Deloitte INED Series
Workshop #33
5G Empowerment in Future of Health
28 July 2020
Opening
Deloitte INED Club

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5G Empowers the Industries

Taylor Lam, TMT Industry Leader
July 2020
Taylor Lam has worked at Deloitte in Beijing, Boston, Hong Kong and New York over 30 years with the Firm, and been based in Beijing since July 2005. Taylor is Deloitte China’s Technology, Media & Telecom (TMT) industry leader and Telecom, Media & Entertainment sector leader. He is also a member of Deloitte’s Global TMT Executive Committee.

Taylor also leads the Firm's Public Offering Group in Northern China, which focuses on IPO services. He has extensive experience in advising clients and helping China-based companies go public in Hong Kong or the US.

Taylor is Deloitte China's Governing Board member.
Technological progress and enterprise upgrade are continuous...
Technology leads to the reconstruction and great changes of the entire industrial chain

The 1st, 3rd, 5th generation of mobile communication are usually the birth of subversive technology. The even generation is usually the optimization and improvement of technology which can “rewrite the rules of the games”.

Mobile phone era begins

1980s

1G: AMPS
Basic Telecom Voice Services

Voice Communication

Mobile phone era begins

1990s

2G: GSM
SMS, Voice Communication

Voice Communication

2 years

“Wireless Voice Communication”

1G: AMPS
Basic Telecom Voice Services

Voice Communication

2000s

3G: UMTS
Multimedia applications

Music, Images, Video

Multimedia application, peak rate up to 10Mbps, the experience of browsing picture improved

“Change the Internet”

“Change the Life”

2010s

4G: LTE
Mobile Internet application

Live streaming, Social Action, Mobile Shopping

iPhone App, sharing economy, the rise of live social networks, BAT

“Change the Society”

“Change the World”

2020s

5G
Internet of application

Internet of Vehicles, Uavs, Remote Control

Smart city, 2B digital leapfrog development

2030s

6G
“Wireless communication convergence generalization”

Fully enabling everything digitalization, realize the ubiquitous wisdom and reach the digital twin world

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Global investment in the 5G industry chain is expected to reach about $4 trillion, of which China accounts for about 30%.

Global 2020-2035 cumulative investment in 5G industry chain and industrial value driven by 5G application.

About $4 trillion has been invested globally. China accounts for about 30%.

The global industrial economic value is about $12 trillion.
5G will change the rule – revolutionizing all levels of society and driving efficiency changes

“5G+AICDE”

“5G+X”

“New product, New model, New service”

Product and service flow

Message flow

Value flow

Open source community

AI enterprise

IoT enterprise

Cloud Computing enterprise

VR/AR enterprise

Robot enterprise

Big data enterprise

Edge computing enterprise

HD video and audio enterprise

……

Healthcare

Transportation

Leisure

Energy

Industry

Agriculture

Finance

Environment

Security

Government affairs

Public services

……

Social economy

Social culture

government regulation

market demand

industrial control

market competition

resources

capital market

serve social governance

consumption ability

serve people’s lives

……

Healthcare

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Leisure

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The requirements of new application scenarios are the core driving force of 5G

- **Enhance mobile broadband (eMBB)**: The speed of 5G is 100 times faster than 4G in theory. Examples include 3D ultra-high resolution images, Cloud office and games, Augmented reality, Industrial automation, Medical operation, Self-driving, and Supply Chain Management.

- **Ultra-reliable and low latency communications (uRLLC)**: Examples include Cloud office and games, Augmented reality, Industrial automation, Medical operation, Self-driving, Supply Chain Management, and Smart City.

- **Massive Machine Type Communications (mMTC)**: Examples include Smart home, Car networking, Big data, and Smart City.

**Note:**
1. enhanced Mobile Broadband (eMBB)
2. Ultra-Reliable and Low Latency Communications (uRLLC)
3. Massive Machine Type Communications (mMTC)

**Source:** Ericsson, 3GPP, Huawei, Deloitte Research

- 5G will be an important step toward 5G support for new use cases, including network slicing and multi-access edge computing (MEC), and will help expand telecom operators’ service offerings to new markets such as enterprise and Industry 4.0.
- *High reliability, low latency scenarios are mainly involved in all walks of life, which is why ecological co-innovation applications need to be established.

