diseases
69. Prevention and Control of Catheter-related Bloodstream Infections
70. Prevention and Control of Catheter-Related Urinary Tract Infections
71. Protective Equipment Management System
72. Emergency Vaccination
73. Management of Domestic Waste
74. Handling of Dead Bodies
75. Prevention and Control of Surgical Site Infections
76. Storage and Distribution of Sterile Items
77. Hand Hygiene for Medical Personnel
78. Sterilization of Medical Devices
79. Use of Personal Protective Equipment by Medical Personnel
80. Prevention and Control of Hospital-Acquired Pneumonia
81. Prevention and Management of Occupational Exposure for Medical Personnel
82. Treatment of HIV Positive Patients
83. Treatment of HIV-positive pregnant women
84. Management of patients diagnosed with HIV during medical consultation
85. Handling of medical disputes
86. Team member selection criteria, training, and management system
87. Team member health examination form
88. Copy of the current vaccination status of team members
89. Medical insurance purchase agreement
90. Emergency treatment for dispatched teams
91. Emergency evacuation plan
92. Regular evacuation plan
93. Safety and security
94. Emergency vaccination
95. Classification of injuries and illnesses among personnel

96. Initial treatment of wounds
97. Standard operating procedures for outpatient pre-examination
98. List of clinical consumables
99. Basic life support (BLS) (emergency department) 2nd edition
100. Advanced life support
101. Treatment of shock
102. Tracheal intubation
103. Standard operating procedure for suctioning with an electric suction device
104. Basic respiratory device
105. Oxygen inhalation standard operating procedure
106. Standard operating procedure for thoracentesis
107. Standard operating procedure for advanced intravenous fluid management
108. Blood transfusion standard operating procedure
109. Resuscitation room equipment and consumables list
110. Resuscitation room medications
111. Standard operating procedures for the transfer of emergency and inpatient patients
112. Referral form
113. Referral form (example)
114. Incised wound
115. Management of peripheral vascular and nerve injuries
116. Standard procedure for delayed primary closure
117. Standard procedure for grafting and basic skin flaps
118. Pediatric trauma care
119. Standard procedures for emergency treatment of burns
120. Trauma standard operating procedures
121. Upper limb bone and joint injuries
122. Lower limb bone and joint injuries
123. Compartment syndrome
124. Inventory and quantity of clinical consumables
125. Surgical instrument pack list
126. Standard procedures for caring for hospitalized patients with complex trauma
127. External fixation device
128. Splinting standard operating procedure
129. Traction standard operating procedure

130.Plaster of Paris standard operating procedure

131.Corrective medical care for hospitalized patients

132.Spinal cord and spinal injury

133.Open bone fracture

134.Amputation surgery

135.Fat embolism syndrome

136.Crush syndrome

137.Inventory and quantity of clinical consumables

138.Surgical instrument tray list

139.General anesthesia

140.Airway management

141.Pediatric anesthesia

142.Subarachnoid and epidural block

143.Advanced life support

144.Pain management

145.Standard operating procedures for basic respiratory devices

146.Standard operating procedure for suctioning with an electric suction device

147.Standard operating procedure for oxygen inhalation

148.Management and cleaning of the 7900D anesthesia machine

149.Management and cleaning of the cardiac monitor

150.Anesthesia informed consent form

151.Anesthesia informed consent form (example)

152.Surgical checklist

153.Surgical checklist (example)

154.Preoperative visit and anesthesia plan record

155.Preoperative visit and anesthesia plan record (example)

156.Anesthesia record (back)

157.Anesthesia record (front)

158.Handwritten anesthesia record (example)

159.Postoperative visit record

160.Postoperative visit record (example)

161.Anesthesia recovery room management system

162.Arrangement and job responsibilities of anesthesia and surgical personnel

163.Medication list

164.Anesthesia and surgical room equipment and consumables (1)

165.Anesthesia and surgical room equipment and consumables (2)

