



5G-Powered Cities: Pre-Hospital Emergency Treatment



China Mobile Guangzhou has built 16,000 5G base stations, making Guangzhou China's first in the number of stations. The endeavour will promote 5G across different industries for business development. We work to build the country's first model pre-hospital emergency treatment project for 5G+ cities to support the Greater Bay Area. In this way, race against time to save lives with prompt medical services.

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Partners



Case Overview

In 2020, Guangzhou Emergency Medical Centre (hereinafter referred to as "Guangzhou 120") and China Mobile jointly launched the "5G City-level Pre-hospital Emergency Treatment Innovation Demonstration Project" in Guangzhou. Relying on the ability of Guangzhou 120 to coordinate 140 local medical institutions and the 5G technology which boasts large bandwidth, low latency, and wide connectivity, the project combines 5G and remote ultra-high-definition multidisciplinary consultation and real-time return of vital signs with 5G+ interactive video capability as the core, building a 5G urban emergency treatment network and a 5G+ pre-hospital emergency treatment platform, reshaping the pre-hospital emergency treatment process, assigning medical treatment resources in advance, and filling the information blind spots to solve the problems caused by the lack of information, such as patients' inability to save themselves, untimely medical and nursing preparation, and poor pre-hospital and in-hospital handover. The project aims to provide instant first aid, and ensure more efficient pre-hospital emergency treatment, smoother pre-hospital and in-hospital transition, and better integrated service capability of pre-hospital and in-hospital emergency treatment. More time can be saved for patients within the golden emergency time window for higher treatment success rate.

In addition to the emergency command and dispatch system, electronic medical record system, and call positioning system built by Guangzhou 120, the project plans to create a 5G city emergency network and a 5G+ pre-hospital care platform that includes a 5G emergency guidance system, a 5G RCS system, a VOLTE system, a 5G on-board consultation system, a 5G coordinated command and dispatch system, a volunteer paging system, and an AED resource management system. At the same time, 400 emergency vehicles will be updated with 5G technologies.



Guangzhou 120 Dispatchers in Remote Scheduling



Director Li Shuangming (Guangzhou 120) Commanding Treatment in the Centre

Industry Challenges

Challenges Facing Pre-hospital Emergency Treatment

The 14-minute emergency treatment window and information absence restrict life-saving aid for patients with acute and critical illnesses

It takes an average of 14 minutes for an ambulance to arrive at the patient's location when an emergency call is made. The golden rescue time is only 4 minutes after the onset of common critical illnesses, such as cardiac arrest, foreign-body airway obstruction, and severe burns. The traditional 120 call model fails to effectively collect patients' immediate pathological status, resulting in wasted time window and insufficient information collected, which prevents targeted guidance for self and mutual medical aid and preparation of doctors in the ambulance and hospital. This severely affects the rescue effect and efficiency on patients with acute and critical illnesses.

Traditional pre-hospital and in-hospital information is not well connected, leading to untimely assignment of high-quality in-hospital medical resources.

There is a certain degree of interaction bottleneck in the pre-hospital and hospital electronic medical records, pathology information, and registration system, and the relevant diagnosis and treatment information cannot be shared with medical institutions in real time. As a result, the hospital's high-quality medical resources cannot be used in the pre-hospital emergency treatment process in a timely manner.

Traditional call technology cannot meet the requirement of instant and efficient video consultation

The traditional mode of communication between the emergency medical command centre and the 120 operators by means of voice call access cannot meet the current demand. Video interaction platforms and technologies are flourishing in China. Although live streaming and on-demand streaming services are common in entertainment and education, they have not yet been employed by government social welfare agencies.