Note: 1. enhanced Mobile Broadband; 2. Ultra-Reliable and Low Latency Communications; 3. Massive Machine Type Communications
Source: Ericsson, 3GPP, Huawei, Deloitte Research
China is firmly in the global leadership position of 5G business

### Commercial progress of major countries

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</thead>
<tbody>
<tr>
<td>First Wave</td>
<td>China, America, Japan, South Korea, and some European</td>
<td>Research and development experiment of 5G</td>
<td>Commercial Use</td>
<td>Large scale commercial use</td>
<td>Large scale commercial use</td>
<td>Commercial Use</td>
<td>Large scale commercial use</td>
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<td>countries</td>
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<tr>
<td>Second Wave</td>
<td>Most of European countries, Hong Kong</td>
<td>Research and development experiment of 5G</td>
<td>Commercial Use</td>
<td>Large scale commercial use</td>
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<tr>
<td>Third Wave</td>
<td>Asia Pacific, emerging countries of the Americas</td>
<td>Research and development experiment of 5G</td>
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<td>Commercial Use</td>
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2020 Mass Adoption for 5G
China’s 5G market is expected to hit US$70-85bn in 2020 with an estimated 160-175mn 5G subscribers.

5G Subscribers in China

Mn subscribers

5G will account for almost half of China’s mobile connections by 2025.
China is also estimated to have 40% share of the total number of global 5G subscribers by

Estimated Market Size of the 5G Market in China, 2020-2030

Source: SCMP Reporting & Analysis, China Academy of Information and Communications Technology, GSMA, iResearch, Company filings
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1 Oct 2019 figures for China Mobile, China Telecom, and China Unicom
A massive infrastructure push this year, worth US$25bn and nearly 500k additional 5G base stations, will potentially let China achieve 5G coverage across all 293 of its prefectural-level cities by year end.

**5G Base Station Installations**

<table>
<thead>
<tr>
<th>Year</th>
<th>5G Base Station Installations</th>
</tr>
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<tbody>
<tr>
<td>2019</td>
<td>110,000s China Mobile, 500-600,000s China Unicom &amp; China Telecom</td>
</tr>
<tr>
<td>2020e</td>
<td>250-600,000s China Mobile, 100-500,000s China Unicom &amp; China Telecom</td>
</tr>
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**5G Capex Investment**

<table>
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<th>Year</th>
<th>5G Capex Investment</th>
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<tr>
<td>2019</td>
<td>5.8 billion China Mobile, 2.7 billion China Unicom, 1.6 billion China Teleom</td>
</tr>
<tr>
<td>2020e</td>
<td>25.4 billion China Mobile, 19.4 billion China Unicom, 11.1 billion China Teleom</td>
</tr>
</tbody>
</table>

**Number of Cities in China with 5G coverage**

- **293** cities expected by the end of 2020.
Chinese consumers and businesses are also racing ahead in terms of interest level and acceptance of 5G as they realize the benefits.

Chinese consumers have the highest intention to upgrade to 5G.

Chinese consumers have the highest willingness to pay more to upgrade to 5G.

Source: SCMP Reporting & Analysis, GSMA Mobile Economy 2020 Survey
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Consumers are willing to pay for 5G

Attitudes of Chinese consumers toward 5G

- Will use 5G if it is mandatory and there are no substitutes, 9%
- Will use 5G, 90%
- Don’t know, 1%

Use 5G as soon as it is available: 36%
Use if 5G gets good comments: 31%
Use 5G eventually: 22%

Source: Deloitte
4G will remain dominant in the short term, but 5G is expanding rapidly.

Source: GSMA
Embracing the New 5G Era in Hong Kong

Commercial 5G services in Hong Kong available since April 2020

China Mobile Hong Kong

• Its 5G network will cover the entire Hong Kong city – 90% of the major Central and Western, Wan Chai, and Causeway Bay Districts; nearly 90% of the Kwun Tong District; and close to 80% of the Tsuen Wan District.

• Carried out a 5G standalone network trial in November last year, which allows for the provision of network slicing services

• Different slices can provide customized private network services and a diverse mix of 5G applications for corporate customers, making it easier to facilitate different projects within the financial, real estate, and property management sectors

• Founded “The Greater Bay Area 5G Industry Alliance” in August last year to promote the sharing of business opportunities as well as the joint research and development of products and services based on 5G

• Its 5G base stations are served by a 10 Gbps optical-fiber backhaul network, and that its 5G service is expected to cover the entire territory within the year. Phase-one will see outdoor coverage initially serving Wan Chai, Causeway Bay, Tsim Sha Tsui, Mongkok, Sham Shui Po, Shatin and Tai Po. Indoor coverage will include the Hong Kong Convention and Exhibition Centre, as well as Hong Kong Land’s Grade-A shopping malls

Hutchison (3 Hong Kong)

• Its 5G coverage initially reach 11 of Hong Kong’s 18 districts.