166.Introduction to anesthesia and surgical tents

167.Surgery registration book

168.Surgical nursing record

169.Surgical nursing record (example)

170.Surgical checklist

171.Surgical checklist (example)

172.Informed consent form for surgery/operation/procedure

173.Surgical tray inventory

174.Surgery notification form

175.Surgical procedure

176.Invasive surgical procedure

177.Surgical specimen management regulations

178.Anesthesia recovery room management system

179.Operating room entry and exit management regulations

180.Medical staff hand hygiene

181.Operating room hygiene and cleaning system

182.Operating room disinfection and control

183.Operating room light usage guidelines

184.Electric scalpel operation guidelines

185.Electric suction device standard usage

186.Sterile item storage in the operating room

187.Operating room management regulations for valuable items

188.Disinfection supply center services

189.Operating room inventory system

190.Management of post-operative room and contaminated items for special infections

191.Operating room instrument management regulations

192.Operating room emergency plan

193.Operating room management system

194.Anesthesia surgical equipment inventory

195.Inventory of consumables and drugs for 200 surgeries

196.Emergency care for pulmonary tuberculosis

197.Emergency care for AIDS

198.Emergency care for avian influenza

199.Emergency care for malaria

200.Emergency care for dengue fever

201.Isolation and prevention of diseases transmitted through different routes

202.DEWS (Early Warning and Response System) example

203.Standard team member composition list

204.Inventory and quantity of clinical consumables

205.Obstetric surgical tray inventory

206.Inventory and quantity of obstetric drugs

207.Multiple fetus vaginal delivery

208.Breech delivery

209.Puerperal infection

210.Postpartum hemorrhage

211.Eclampsia rescue plan

212.Critical obstetric care system

213.Critical obstetric care workflow

214.Informed consent for cesarean section

215.Notification of placenta ownership after childbirth

216.Authorization letter for obstetric inpatient women

217.Normal delivery assistance

218.Emergency cesarean section

219.Cesarean section package

220.Amniotic fluid embolism rescue plan

221.Shoulder dystocia rescue plan

222.Standard team member composition list

223.Inventory and quantity of clinical consumables

224.Catalog of commonly used pediatric drugs

225.Common pediatric diseases requiring referral

226.Guidelines for the diagnosis and treatment of diarrhea

227.Guidelines for the diagnosis and treatment of bronchopneumonia

228.Guidelines for the diagnosis and treatment of malnutrition

229.Guidelines for the diagnosis and treatment of measles

230.Guidelines for the diagnosis and treatment of malaria

231.Emergency care for pediatric hypoalbuminemia

232.Emergency care for pediatric acute respiratory diseases

233.Emergency care for pediatric malaria

234.Emergency care for pediatric gastrointestinal diseases

235.Emergency care for pediatric acute trauma

236.Pediatric surgical tray checklist

237.Emergency treatment for acute coronary syndrome

238.Management of hypertensive crisis

239.Management of acute respiratory failure

240.Management of acute exacerbation of chronic obstructive pulmonary disease

241.Emergency treatment for acute exacerbation of bronchial asthma

242.Treatment of gastrointestinal bleeding

243.Emergency treatment for hypoglycemia

244.Emergency treatment for diabetic ketoacidosis

245.Emergency treatment for hyperglycemic hyperosmolar syndrome

246.Standard operating procedures for simple respiratory equipment

247.Management and cleaning and disinfection of electrocardiograph

248.Standard operating procedures for suctioning with electric suction device

249.Standard operating procedures for defibrillator use

250.Standard operating procedures for ventilator use

251.Inventory and quantity of NCD (Non-Communicable Diseases) drugs

252.Inventory and quantity of clinical consumables

253.Psychological first aid

254.Rehabilitation team member list