Solutions and Benefits

Featured with stable, safe, and efficient data transfer, the private 5G medical network has become a trend. It enables video calls among the 120 command centre, first witnesses, volunteers, onboard doctors, in-hospital doctors, medical officers, and patient families by using 5G+ video interaction technology, big data analysis, network slicing, and other technologies. 5G RCS allows rescue mission release, AED resource positioning and release, rescue video guidance, patient identity and family signature, which breaks down the information silos, helps patients in self medical care, gives hospitals necessary preparation time, and guides emergency treatment on the road. In this way, the high-quality medical resources in the hospitals are utilized earlier. Information sharing and collaborative interaction shorten the response time and improve the rescue success rate.

Solutions

01 System architecture

An innovative "1+1+N" 5G+ city-level pre-hospital emergency treatment demonstration project is built by using modern information technologies such as 5G, Internet of Things, cloud computing, big data, and artificial intelligence.

A dedicated 5G emergency treatment network covering Guangzhou is established to connect Guangzhou 120, hospitals, ambulances, medical

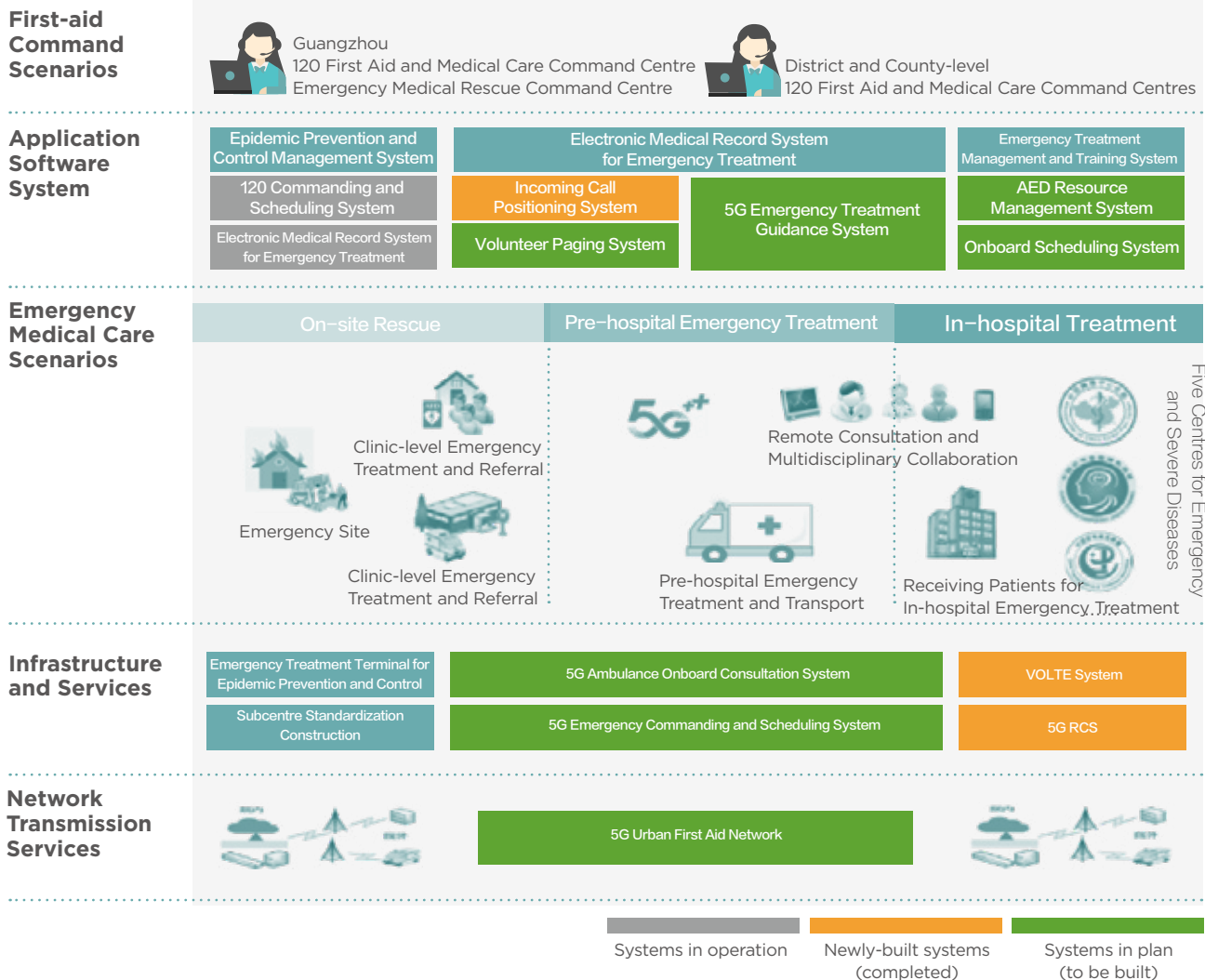
personnel, and medical equipment for precise emergency treatment right after emergency calls.