HKT

• Its 5G network will cover the entire Hong Kong city – 90% of the major Central and Western, Wan Chai, and Causeway Bay Districts; nearly 90% of the Kwun Tong District; and close to 80% of the Tsuen Wan District.

Government’s Subsidy Scheme

• The Office of the Communications Authority (OFCA) aims to encourage various sectors to deploy 5G technology early to foster innovation and smart city applications, and to improve efficiency of their operations and quality of their services that will contribute to enhancing Hong Kong’s overall competitiveness.

• Under the Scheme, the Government will subsidise 50% of the actual cost directly relevant to the deployment of 5G technology in an approved project, subject to a cap of $500,000. Around 100 qualified projects will be subsidised.
Accompanied with basic techs such as cloud and AI, 5G could establish and optimize many general techs that will eventually benefit vertical scenarios.
5G Smart Transportation

Technologically, IoV requires connections between large amount of infrastructure and vehicles and the integration of sensing, computing and location technologies. In addition to 5G-based communication guarantees, considerable technical breakthroughs are also necessary for “data and mobility management platforms”. Besides, it will take a long time to establish such platforms due to the impact of policies and regulations.

Note: 1. IoV technology based on cellular network
Source: CAICT, Deloitte Research
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**5G Smart Production**

**Equipment**
- **Industrial equipment providers:** Provide fixed and mobile industrial equipment and robots for factories
- **Assembly line designers:** Install and allocate equipment such as PLC based on factories’ needs, and provide electricity, communications and security infrastructure

**Automated equipment**
- Industrial robots
- Mobile robots

**Communication services**
- 5G technology
- Industrial Ethernet

**Industrial internet platforms**
- Cloud computing
- Disaster recovery and backup technology
- Industrial data modelling
- Cloud PLC
- Real-time computing technology

**Potential participants**
- **Industrial internet platform hardware providers:** Provide computing, storage, bandwidth and other basic resources required to run platforms
- **Industrial internet platform software developers:** Design the underlying architecture of platforms, connect internet platforms with PLC controllers in industrial equipment, develop specific functions required by clients, and realize remote control

**Industrial control network communication protocols** are needed for data collection, conversion and communication among different devices.

**Participants**
- **Industrial equipment providers:** Provide fixed and mobile industrial equipment and robots for factories
- **Assembly line designers:** Install and allocate equipment such as PLC based on factories’ needs, and provide electricity, communications and security infrastructure

**Mobile maintenance devices**
- **Maintenance robot provider:** Provides maintenance robots that can check and repair industrial equipment through tele-instruction

**Maintenance robots**

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With the support of 5G networks, intelligent manufacturing requires not only basic technologies such as cloud computing, AI and VR etc., but also application of these technologies throughout the manufacturing process from design to production, management and service, to establish an integrated cyber-physical system. Currently, only a few mature technologies have implemented, with most still at the development stage and awaiting their tipping point.

Source: Huawei, Tencent, CAICT, Deloitte Research

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5G+ Smart Healthcare - opening a new era of smart healthcare

Open Collaborative Platform

Smart Ward
- Mobile infusion
- Patient location management
- Mobile ward check
- Mobile x-ray reading

Smart operating room
- Hospital multi-screen interaction
- PACS holographic display
- Cloud electronic medical record for surgery
- HD video broadcast
- Materials and consumables management
- AR/VR operation teaching

Smart patient service
- Cooperation of intelligent ambulance
- Electronic medical record
- Big data diagnosis and treatment
- Medical logistics robot
- Medical testing equipment networking

Smart Environment
- One button alarm for hospital
- Temperature and humidity monitoring
- Smart access badge
- Mobile video surveillance

Business Integration Platform

Information Integration Platform

HIS
EMR
PACS
Anesthesia System
Mobile Healthcare
LIS
HRP

Promote medical development
Improve medical efficiency
Improve medical capacity

Information perception and connectivity layer: 5G

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5G+ Smart Healthcare Application cases

5G remote surgery & multi center remote collaborative surgery

China Unicom helped Beijing 301 Hospital and Fujian Mengchao Hepatobiliary Hospital complete the first 5G remote surgery in the world