255.Rehabilitation equipment and consumables list

256.Fracture rehabilitation

257.Amputation rehabilitation

258.Peripheral nerve injury rehabilitation

259.Standard procedures for skin grafting and basic skin flap

260.Rehabilitation of cranial and brain injuries

261.Rehabilitation of spinal cord injuries

262.Standard procedures for clinical specimen collection and transportation

263.Standard procedures for blood specimen collection and transportation

264.Standard procedures for microbial specimen transport

265.Emergency standard procedures for routine blood tests

266.Emergency standard operating procedures for routine urine tests
267.Standard procedures for routine fecal and occult blood tests
268.Emergency standard procedures for coagulation function tests
269.Emergency test standard procedure for malaria parasites (colloidal gold method)
270.Standard procedure for malaria parasite microscopic examination (microscopy method)
271.Emergency qualitative testing standard procedure for urine human chorionic gonadotropin
272.Standard procedures for emergency biochemical (ion, blood gas, blood sugar, renal function, myocardial infarction) tests
273.Standard procedure for rapid testing of hepatitis B surface antigen
274.Standard procedure for rapid testing of hepatitis C antibody
275.Standard procedure for rapid testing of syphilis antibody
276.Standard procedure for rapid testing of human immunodeficiency virus (HIV)
277.Standard operating procedure for microbial microscopic examination
278.Gram staining standard operating procedure
279.Acid-fast staining standard operating procedure
280.Introduction to mobile blood bank
281.Blood supply contingency plan for mobile blood bank
282.ABO blood type confirmation
283.RhD blood type identification
284.Cross-matching blood test
285.Observation and handling of adverse blood transfusion reactions
286.Use and management of blood storage boxes in mobile blood bank
287.Management of mobile blood bank
288.Laboratory safety and biosafety management regulations
289.Laboratory medical waste management regulations
290.Critical value reporting system
291.Laboratory test report
292.Detailed list of instruments, reagents, and consumables
293.Record of indoor temperature, humidity, refrigerator temperature, etc. in the laboratory
294.Register of reagent and consumable disbursement
295.Instrument usage record

296.Critical value report register

297.Medical waste register

298.Register for receiving test specimens and issuing test reports

299.Blood component entry and exit register for mobile blood bank

300.Blood request form

301.Blood request form and specimen submission register for mobile blood bank

302.Blood issue report

303.Temperature monitoring register for blood storage boxes in mobile blood bank

304.Organizational structure of the laboratory and blood transfusion tent

305.Standard operating procedure directory

306.International medical team drug list

307.Standard operating procedures for the formulation of drug lists for international emergency medical teams

308.Standard operating procedures for routine reserve of drugs for international emergency medical teams

309.Standard operating procedures for deployment and initiation of drug lists for international emergency medical teams

310.Standard operating procedures for maintaining the cold chain of drugs for international emergency medical teams

311.Standard operating procedures for customs declaration of drugs for international emergency medical teams

312.Standard operating procedures for the management and use of drugs for international emergency medical teams

313.Standard operating procedures for the receipt of donated drugs for international emergency medical teams

314.Standard operating procedures for drug adjustment and registration for international emergency medical teams

315.Standard operating procedures for handling and disposal of damaged drugs for international emergency medical teams

316.Standard operating procedures for unused drugs for international emergency medical teams

317.Adverse drug reaction reporting system for international emergency medical teams

