ConnectedHealthcare-a medical revolution in India post Covid-19

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ConnectedHealthcare-a medical revolution in India post Covid-19

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Abstract

Technological advancement has brought about a revolution in every sector in the world. The Healthcare sector is one of the most essential sectors and is still far behind especially in developing countries. With the help of 5G, connected healthcare is the future. Countries like India can be a great model for the rest of the world with the connected healthcare services. As the majority of the population still resides in a rural area, this will help save more lives. This will be economical to build multispecialty hospitals in every village in India will be very expensive. Together we can build a powerfully connected healthcare India.

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ConnectedHealthcare-a medical revolution in India post Covid-19

Dr Arefa Sultana, Rishiraj Sengupta, Arijit Sengupta

Abstract:
Technological advancement has brought about a revolution in every sector in the world. The Healthcare sector is one of the most essential sectors and is still far behind especially in developing countries. With the help of 5G, connected healthcare is the future. Countries like India can be a great model for the rest of the world with the connected healthcare services. As the majority of the population still resides in a rural area, this will help save more lives. This will be economical to build multispecialty hospitals in every village in India will be very expensive. Together we can build a powerfully connected healthcare India.
Key words:
Economical, Health care, Advance technology, Connected Hospitals, Collection of Patient data, Instant treatment, 5G technology, Health technology

Background:
Connected healthcare includes plans in telehealth, distant care and disease management by exploiting cutting edge technologies such as cellular networks enabling instant and effective decision-making process for doctors by removing geographic limitations. (1) Connected healthcare is the future and it can be very helpful in cases of emergencies and life-threatening situations. The United Kingdom and Spain have started working on implementing rapid diagnosis and treatment even before the patient reaches the hospital by effective usage of 5G. It can bring revolution in healthcare especially in developing countries like India, a country where 67.97% of its population resides in rural areas where the healthcare system is underdeveloped. Mortality rate is higher due to less accessibility to emergency healthcare. (2) Hence, it becomes a long and tiresome process to even get the basic treatment in rural areas.
India's rates in cardiovascular disease related death is higher than many other nations. Ischemic heart disease with stroke and COPD related deaths together contribute to majority of total deaths in India. (3) The deaths in the rural area can be avoided with instant remote diagnosis and treatment. Myocardial Infarction, cerebrovascular accidents (CVA), road traffic accidents related deaths have increased exponentially, especially among youth. For instance, in 2018, deaths number due to road calamities in India among fatalities between 25 and 35 years amounted to around 40 thousand, the most compared to other age groups. (4)These deaths can be prevented with instant diagnosis and remote treatments with the help of advance 5G telecommunication technology.

Discussion:

5G can revolutionise the healthcare in various ways.

Ambulances are available in various cities, towns, and villages to transport patients from their home or rural healthcare centre to a bigger multispecialty hospitals. These ambulances currently provide oxygen supply to maintain the saturation of these patients until they are safely transported to the nearest health care facility. Development of such vehicles into a mobile medical facility with the help of 5G will reduce county's mortality rate to a greater extent. In this method, robotic surgeries are being performed in various developed countries with a proper setup using 5G. Similarly, the idea of diagnosing and treating patients remotely with the help of doctors and advance telecommunication technology can bring immense change in the current healthcare scenario of India. In addition,

ultrasonographic scans can be performed with the help of paramedics or doctors available in the ambulance, and diagnosis of this can be done remotely with the help of 5G connectivity, thus providing time for further medication procedures.

In case of extreme emergencies like avalanches, earthquakes and other natural disasters, helicopter ambulances equipped with basic investigation techniques and 5G can be very helpful in speedy 'triage'.

Primary Health Centre (PHCs) also referred to as public health centres are state-owned rural health care facilities in India whose nationwide numbers are approximately 28,86,30,000. These PHCs provide medical care and basic facilities. The patients with serious diseases and life-threatening conditions are usually referred to higher state general hospital which is few hours away. Development of the basic infrastructure with the help of 5G, similar to the structure of connected ambulance can bring about a huge change in healthcare in the rural areas. But its application can also be implemented in urban centres across different sectors, such as the Information Technology campuses.

IT Hub Medical Centre: India's large-scale IT industry can be benefited from these **medical centres.** The IT Hub medical centres, which can be built in these campuses can be ideal to get an instant and remote diagnosis even without the physical presence of a doctor. These zones can be accessed by the entire staff of IT companies along with their families, thus targeting healthcare motoring to substantial portion of urban population. Revenue generated from this initiative can be further used to develop 5G enabled rural healthcare system.