China Unicom helps Beijing Tsinghua Changgeng hospital complete the first 5G multi center remote collaborative operation in the world

The biggest problem of remote surgery: real time interconnection of signals

5G technology application

Low Delay
- Doctors know the situation in real time
- The processing is completed by remote synchronization of the device

Big Connection
- The control links and two video links at both ends of the remote control surgical robot

5G power
- Real time sharing of high definition images of surgery between the two places
- Online seamless interaction and guidance
- Faster speed, more accurate reconstruction, more realistic reduction of organs and lesions of the anatomical structure

Hybrid reality technology:
- Discuss the preoperative plan with the operator
- In the process of two remote operations, the remote technical guidance was implemented

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**5G+ Smart Medical Application cases**

**Live broadcast of ultra high definition Surgery & Remote Robot Ultrasonic “consultation”**

**China Unicom helps Shanghai Huashan Hospital**
**Complete the live broadcast of ultra high definition surgery**

On April 11, 2019, the opening ceremony of Shanghai’s first 5G smart medical application demonstration base and the live broadcast of Neurosurgery of Huashan Hospital Affiliated to Fudan University was held in Unicom building.

**Remote “zero distance” explanation of operation process**
- This activity will carry out 4K HD live broadcast of two remote operations through China Unicom 5G technology
- Based on 5G network, doctors who are not on site can watch the operation process online through the mobile terminal
- Top experts explain the operation process remotely for the Training Foundation College

**China Unicom helps hospitals on both sides of the Taiwan Straits complete the interaction of telemedicine operation live broadcast**

On May 2, 2019, a live online telemedicine surgery interaction between the two sides of the Taiwan Strait was successfully held between Ningbo first hospital and Taiwan Yadong Memorial Hospital.

- The Third People’s Hospital of Chengdu City and China Unicom have built 5G smart medical services under the work deployment of the Municipal Health Commission
- “Face to face” between patients in primary hospitals and expert teams of superior hospitals
- Through 5G network, professors from both sides of the Strait gave guidance and comments on relevant operations before and after operation
- Normalize real-time medical exchanges between the two sides of the Taiwan Strait
- Cross regional real-time guidance for clinical and surgical problems

**China Unicom helps Chengdu Third People’s Hospital complete remote robot ultrasonic “consultation”**

On Feb. 26, 2019, director Zhou Hong, ultrasound expert of Chengdu Third People’s Hospital, conducted a remote ultrasound “consultation” for patients through 5G and doctors from Pujiang People’s Hospital nearly 100 km away.

- The doctor side and patient end of the two hospital sections realize the whole process rapid synchronization through 5G network
- Ultrasonic inspection of remote manipulator
- The image details are clear and smooth
- Real time transmission of technology, image and voice

**China Unicom helps Guangzhou First People’s Hospital complete ultrasonic diagnosis based on 5G remote real-time operation manipulator**

On May 6, 2019, a 60 km interval ultrasound diagnosis was successfully carried out between Guangzhou First People’s Hospital and its Nansha park.

- China Unicom helps Guangzhou First People’s Hospital complete remote robot ultrasonic “consultation”
Economic value from 5G-based downstream applications will emerge in more scenarios.

Note: 1. Including the difficulty of applying 5G technology and other necessary basic technologies
2. Including the market size of scenarios and the payment capability of downstream clients

Source: Deloitte Research

Comment: Marked positions indicate the time when pilot projects are completed and extensive commercial application starts
Future of Health and New Technologies

Jens Ewert, China LSHC industry leader, Deloitte China

July 28, 2020
Jens Ewert is a Senior Partner with Deloitte based in our Shanghai office and has been with the China Firm since 2002. He has more than 30 years of working experience in professional services, and has been a member of the Deloitte China Eastern Region Management team for several years.

Jens leads the Deloitte China Life Sciences & Health Care Industry team of more than 600 partners and professionals who are dedicated to working with companies in life sciences, pharmaceuticals, healthcare and related sectors.
Contents

• Future of Health
• China characteristics to consider
• New technologies and 5G
• Outlook
The future of health will be driven by digital transformation enabled by radically interoperable data and open, secure platforms
Change accelerates disruption

Exponential change will accelerate the pace of disruption

- Perception is linear...
- Reality is exponential...

In traditional models of change tech leads charge, followed by business models, and then regulation.

- In health care, regulatory bodies (e.g., FDA) are working to keep up with the pace of change spearheaded by innovative entrants.