318.Emergency reserve drug call order

319.List of emergency reserve drugs called

320.Inventory of drugs

321.Drug quality inspection record

322.Packing list for emergency reserve drugs

323.Drug receiving registry

324.Drug issue registry

325.Prescription template

326.Clinical drug return form

327.Drug distribution registry

328.Registry of unused drugs

329.Anesthetic drug usage registry

330.Refrigerator temperature record

331.Approval and disposal form for expired drugs

332.Drug donation registry

333.Adverse drug reaction event report form

334.Group adverse drug reaction event report form

335.Radiology emergency medical team report

336.Radiology emergency medical team X-ray report writing standards

337.General X-ray methods for chest imaging

338.General X-ray methods for abdominal imaging

339.General X-ray methods for pelvic imaging

340.General X-ray methods for spinal imaging

341.General X-ray methods for limb imaging

342.Services and functions

343.Duties and responsibilities

344.Workflow and quality standards for recycling

345.Manual cleaning process for contaminated items

346.Special infection operative instrument cleaning process

347.Standard operating procedure for desktop ultrasonic cleaning machine

348.Operating procedure for medical washing and disinfection tank

349.Packaging process and quality requirements for instrument packs

350.Standard operating procedure for type B steam sterilizer

351.Management process for aseptic item distribution

352.Standard operating procedure for rapid biological reader

353.Quality inspection traceability record for pressure steam sterilizer

354.Emergency contingency plan for sterilization failure

355.Equipment, dressing, and material inventory

356.Anticipated generation of medical waste and garbage

357.List of essential living support items

358.Food distribution

359.Tent hospital clean water and water supply

360.Water quality monitoring

361.Tent hospital electricity generation and supply

362.Security measures

363.Tent hospital wastewater treatment

364.Tent hospital material transport process

365.Toilet construction requirements

366.Layout diagram

367.Overall inventory of items

368.Number of team members' accommodation tents and beds

369.Medical waste disposal

370.Domestic waste disposal

371.Handling of dead bodies

372.Fecal matter disposal

373.Vital communication technology list

374.List of rescue personnel

375.Organizational structure chart of the team

376.Standard operating procedure for outpatient pre-examination

377.Categorization of injury assessment for casualties

378.Standard operation procedures for emergency treatment and referral of emergency and inpatient patients

379.Referral form

380.Referral form (example)

381.Initial treatment of wounds

382.Standard operating procedures for trauma care

383.Treatment of multiple injuries

384.Treatment of cranial and brain injuries

385.Treatment of shock

386.Standard operating procedure for female genital injuries

387.Standard operating procedure for pediatric trauma care

388.Closed thoracic drainage

389.Emergency first aid standard procedure for burns

390.Standard protocol for hospital inpatients with complex trauma

391.Emergency treatment of acute pediatric trauma

392.Corrective medical care for hospitalized patients

393.Isolation and prevention SOP for diseases with different transmission routes

394.Emergency care for dengue fever

395.Emergency care for malaria

396.Emergency care for avian influenza

397.Normal childbirth delivery

398.Emergency caesarean section

399.Emergency care for pediatric hypoproteinemia

400.Emergency care for pediatric acute respiratory diseases

401.Emergency care for pediatric malaria

402.Emergency care for pediatric gastrointestinal diseases

403.Invasive surgical procedures

404.External fixation SOP

405.Spinal cord and spine injury SOP

406.Open bone fracture SOP

407.Amputation SOP

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Annex P: Medical Quality Safety Management and Continuous Improvement Manual (Table of Contents)

1. Responsibilities and List of Members of the Departmental Quality and Safety Management Committee

2. Annual Work Plan for Medical Quality and Safety Management

3. Records of Departmental Quality and Safety Management Training

4. Records of Medical Quality Management Self-Inspection and Continuous Improvement

1) "Departmental Self-Inspection and Discussion Item List"

2) "Departmental Medical Quality Self-Inspection Record Form"

3) "Departmental Medical Quality Self-Inspection and Improvement Activity Record Form"

5. Departmental Medical Quality and Safety Management Objectives

1) Departmental Annual Objectives for Medical Quality and Management

2) Quarterly Summary and Analysis Report of Medical Quality Situations

3) "Departmental Quarterly Medical Quality Improvement Activity Record Form"

6. Continuous Improvement Project Cases

7. Status of Departmental 1-2 Annual Continuous Improvement Project Cases

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Annex Q: Guangdong Provincial Emergency Hospital COVID-19 Infection Medical Treatment Manual (Table of Contents)