A 5G+ pre-hospital emergency treatment platform is built to allow information sharing and exchange in all scenarios to facilitate collaboration.

A number of pre-hospital emergency treatment scenarios, especially call reception, task scheduling, pre-hospital referral, pre-hospital emergency treatment, hospital admission, and in-hospital emergency treatment, are created to reshape the pre-hospital emergency treatment process and provide medical treatment resources earlier. Such information as 120 first-aid, on-site information of patients, ambulance location, onboard situation, inspection results of medical equipment onboard can be shared to medical treatment officers, social rescue volunteers, in-hospital emergency ICU doctors and other rescuers in real time, which allows instant emergency treatment via professional guidance.



5G+ Pre-hospital Emergency Treatment Platform



02 Network

A dedicated, secure, and reliable 5G urban emergency treatment network that offers all-round and continuous coverage, high speed, low latency, and wide connection is built by using key technologies such as network slicing and edge computing to connect the 120 command centre, digital and intelligent middle office, hospitals, ambulances, medical personnel, and medical equipment.

03 Technical solutions

1 A 5G+ pre-hospital emergency treatment platform

The platform is comprised of a 5G emergency treatment guidance system, a 5G RCS system, a VOLTE system, a 5G on-board consultation system, a 5G coordinated command and dispatch system, a volunteer paging system, and an AED resource management system. Such information as 120 first-aid, on-site information of patients, ambulance location, onboard situation, inspection results of medical equipment onboard can be shared to medical treatment officers, social rescue volunteers, in-hospital emergency ICU doctors and other rescuers in real time. This ensures more efficient pre-hospital emergency treatment, smoother pre-hospital and in-hospital transition, and better integrated service capability of pre-hospital and in-hospital

emergency treatment. More time can be saved for patients within the golden emergency time window for higher treatment success rate.

2 Renovation of 5G ambulances

5G is introduced in ambulances with multidisciplinary consultation devices, cameras, and customized management software. When medical equipment and systems such as ECG monitors, ultrasound, and respiratory machines are connected to the 5G network, patients' examination information (such as routine vital signs, and data from ECG, a multi-parameter monitor, and other test and examinations) in the ambulances can be transferred to hospitals in real time to help diagnose patients and develop treatment plans.

04 Project Features

1 Technological innovation

The project has innovated in and verified the application mode of intelligent medical technologies, especially a dedicated 5G network, big data, Internet of things, positioning, and artificial intelligence. Smart medical technology for pre-hospital emergency treatment quality management combines pre-hospital emergency treatment quality measurement and decision support and single-disease clinical pathway to significantly optimize the pre-hospital emergency treatment process. Built on it, rapid-delivery information solutions and comprehensive product lines have been put in place.

2 Management model innovation

Starting from overall informatisation planning and design, quality management, operation management, and patient safety, Guangzhou has presented a new management model for intelligent medical care in pre-hospital emergency treatment scenarios.