TECHNOLOGICAL DEVELOPMENT
- Moore’s law: the power of chips, bandwidth and computers doubles approximately every 18 months
- MOBILE PHONES: The number of mobile phones worldwide doubled in the last 48 months
- DNA SEQUENCING: From $1 billion and 13 years to <$100 and <1 hour
- DATA STORAGE: From $569 per GB to <$0.01

Trends underlying exponential growth
- Nanotechnology
- Quantum computing
- Robotics
- Biomedical engineering
- Artificial intelligence
- Cost of data storage
- Connectivity
- Augmented reality
- 3D printing

THE HUMAN FACTOR
- Technology development feeds and enables various trends in society:
  - Social connection
  - Well-being
  - DIY
  - Decentralization

PERCEPTION
- Understanding...
- Directional...
- Unknown

Pace of innovation

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Trends driving a new Future of Health in 2040
Changes are taking place in the health care industry, driving towards large-scale industry disruption

The **empowered consumer** is becoming increasingly focused on their **well-being** and demanding more **customized products and insurance offerings**

- Affordable health for all
- From care to health to well-being
- Interconnected health communities
- Evolution of trusted patient/caregiver relationship
- “N of 1” personalized care
- Native data-oriented entrants disrupting incumbents
- Acceleration of digital health evolution
- Regulation encouraging long-term accountability
- Health data ownership by consumers
- Personal cognitive and AI for improved outcomes
Today’s health care sectors will be disrupted by radically interoperable data and the empowered consumer

The existing health ecosystem will change dramatically in a world with real-time access to data and advanced capabilities to capture, interpret, and act on near-perfect information

Providers
The shift to prevention and wellness will cause complex procedure volume and routine care costs to crater

Increased connectivity will transform care delivery models and engage consumers via virtual and localized care hubs, leading to shifts in care delivery location and type

Plan
The availability of real-time data and advanced, predictive analytics removes uncertainty and risk from the market and eliminates the need for traditional coverage

Increased interoperability, consumer-centricity and technological advances drive change in health coverage offerings

Life Sciences
Advanced early intervention, prevention, and precision medicine will contribute to a shift towards curative and preventative therapies and drop in volume of units

Cognitive technology applied to massive data sets automate R&D and lower costs

Medical technology will advance exponentially and uses will extend across the entire health ecosystem

Government & Public Sector
The role of government shifts to catalyst of change and enabler of equitable health care for all
China Industry Predictions
Our Deloitte view of ‘Future of Health’: Attributes of the 10 winning archetypes

**Data + Platform**
- **Data Convener**: Government-owned healthcare data
- **Science and Insights Engine**: Advanced algorithm led by technology giants, empowered by rich consumer data
- **Data / Platform Infrastructure Builder**: Run by large conglomerate with government background (e.g. Huawei, Ping An)

**Well-being + Care Delivery**
- **Health Products Developer**: Traditional healthcare giants and emerging local innovation players
- **Consumer-Centric Health “Virtual Home + Community”**: Online healthcare players, typically backed up by internet giants
- **Specialty Care Operator**: Leading public hospitals will become more specialized in complex diseases
- **Localized Health Hub**: Streamlined primary healthcare facility that consolidates prevention, treatment, and re-hab

**Well-being + Care Enablement**
- **Supply Chain Optimizer**: On-demand supply chain ran by leading logistic players, either existing ones or logistics new entrants (e.g. SF)
- **Individualized Financer**: Commercial insurance will eventually gain meaningful share
- **Regulator**: Strike balance across cost, outcome, and access

*Powered by radically interoperable data for a personalized and seamless patient experience*
### Critical driving forces shaping the future of China health system

#### Politics
- **Re-balancing of healthcare resources to improve efficiency and quality**
  - CDC, specialty public hospitals, and CHCs will drive early disease detection and interventions as well as stimulate the efficiency of overall health system
- **Encourage localized innovation**
  - R&D of innovative companies in health industry are supported, including land, talent and finance
  - Translational medicine will be uplifted through regional AMCs
- **Strengthen supervision & enforce IP protection**
  - The quality of drugs will improve with strict supervision
  - The government protect IP, which promotes the enthusiasm of patent development and transfer and the healthy development of the healthcare industry

#### Economy
- **Tangible growth of China’s GDP and allocation to HC**
  - The economy in China will keep growth to create an environment for health industry developing
  - Healthcare expenditure will still grow from 5% to 8%-9%
- **Capital investment increase**
  - PE and VC invest much in healthcare industry, and the invested project number and money are ranked in top tier in recent years
  - More capital will be contributing towards the growth of a local commercial insurance / provider sector