1. Notice on the Establishment of the Leading Group for the Treatment of COVID-19 Designated Hospitals in Guangdong Province Emergency Hospital
2. Work Plan for Medical Treatment of Novel Coronavirus Pneumonia in Guangdong Provincial Emergency Hospital
3. Setting up of Isolation Wards for the Treatment of COVID-19 Patients in Guangdong Provincial Emergency Hospital (including floor distribution, responsible persons, and second-line measures)
4. Arrangement and Responsibilities of Doctors at different levels in the Admission Ward
5. List of frontline doctors on duty in the Admission Ward
6. Process for admitting patients with COVID-19 infection
7. Process for transferring mild COVID-19 patients to lower-level hospitals
8. Discharge process for COVID-19 patients
9. Precautions for admission, discharge, and referral
10. Management Regulations for Case Discussion Meetings
11. Medical insurance guidance for COVID-19 patients
12. "Diagnosis and Treatment Plan for Novel Coronavirus Pneumonia (Trial Ninth Edition)"
13. Treatment plans for different clinical types of COVID-19
14. Consultation system for patients with COVID-19
15. Consultation system for non-COVID-19 diseases in admission wards
16. Plan for converting the Intensive Care Unit into an emergency ward for treating critical COVID-19 patients
17. Emergency plan for childbirth for patients with COVID-19
18. Surgical procedures for patients with COVID-19 infection
19. Admission process for the neonatal ward
20. Admission process for the pediatric ward

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Annex R: Compilation of Emergency Plans of Guangdong Provincial Emergency Hospital (Table of Contents)

1. Hospital Emergency command System

2. General Plan for Hospital emergency. Special emergency plan for Hospital emergencies Emergency Plan for administrative duty class

3. General Duty system of hospital administration (revised)

4. Medical safety emergency Plan

5.Medical technical risk early warning and damage disposal plan

6. Hospital emergency Medical incident Rapid Response team (RRT) work guidelines

7.Emergency material allocation mechanism for emergency medical incidents

8.Emergency plan and processing process for handling large numbers of wounded patients

9.Emergency plan for triage and rescue of large numbers of wounded patients.

10. Plan for the prevention and control of sudden acute infectious diseases

11. Plan for the designated treatment of COVID-19 patients in civil aviation hospitals (1,000 beds)

12. Plan for the prevention and treatment of malignant medical disputes

13. Hospital personnel emergency replacement procedures and programs.

14. Emergency plan for pregnant women seeking medical treatment during the outbreak of epidemic

15. emergency rescue plan of Guangzhou Baiyun International Airport.

16. Nursing emergency plans and procedures in case of emergency

(1) Emergency replacement procedures and programs for nursing personnel

(2) Emergency plans and procedures for handling nursing complaints

(3) Emergency plans for occupational exposure of nursing personnel

(4) Needle stab injury treatment plan and process

(5) Emergency plan and process for emergency storage of patient medical records

(6) Emergency plan and process for emergency storage of reaction specimens

(7) Emergency plan and process for nursing of major accidental injuries

17. Emergency plan and process for key links of nursing

(1) Emergency plan and process for poisoning patients

(2) Emergency plan and process for poisoning chemical and biological toxic drugs.

(3) Emergency plan and flow volume when the ECG monitor fails

(4) Emergency plan and flow when the defibrillator fails

(5) Emergency plan and flow when the ECG machine fails in the ward

(6) Emergency plan and flow when the ventilator fails

(7) Emergency plan and flow of mercury leakage from the thermometer and blood pressure monitor

(8) Emergency plan and process for patients with infusion reaction

(9) Emergency plan and process for patients with blood transfusion reaction

(10) Emergency plan and process for patients with acute left heart failure

(11) Emergency plan and process for patients with air embolism

(12) Emergency plan and process for patients with acute gastrointestinal massive hemorrhage

(13) Emergency plan and procedures for patients with hemoptysis

(14) Emergency plan and process for patients with accidental tracheotomy catheter catheterization

(15) Emergency plan and process for patients with accidental central venous catheter catheterization

