Digital health technology in combating COVID-19

Shan Xu, CAICT
Contents
- to share Chinese experience and fight the COVID-19 together

- Background
  Introduce the background and where ICT may help

- ICT use cases
  Share typical cases in this outbreak prevention and control

- Learn together
  Discussion and conclusion, also expect feedback from you!
Outbreak Starts

On Dec 30, the Wuhan Municipal Health Committee's Medical Administration Department issued the "Urgent Notice on Doing a Good Job in the Treatment of Unknown Cause of Pneumonia". The NHC Expert Group has arrived in Wuhan on the morning of the 31st, and conducted relevant inspection and verification work.

The notice said that some medical institutions in Wuhan have appeared patients with pneumonia of unknown cause. It requires each medical institution to follow up the statistics and treatment and report it in time as required.
A novel coronavirus was isolated by China CDC

Emergency monitoring, case investigation, close contact management and market investigation initiated, technical protocols for Wuhan released

NHC notified WHO and relevant countries and regions
Gene sequencing completed by China CDC

Huanan seafood wholesale market closed

Outbreak announced by WHC. NHC and China CDC involved in investigation and response

China CDC publicly shared the gene sequence of the novel coronavirus

NHC issued diagnosis and control technical protocols

NCIP incorporated as a notifiable disease in the Infectious Disease Law and Health and Quarantine Law in China

NHC started officially daily disease information release

State council initiated joint multisectoral mechanism

Wuhan implemented strict traffic restrictions

WHO announced PHEIC

Two new hospitals were established in Wuhan

Enhanced admission and isolated treatment of cases in Hubei

Resumption of labor and rehabilitation

Strategy and response adjustment

Date of onset 4/7

62

First Stage (before Jan. 19, 2020)
Second Stage (Jan. 20-Feb. 7, 2020)
Third Stage (after Feb. 8, 2020)
Give credit where credit is due…

**Medical staff**
42,600 medical staffs came from all over the country to support 28 designated hospitals in Wuhan, and other sites in Hubei.

**Infrastructure**
Thousands of construction workers working day and night during the Spring Festival, making the Vulcan/Thunder Mountain Hospital possible.

**Government**
State Council Joint Prevention and Control Mechanism is a multi-ministerial coordination platform, launched by the Chinese government at very beginning of the outbreak.

**Manufacturer**
A national key medical material dispatching platform was launched, including the production, scheduling and security of protective clothing, masks, medicines, etc.

**Community**
Community Outbreak Screening workers, disinfection staff, police officers, volunteers protecting the lives of elderly living alone...
We must remember that these are people, not numbers.

"What digital technology can do?"

"To make life better"

World Health Organization (WHO)
Requirements vs Solutions

To help with ...

Patient treatment
Reduce the burden on doctors
Front-line protection
Medical supplies
Risk communication
Citizen protection
Isolated normal life
Risk assessment

Digital health

Artificial Intelligence
5G Medical
Cloud computing
Industrial Internet
Telemedicine
Big data
Intelligent hardware
Internet
Robots

……
Magic combinations...

**Requirements**

- Patient treatment
- Reduce the burden on doctors
- Front-line protection
- Medical supplies
- Risk assessment
- Risk communication
- Citizen protection
- Isolated normal life

- Artificial Intelligence + Cloud computing → AI assisted system
- 5G Medical → Telemedicine
- Robots
- Industrial Internet + Big data → Material Dispatching Platform
- Artificial Intelligence + Big data → Vaccine development
- Artificial Intelligence + Big data → Case tracking and modeling
- Internet → Information publishing platform
- Artificial Intelligence + Big data → Public place screening
- Internet → Various applications to meet basic needs

Source: CAICT
Telemedicine

On Feb 9, the PLA General Hospital conducted the first 5G network remote consultation with Vulcan Mountain Hospital. Experts stared at the electronic screen in front of them, and the results of patient medical records and biochemical indicators were uploaded in real time, and clear at a glance.