#### Society
- **Arrival of an aging and second child society**
  - China is entering to the aging society, and the increasing number of old people stimulates the demands of healthcare industry
  - The second child promotes the growth of infant market, and parents are paying more and more attention to their children's health investment
- **Improvement of people’s education level and health awareness**
  - With the increase of people’s education level and health-related promotion, people pay more attention to their own health condition, disease protection and medical service experience
- **Urbanization rate**
  - In the process of urbanization, the health issues are increasing, esp. on mental illness

#### Technology
- **Digitalization**
  - The digital technology create new devices and business model to fulfill the demands of the people such as AI enabled medical service, IoT devices, electronic medical records and etc.
  - Big data helps medical institutions provide better services, which promote medical satisfaction, and optimize the allocation of medical resources
- **Novel discovery in basic biomedical research**
  - The breakthrough in basic research in synthetic biology, epigenetics and immunology make the change of the health industry possible
- **Vaccine, diagnostics and disruptive therapeutics**
  - Precise medicine such as cell and gene therapy have the capability to cure the severe diseases like cancer

#### Environment
- **Environment changes**
  - Environmental pollution, such as air, water, are profoundly driving health issues
- **Emergence of super bugs**
  - Increasing economic activities will contribute to more frequent super pandemics and raising the need for systemic surveillance

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Source: PingAn GoodDoc homepage, MOFCOM, Dingxiangyuan, Kantar Health+, iyiou, Health 100 homepage

Note: "2019, ‘2017, ’2018

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We summarize five themes for the future of China healthcare system

<table>
<thead>
<tr>
<th>Expanded health value chain</th>
<th>Empowered consumers</th>
<th>Rise of private insurance</th>
<th>Smart healthcare</th>
<th>Innovation clusters</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Personalized Health Management Needs</strong></td>
<td><strong>Diet Management:</strong> with the popularization of health mindset, more families, especially high-risk groups, will manage diet and nutrition scientifically</td>
<td><strong>Cost Control Mode:</strong> changing from zero plus and Volume-based Procurement (VBP) to cost control mode oriented by disease type, DRG and treatment results, disease detection outsourcing, and whole process of diagnosis, treatment and curative effect evaluation</td>
<td><strong>Health Care Big Data Upgrade:</strong> cross-industry cooperation further accelerating the health care information system data collection and integration of gene, clinical, cost, behavior and others, monetizing the consumer health data</td>
<td><strong>The Emerging of Translational Medicine:</strong> a number of clinical translational medicine centers based on hospitals, universities and research institutes vigorously developing cutting-edge technologies such as omics technology, stem cell and regenerative medicine, new vaccines, and so on, boosting the demand for testing</td>
</tr>
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<td><strong>Disease Prevention and Control:</strong> risk assessment and early intervention of infectious diseases, cancers, genetic diseases and immune diseases</td>
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<td><strong>Increased Commercial Medical Insurance:</strong> further development of commercial health insurance service, significantly increased proportion of commercial health insurance compensation in total health expenditure, and increased coverage ratio of testing products and services</td>
<td><strong>Accelerated ‘Internet + Smart Medical’ Layout:</strong> 5G, wearable devices, AI, robots and other new technologies in the healthcare industry, giving birth to new diagnosis and treatment mode</td>
<td><strong>Industrialization of Precision Medicine:</strong> the clinical development and industrialization of the next generation of cells, genes, vaccines and targeted drugs, boosting the demand for special testing</td>
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<td><strong>The Industrialization of Health Services:</strong> the spring up of baby care covering the whole life cycle, health management, rehabilitation and senior care, boosting demand for subdivision detection</td>
<td><strong>Diet Management:</strong> with the popularization of health mindset, more families, especially high-risk groups, will manage diet and nutrition scientifically</td>
<td><strong>Increased Commercial Medical Insurance:</strong> further development of commercial health insurance service, significantly increased proportion of commercial health insurance compensation in total health expenditure, and increased coverage ratio of testing products and services</td>
<td><strong>Accelerated ‘Internet + Smart Medical’ Layout:</strong> 5G, wearable devices, AI, robots and other new technologies in the healthcare industry, giving birth to new diagnosis and treatment mode</td>
<td><strong>Industrialization of Precision Medicine:</strong> the clinical development and industrialization of the next generation of cells, genes, vaccines and targeted drugs, boosting the demand for special testing</td>
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The future of health will be driven by digital transformation enabled by radically interoperable data and platforms.