First, an intelligent quality management model for pre-hospital emergency treatment is used. A combination of 5G+ video interaction, intelligent mobile emergency care devices, and medical information

integration makes possible the model of "utilizing pre-hospital care quality measurement and decision support to drive pre-hospital care quality improvement" in replacement of the existing model of filling forms for quality management. Guided by the 5R principle, precise medical behaviour intervention and process quality control are implemented in the least invasive way, a solid boost in the compliance of single-disease emergency pathways and clinical guidelines with clear "time windows".

Second, an intelligent pre-hospital and in-hospital emergency operation and management model with multidisciplinary collaboration is adopted. As the emergency green channel management model is integrated with 5G+ video interaction, intelligent mobile emergency treatment devices, and medical information integration, hospitals can allow fine clinical process monitoring that takes into account both facts and subjective judgment based on each patient's conditions. Along with green channel operation assessment indexes and reminder mechanism, it offers an opportunity to solve the lasting challenge of collaboration and coordination across disciplines and departments in pre-hospital and in-hospital emergency care. The original serial processes are parallelized to materialize the patient-first pre-hospital emergency treatment management model.

Commercial Value

Guangzhou 120 can directly command and schedule the pre-hospital emergency care teams of 140 local hospitals, including over 2,000 first responders and more than 400 ambulances. The mature regional emergency system for mega cities has been operating stably for more than 30 years, receiving over 22 million citizen calls and dispatching ambulances more than 2.8 million times. It is the largest command emergency centre in China, with the appropriate scale and ability for pilot demonstration. In 2021, China has a total of 1.02 million 120 command centres and medical institutions, with about 1.32 million ambulances. Around 400 million pre-hospital emergency cases are handled annually. This means there is a promising scale effect for information system construction. If the 5G pre-hospital emergency treatment platform can be applied to 120 command centres or medical

institutions at all levels nationwide, the estimated market will value more than 20 billion yuan. There are 400 million 120 calls every year, and when the 5G+ video sees scale application, the existing workflows of 120 command centres and medical institutions will be optimized for better work standards, quality, and service methods in pre-hospital emergency treatment. The scale renovation will facilitate the cost sharing of public 5G network and investment in private 5G network by ISPs. The introduction of functions including 5G+ interactive video, VOLTE, and 5G RCS will attract software and hardware players to invest more in R&D and expand the market.

In the future, the 5G pre-hospital emergency treatment platform will cover the entire Guangzhou city and be replicated nationwide.

Summary and Next-steps

This project is a successful exploration into the application value of 5G+ pre-hospital emergency treatment platform, which is developed for Guangzhou 120's pre-hospital and in-hospital work scenarios. It leverages the excellent network provided by China Mobile to establish a 5G intelligent medical ecosystem led by China Mobile, along with such partners as hospitals, ISPs, equipment vendors, and application service vendors. Focusing on the emergency treatment resource management, process management, and quality management, a city-wide one-stop emergency treatment network targeting multiple diseases is put in place, therefore breaking down the "information silo".

The 5G+ video interaction and 5G ambulance involved in the project have been adopted and tested in the medical security for 2020 Guangzhou Marathon, the command and scheduling for Guangzhou Mountain Marathon in January 2021, and the medical emergency security exercise of Beijiang Dike in April 2021. The excellent results have been praised by leaders at all levels. The incoming call positioning was launched in December 2020, and the system has been running stably for seven months, with 200,000 incoming calls precisely

positioned. 5G ambulances have also been tested in a number of local hospitals.

Next

1 Along with 5G ambulance transformation for multidisciplinary consultation, integrated vehicle management, electronic medical record expansion, and standardized construction of each 120 sub-centres,

Guangzhou will focus on data integration and service governance, construct emergency care training management module, and standardize pre-hospital care and emergency medical rescue services across the city. The intelligent medical emergency data middle office will be optimized and connected with Guangzhou resident health information platform to obtain patient health data and upgrade the emergency treatment platform.

2 Targeting market demand, the platform will facilitate efficient yet easy ways to save lives. After being recognized by the public, the solution will be replicated to other parts of China.