Image Source: http://www.legaldaily.com.cn/index/content/2020-02/10/content_8114084.htm
DH cases 01- Telemedicine
-reducing infections and increasing efficiency in diagnosis & treatment

5G telemedicine cart

➢ The carts were installed a mobile cloud video client on the terminal. Frontline staff at Vulcan Mountain Hospital can transfer local medical data (including CT images, detection Indicators, etc.) and share with Beijing 301 Hospital to achieve remote diagnosis by expert groups.

- In telemedicine consultations, medical experts from both places need to share the patient’s medical files with high-definition image. " With 5G equipment and network, it supports 1080P high-definition image. It takes full advantages of 5G- large bandwidth, low latency, and wide connectivity, making remote diagnosis possible.
Assisted diagnosis

This system only needs seconds to process dozens of high-resolution CT data from a patient, providing support for rapid screening of a large number of case data. The average sensitivity and specificity have reached the judgment results of a chief physician in hospitals.

Image Source: http://news.nankai.edu.cn/ywsd/system/2020/03/12/030038105.shtml
DH cases 02- AI assisted diagnosis

-providing support for rapid screening of a large number of cases
Vaccine development

This picture is the homology modeling of some targets for COVID-19 protein sequence, by Global Health Drug Discovery Institute (GHDDI). They are working with Alibaba Cloud to develop a drug R & D platforms on AI and big data, to support the COVID-19 vaccine development.

Image Source: https://blog.csdn.net/dQCFKyQDXYm3F8rB0/article/details/104109258
DH cases 03- Vaccine development

-hopefully shorten the research and development of vaccine

The Ma Yun Charity Foundation also announced a donation of 100 million to support the accelerated development of vaccines for COVID-19. Aliyun High Performance calculation, SCC supercomputing cluster and CPU cluster are provided free of charge. Examples of support scope are as follows:

1. Use molecular dynamics HPC applications to calculate viruses, proteins, drug structures, target action simulations and design drug screening experiments.
2. Extract virus DNA from infected persons and perform genomic calculation;
3. Large-scale analyze and screen of global literatures and scientific research institutions.
4. Do virtual screening on the basis of MD, MM, and QD.

Chinese CDC successfully isolates the first virus strain, with its electron micrographs, nucleic acid detection primers and probe sequences information released and shared On Jan 24, 2020.

Image Source: https://baijiahao.baidu.com/s?id=1656608610753363826&wfr=spider&for=pc
Public place screening

Integrating infrared thermal imaging technology, temperature detection system can be performed on pedestrians in densely populated areas such as railway stations, airports, subway stations, shopping malls, and building entrance, etc.

DH cases 04- Public place screening
-supporting precision screening and population risk assessment

The traditional detection is based on the infrared mode. It can locate passengers with abnormal temperatures, but if in crowdy cases, it can not effectively distinguish the image due to too many heat sources.

This AI-based temperature detection solution combine an artificial intelligence model to achieve the consistency of temperature positioning and body positioning. It can accurately match and lock the abnormal temperature "face area" and its actual counterpart, and alarm automatically to facilitate the staff to conduct a second review of the forehead thermometer. As a result, in public places with high-density, the efficiency of traffic and screening can be effectively improved under its help.

Image Source: http://www.sxdaily.com.cn/2020-02/05/content_8425721.html
Case tracking & modeling

To support social recovery, CAICT, China Telecom, China Unicom, and China Mobile jointly launched a travel card based on telecommunication data, to give a self-check and proof if you have been to any epidemic region in the past 14 days or not.

DH cases 05 - Case tracking & modeling
-supporting precision screening and individual risk assessment

“Traffic light” for individual risk assessment

Low risk  Medium risk  High risk

The big data from three telecommunications operators is utilized to provide itinerary inquiry services for 1.6 billion mobile phone users across the country. It supports one-click inquiry of the countries (regions) and domestic cities (stay for more than 4 hours) you have visited within 14 days.

1. National coverage: The data of the “travel Card” covers the whole country and is consistent across provinces and cities.

2. Easy to operate: Users only need to scan the QR code or enter the WeChat mini-program, input the mobile phone number, and verify by SMS.

3. Safe and reliable: "Travel Card" service requires the authorization and SMS verification. No additional information such as ID number, home address is collected.