Radical Interoperability enables the seamless integration of multiple, disparate data sources and the application of advanced analytics to derive real-time insights to improve the patient experience and drive the delivery of Always-On care.

Data Sources
- Environmental (e.g. air pollution, UV levels)
- Institutional (e.g. claims)
- Population (e.g. public health)
- Individual (e.g. IoT use, genomic, mental health)

The “Always-On” sensor-driven environment generates massive amounts of data that is continuously gathered and stored by multiple owners and selectively made available.

Connected databases allow for aggregation and access to multiple data sources.

Platform Features
- Real-time advanced analytics and machine learning
- Data governance
- Security

Advanced analytics generate real-time insights.
China’s technology champions are stating:
Huawei began 5G+ healthcare research in 2016,” said Zhang Wenlin, president of the Corporate Strategy Department at Huawei. “Since then, Huawei has built hundreds of 5G+ healthcare pilot projects based on our 5G indoor solution. Now, we have already contributed to the commercial implementation of many healthcare applications, including telemedicine (MDT cares), imaging tele-diagnosis, ECG tele-diagnosis, ultrasonic diagnosis, and training online.”
Health Monitoring capabilities
Higher speed and increased data accuracy will enable a more efficient and effective monitoring and prevention measures eventually.

Technology solutions providers like Alibaba have brought to market solution enabling effective monitoring and reporting during the health crisis period we are going through. 5G transmission capabilities will not only increase the speed of making data available – thus enabling effective responses, but also a better overall data management system currently controlled by government agencies.

Epidemic Prediction
Help organizations estimate epidemic characteristics of coronavirus disease (COVID-19); predict the spreading trend of a disease in a particular region; and provide sensitivity test under different conditions.
Health Treatments remotely delivered

Significantly increased visibility, speed and accuracy will allow remote surgeries, thus bringing to patient the best solution regardless of their distance to the highest expertise

5G requirements for remote robotic surgery

- Swedish telecommunication giant Ericsson has collaborated with King's College London to develop a pair of haptic feedback gloves. Surgeons are able to operate on a patient via a robotic intermediary from thousands of miles away. The result is sent to the cloud promptly, utilizing faster speeds that 5G provide, helping to prevent lag or data shortages during transmission and keep patients safe during surgery.

- In March 2019, the People's Liberation Army General Hospital chief physician carried out brain surgery remotely to insert an implant in the brain of a Parkinson's patient from Beijing at the PLAGH Hainan Hospital, 3,000km away.

https://wwwericssoncom/en/networks/trendinginsightsandreports5ghealthcare

• Accessible to in-person surgeons via augmented reality (AR), high-definition video and real-time data readings from medical sensors
• Guiding surgeons with precise 3D information -- such as X-rays, CT scans or MRI -- overlaid into an AR headset, delivered with virtually no latency, as well as remote robotic surgical tool operated miles away
• Less time solving complex problems alone and more time saving
China’s 2030 plan in its 15 key initiatives, does cover the ‘Elderly Care’, as this population segment is expected to increase significantly to reach 350M by 2030 (ie. +100M from 2020), and will likely to influence significantly total Healthcare expenditures. Also, new technologies that could limit the exponential increase of resources required, receives all support from the government.

While the population continues to age in China, senior housing and well being for elderly becomes an increasingly important demand, part of the China ‘Healthy China 2030 plan’

### Government Policy Support
- The epidemic has accelerated the integration with ‘Internet+’, such as telemedicine, health monitoring, mental comfort and online family visits.

### IoT Home Automation technologies
- Smart Furniture equipped with sensors
  - ‘Press-the-button’ calling for help
  - Falling over alert
  - Walking assistant robots
  - AI Intelligent Steward

### Digital Health Intelligence Service Practice
- Informatization Management Platform
  - Standardized modular services
  - 24h tracking the elderly’s movement and health conditions via smart devices
  - Personalized nursing plans

- Virtual Nursing Home
  - Big data assigning each person to the responsible community-based nursing institute nearby
  - Ordering nursing, purchasing and housekeeping services via APPs or phone calls from home

- Wearables Health Monitoring
- Treatment Management
- Home Consultations
- Medication Management

### Senior well being and health surveillance 24H round will arrive
- Personal Health
- Medical Status
- Personal Safety
- Home Safety