The medical devices which can be used in these infrastructures (PHCs, ambulances, IT hub medical centre) are ultrasonography scans, multiparameter patient monitor, portable X-ray and the results can be instantly sent to a doctor within seconds. This can be done with the help of a team of paramedics, technicians and clinicians who are ready to receive the report at the hospital and help them diagnose and enables triage in the process. With the help of robotic arm/haptic glove, doctors can remotely use a joystick which sends control signals and help in diagnosing various diseases without direct contact, which could very useful in an outbreak of human-human transmission virus or bacteria. The vibrations created by gloves will help the paramedic to direct the USG sensor to the anatomical sites that the clinician wants to examine. A high definition (HD) screen will be available which will be connected with another screen located in the hospital. With the 5G network, a doctor can view the screen and diagnose the condition instantly and start initial treatment. Similarly, X-ray reports can be instantly sent in real-time to the doctors/clinicians and diagnose various fractures and other soft tissue injuries and advise initial treatment protocols.

We can work with USG equipment vendors to develop cloud-based USG machines. These USG machines can be installed in hospitals and probes can be connected over 5G network. Doctors can use these probes remotely to diagnose and treat on an urgent basis. Hospitals will be connected to these PHCs, IT hub medical centres and ambulances. Data will be collected and treatment will start instantly as directed by the doctors.

Such healthcare setup using 5G network capability will enhance India's defence level in future epidemic outbreak, although we hope that doesn't occur, but for a population of 1.38 billion, there is a need to accept and include such technology into our healthcare system.

Above mentioned 5G enabled PHCs, IT medical centres and connected ambulances can be used as a COVID-19 or other communicable disease test centres. This model can also be adapted by other countries to prepare them for any future disaster or crisis. The data can be collected and managed with the help of 5G and in real-time and sent to the hospital and the treatment protocol can be explained directly to the patient.

How 5G can help use this solution to reality-

The biggest advantage in 5G is its flexibility in the technology which starts with the malleable frame structure and enhanced slot configuration as per 3gpp 38.211. 5G New Radio (NR) is based on the

OFDM waveform like LTE, but provides elasticity to meet the demand of various applications such as Enhanced Mobile Broadband (eMBB), Ultra-reliable and Low-latency Communications (uRLLC), Massive Machine Type Communications (mMTC) and IoT, etc.
Furthermore, 5G is a high bandwidth and low latency tech which comes from various numerology configurations. Also, it allows schedule users as per demand, there by optimizing the usage of this technology. According to 3gpp 38.211, it introduces the concept of Bandwidth part which can be used as a sliced network on the radio side to handle solutions like connected healthcare. Here, the requirement of the service will be prioritized with the least latency and enhanced security. Moreover, 5G also supports semi persisting scheduling and configured uplink grant which can be used to deliver critical communication-related service into healthcare to reduce latency.
This will be a part of the “tactile internet” application as per ITU (5) with extremely low latency, high reliability, and security. The important fundamental to deploy telemedical technologies is high-fidelity interaction. The physician or doctor needs a realistic feel of the remote patient's status.
This can be achieved over the 5G network which can help to achieve end-to-end latency of 1-10 milliseconds with highly reliable data transmission.