(16) Emergency plan and process for patients with accidental thoracic closed drainage tube catheterization

(17) Emergency plan and process for patients with intravenous infusion with drug exosmosis and process

18. Emergency response for patients with catheter-related bloodstream infection during intravenous therapy Plan and process

19. Emergency Plan for Radiation Safety Accidents (revised draft)

20. Emergency Plan for Special equipment Accidents

21. Emergency plan management system of hospital information system

22. Emergency plan of hospital network fault

23. Emergency plan of HIS information system in hospital.

24. Emergency plan of LIS information system in hospital.

25. Emergency plan of hospital PACS information system.

26. Emergency plan of hospital surgical anaesthesia information system

27. Emergency plan of hospital electronic medical record information system

28. Emergency plan of hospital ECG information management system

29. Emergency plan of hospital mobile nursing information system

30. Emergency plan of hospital critical care information system

31. Water/electricity/Ladder Emergency Plan of the Ministry of General Affairs

32. Fire Emergency Plan (revised in 2022)

33. Emergency fire Response Plan (revised in 2022)

34. Emergency Response Plan for Prevention of Violent Medical Incidents (revised in 2022)

35. Emergency plan for logistics warehouse

36. Emergency plan for fire prevention and flood control of logistics warehouse.

37. Emergency Plan for Handling chemical dangerous Goods Accidents (revised in 2022)

38. Emergency Plan for Logistics Maintenance Support (revised in 2022)

39. Emergency plan for food poisoning in hospital canteen.

40. Emergency plan for laundry class.

41. Emergency plan for transport escort management.

42. Emergency plan for sewage treatment and water pollution.

43. Emergency plans for vehicles

44.Emergency measures and rescue plans for special equipment (boilers)

45. Emergency control Process (revised in 2022)

46. Emergency Rescue Plan for Confined Space Operations (revised in 2022)

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Annex S: Results of Total Variance Explained by Components Analysis

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	12.135	52.763	52.763	12.135	52.763	52.763	6.622	28.792	28.792
2	2.780	12.088	64.851	2.780	12.088	64.851	3.915	17.022	45.814
3	1.331	5.788	70.639	1.331	5.788	70.639	3.461	15.049	60.863
4	1.129	4.907	75.545	1.129	4.907	75.545	3.377	14.682	75.545
5	.802	3.486	79.031						
6	.699	3.039	82.070						
7	.581	2.525	84.596						
8	.494	2.146	86.742						
9	.370	1.610	88.352						
10	.346	1.506	89.858						
11	.324	1.407	91.265						
12	.299	1.300	92.565						
13	.274	1.193	93.759						
14	.233	1.014	94.772						
15	.208	.905	95.678						
16	.201	.873	96.551						
17	.167	.726	97.276						
18	.149	.648	97.925						
19	.117	.509	98.434						
20	.115	.501	98.936						
21	.091	.397	99.332						
22	.079	.343	99.675						
23	.075	.325	100.000						

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Annex T: Rotated Component Matrix from Principal Component Analysis

	Component			
	1	2	3	4
Egalitarian leadership 1		.769		
Egalitarian leadership 2		.806		
Egalitarian leadership 3		.745		
Egalitarian leadership 4		.744		
Collaborative working environment 1				.629
Collaborative working environment 2				.728
Collaborative working environment 3				.775
Collaborative working environment 4				.703
Collaborative working environment 5	.629			
Top management commitment 1	.633			
Top management commitment 2	.657			
Top management commitment 3	.682			
Supportive management 1	.772			
Supportive management 2	.765			
Supportive management 3	.745			
Supportive management 4	.659			
Use of information technology 1	.743			
Use of information technology 2	.726			
Use of information technology 3	.751			
Resistance to change 1			.863	
Resistance to change 2			.905	
Resistance to change 3			.910	
Resistance to change 4			.859	

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Annex U: Comparison of Primary Indicators in National Monitoring between 2021 and 2019