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Data sharing and remote sharing
Allowing an significantly enlarged transmission of data & medical images files, knowledge, diagnosis and wider support to patient should become much faster and live saving

5G has the capacity to enable faster transfers of huge medical images, with exceptional network performance

- Patient benefits are obvious with diagnosis competencies become much larger, avoiding lengthy travel & access time
- Diagnosis and treatment eventually increase through wider consultation possibilities
- Physicians are able to ‘see’ patients in less amount of time

CT Image Analytics (Alibaba / Ali-Cloud)
Assist doctors in the diagnosis and detection of COVID-19 within seconds, with an accuracy of ~96% and at least 60 times faster than human detection

BEIJING, Dec. 29, 2019 (Xinhua)
Wearing VR glasses to check a life-or-death situation in an ambulance, and closely watching the patient’s electrocardiogram and ultrasonic images transmitted back in real time, doctors at a hospital in east China’s Zhejiang Province remotely guided the paramedics and were fully prepared when the patient arrived.

Beijing Mar 23, 2020 (China Daily)
JinCheng Medical Technology, a medical equipment company, provided hospitals in Wuhan with a CT and X-ray coordination solution based on 5G cloud collaboration, which addressed the shortage of radiologists, thereby improving efficiency in screening suspected COVID-19 cases.

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Online consultations and prescriptions model will become standardized

A number of barriers continue to exist in China (Rx Online purchasing, Initial (1st) prescriptions are constraints to date), but a better & larger healthcare access to China’s population will change going forward.

In August 2019, China released the tele-healthcare pricing and assurance policy, pushing tele-healthcare services a step closer to the commercial stage. As part of the infrastructure of information-driven primary healthcare, it will accelerate the Internet and medical development, improve primary healthcare to become more convenient, accessible and helpful to the people.

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Policy

- Increased patient experience
- Increased access nationwide
- Reduced resources

Source: expert interview, Monitor Deloitte analysis
Bundling multi-solution into the healthcare delivery model

Shanghai Health commission has authorized in June 2020, a Hospital (Fever Clinic) operating using the new 5G communication standards and infrastructure

- Remote supervision of patients
  - Allows visual and risk reduced patient monitoring by physicians
  - Permits recording of real time health-data

- Robots ensure cleaning
  - Allows 24H facilities management and monitoring.

- Robots ensure medicine delivery
  - Allows medicines patient delivery reducing infection risks for physicians and other subjects
In perspective & conclude

China’s unique eco-system fostering the use of mobile technologies and adherence in general to new technologies will certainly allow 5G in Healthcare to have a very speedy application path

Tech giants involvement in healthcare

- In January 2020, Alibaba launched online clinic service for Hubei users on Alipay and Taobao, then extended its service to Beijing.
- In February 2020, Alibaba launched drug delivery service for chronic diseases.
- Alibaba developed an AI algorithm, which can "identify the image of coronavirus infected pneumonia in 20 seconds, with an accuracy rate of 96%." By the beginning of March, the algorithm has been applied to 26 hospitals in 16 provinces and cities, and was expected to expand to more than 100 hospitals.

- Huawei developed a cloud computing tool to screen drugs and find five candidates, two of which have entered clinical trials.
- On January 30, Huawei launched a rapid gene detection technology. The data was transmitted to Huawei Cloud through 5G network, and got quickly analyzed by AI.
- On February 10, Huawei launched a cloud platform for gene identification and providing one-click automatic service for clinical diagnosis and monitoring during the epidemic.
- Since February 10, Huawei and Zhejiang University have released a number of AI knowledge maps for coronavirus scientific research.

- Since January 26, WeChat launched a "national epidemic dynamic" page to provide comprehensive functions, such as medical popularization, real-time epidemic statistics, fever outpatient map, etc.
- Tencent launched a "symptom self screening" tool, which helps users with suspected symptoms to obtain guidance through AI.
- For virus mutation prediction, antiviral drug screening and vaccine research, Tencent has opened its own cloud computing, AI and big data capabilities to provide technical support for free.
In perspective & conclude
China’s future of Health care will certainly integrate much of the new possibilities of 5G technologies

A few ending thoughts

5G technology is not unique to China, but likely to be rolled out faster in China with the ‘New Infrastructure Plan’

Mobile solutions given China’s eco-system and wide adoption by the population, will make it easier to implement and roll-out health solutions

Privacy concern of course remain...
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