4. Objective and accurate: The "Travel Card" service is based on personal mobile phone data, and the calculation and processing are performed in the operator's backend, which is relatively accurate.

5. Dynamic update: New calculations will be performed every day to include the user's latest itinerary.

6. International characteristics: You can check your global itinerary of your stay within 14 days by your Chinese mobile phone number.
On February 1, Premier Li Keqiang came to check the national key medical material dispatching platform with COVID-19, to learn process about the production, scheduling and security of key medical supplies such as medical protective clothing, medical masks, and drugs.

Image Source: http://www.gov.cn/xinwen/2020-02/01/content_5473686.htm
A national key medical supplies dispatching platform was built by MIIT, with 21 categories of key medical supplies (especially protective clothing, masks, goggles, drugs, etc.)

- collection, statistics, 
- analysis, 
- monitoring, 
- scheduling, 
- production capacity, 
- output & inventory

With the platform, you can

- post demand information and contact information.
- post supply information and contact information.
- Products including:
  - Medical protections
  - Software and solutions
  - Device and equipment
  - Computing capacities
  - Etc.

https://dhrp.3incloud.com/#/home
The National Health Commission has developed a special webpage for the announcement and communication on COVID-19, including updates of posters for protection knowledge, clinical strategy for diagnosis & treatment, as well as front-line stories during the outbreak.
DH cases 06- Statistics platform

- In time risk communication and public education on protection

Multi-functional Robots

The medical robots have been officially used at Wuhan Thunder Mountain Hospital. The robot is 1.5 meters tall and can move forward and backward freely. It can disinfect the ward and distribute medical supplies, reducing the workload of medical staff and risk of cross infection.

Image Source: https://www.sohu.com/a/378301359_100256408
DH cases 07- Robots

-supporting front-line protection, and reducing infections

Temperature measuring robot

Sampling report before and after robot disinfection

Delivery robot

Image Source: https://tech.sina.com.cn/roll/2020-02-06/doc-iimxyqvy0647075.shtml
Various living applications

During the isolation period, various digital applications are needed to ensure normal life for most people, including online consultants, online shopping, online study/work, psychological intervention, etc.
DH cases 08 - Various living applications
- to ensure normal life of most people in quarantine period

Community Entry and Exit Registration System
Online consultation and buy medicine online
Order takeaway online (including grocery...)
Teleconference, work from home
Online Education, study from home

Other entertainment...
More digital health cases in COVID-19

During the epidemic prevention and control period, China Academy of Information and Communications Technology (CAICT) continued to collect digital health case from the industry. Use cases collection of digital health technology and application in COVID-19 prevention and control has been released in three editions and will be continuously updated in CAICT website. (http://www.caict.ac.cn/english/)

Edition 1: includes 51 Cases
2020-02-17

Edition 2: includes 58 Cases
2020-03-01

Edition 3: includes 66 Cases
2020-03-24

https://mp.weixin.qq.com/s/WxEbQkVHSVWV70xcdVFA9w; http://www.caict.ac.cn/xwdt/hyxw/202003/t20200301_275471.htm; http://www.caict.ac.cn/xwdt/hyxw/202003/t20200324_277621.htm
In order to share a reproducible experience that works for other countries, it is important to monitor and evaluate (M&E) the effect and cost of different digital cases.

https://forms.gle/S4JnhjPtDBzdZBo46

Thank you very much for your input!!
Digital health would not be the main contributor in combating COVID-19, but it could play a very important supporting role on the control and prevention work.

Telemedicine, AI for health (assist diagnosis, vaccine development, public screening, individual risk assessment, etc.), platform of material dispatching and risk communication, medical robots as well as digital living applications were introduced as typical cases.

More details of digital health uses cases could be found in CAICT best practice reports.

To further share a reproducible experience for other countries, it is important to monitor and evaluate(M&E) the effectiveness of different digital cases. Further research is in progress, and thank you for the input of M&E Questionnaire!
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Thank you for listening!
Thanks

Xu Shan
xushan@caict.ac.cn
http://www.caict.ac.cn/english/