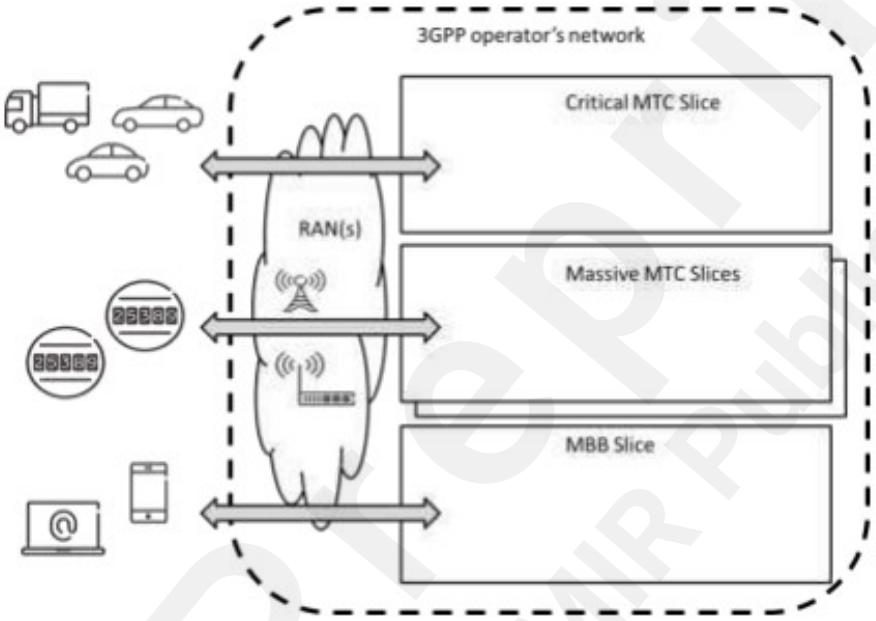

Figure 1 Network slicing from 3gpp 22.891

High-level Architecture-

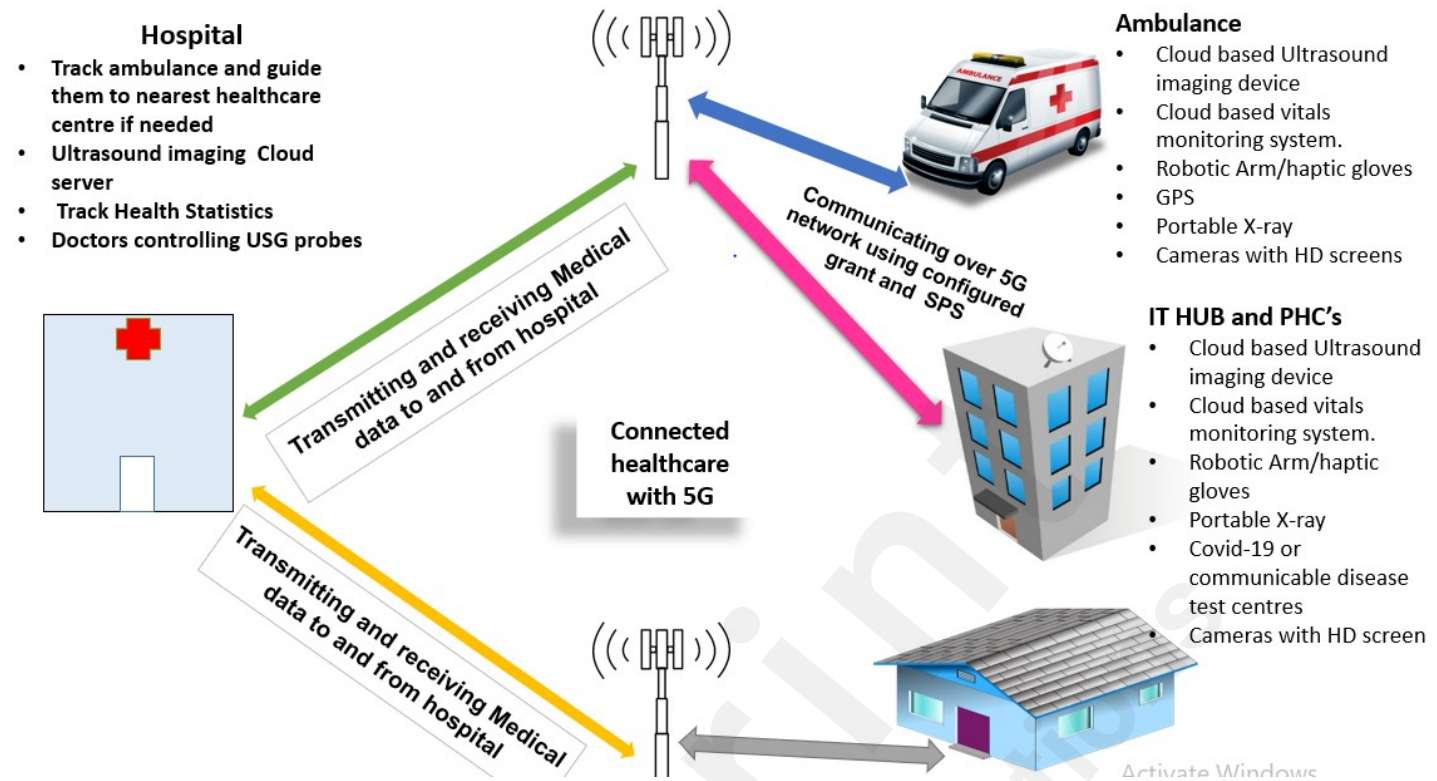

Figure 2: Architecture showing solution of Ambulance, IT Park and Public health centre connected over 5G network

Summary:

1. This solution consists of an ambulance connected to a hospital over a 5G network via a 5G CPE configured specifically for emergency services.
2. The ambulance unit consists of an ultrasound imaging device which is controlled via a robotic arm/haptic glove and is connected to the hospital and controlled by a doctor remotely.
3. A healthcare practitioner can also virtually monitor the patient with cameras connected to the ambulance and the reading will reach the doctor in intervals.
4. A paramedic will assist the doctor to perform Xray with a portable Xray machine and the image acquired will be transmitted immediately to the doctor.
5. An instant diagnosis can be made remotely by the doctor and treatment can be started.
6. An ambulance is also tracked using GPS which enables doctor to take decisions based on the distance and perceive actions such as guiding the ambulance to nearest healthcare centre to avoid further complications.
7. Such tech can be installed in major IT campuses across India, where health check-up and diagnosis will be done without physical presence of a doctor, and the revenue generated from this can be used to upgrade 5G enabled rural healthcare system.

Business Applicability:

- Hospitals can introduce 5G connected ambulance for Emergency.
- Ambulance service providers can enable 5G connected ambulance.
- Small to medium scale entrepreneurs can setup 5G connected Health centres in the IT HUB.
- The government can set up 5G connected PHC.
- Small to large scale entrepreneurs can host cloud-based USG and patient monitoring machines and rent (lease) them to health care providers.

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