How Can Internet Technologies Help Hospital to Curb COVID-19: PUMCH Experience from China

Qianyu Zhuang[1], Guoqiang Sun[1], Feng Zhang[1], Jianguo Zhang[1], Liluan You[1], Si Chen[1], Ke Zeng[1], Xiaoyang Meng[1], Wen Li[1], Yue Peng[1], Peng Peng[1], Weiguo Zhu[1], Mingwei Qin[1], Mingyan Chen[1], Bingshui Hu[1], and Hui Pan[1]

[1]Peking Union Medical College Hospital

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1. Department of information management
2. Department of Orthopedics
3. Department of Obstetrics and Gynaecology
4. Department of Primary Care and Family Medicine
5. Telemedicine center
6. Publicity Department
7. Outpatient department
8. Medical administration department, Peking Union Medical College Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College (CAMS & PUMC), Beijing, P.R. China

*Corresponding Author:

Weiguo Zhu M.D.

Director

Department of information management

Peking Union Medical College Hospital

Chinese Academy of Medical Sciences and Peking Union Medical College (CAMS & PUMC)

Associate Professor

Department of Primary Care and Family Medicine

Peking Union Medical College Hospital

Chinese Academy of Medical Sciences and Peking Union Medical College (CAMS & PUMC)

Postal address: 1 Shuai Fu Yuan, Beijing, P. R. China

Postal number: 100730

Telephone Number: 86-18612671096

Fax Number: 010-69154149

Email: zhuwg@pumch.cn

Dear Editor,

From the end of 2019 to early 2020, an outbreak of COVID-19 has spread throughout China and soon became a global concern.[1] Currently, it has spread to over 3 million people in over 210 countries and territories around the world.

Peking Union Medical College Hospital (PUMCH) has been ranked 1st for ten consecutive years according to the "Best Hospital ranking" in China. PUMCH initiated the prevention and control of COVID-19 immediately after the outbreak and dispatched a total of 186 medics in three batches to support the fight against the outbreak of COVID-19 in Wuhan. After months of fighting COVID-19, we found that the Internet technology is one of the most pivotal measures. Here we would like to summarize the current work and share our experience. In brief, we adopted different strategies and according techniques to help different groups of people.

Firstly, for the healthy public who are nervous about the epidemic and eager to obtain the correct knowledge and measures to prevent infection, we made home quarantine tips, self-isolation guidance, personnel prevention guideline and medical education videos of COVID-19, then send them regularly through our epidemic information dissemination platforms, including official mobile Application, WeChat official accounts and other social medias (*https://weibo.com/pumchdoctor*, etc). We also provided online mental counseling to comfort these nervous people and release their mental anxiety and stress.[2] Based on the high reputation of PUMCH among the public, these measures successfully reduced the social panic and promoted social distancing during the pandemic, and contained the pandemic of misinformation in some sense.

Secondly, for those patients with various chronic diseases requiring constant medical services, we adopted a free online clinic providing regular follow-up, medication prescriptions and contactless drug delivery. The quarantines and restrictions on the movement of people and social gatherings inevitably brought barriers to these patients' treatments, most of which were susceptible populations. Over 50,000 patients received free online remote consultations, which not only brought convenience to the patients, but also reduced the risk of cross-infection comparing to seeing doctors offline. Recently through cooperation with express service, we can deliver drugs directly to patients' homes.

Thirdly, for those patients who indeed developed fevers or coughs, we conducted online counseling to acquire necessary information including the epidemiological history, present history, symptoms characteristics to identify and stratify the possible risks for COVID-19 virus infection. For those low-risk patients, we gave professional advice on self-management of care and treatment and conducted follow-ups. For high-risk patients, we'll strongly suggest and guide them to the offline fever clinic immediately, where they will be screened for COVID-19 first.

Fourthly, for patients whose conditions really required offline clinic visits, we designed Intelligent Pre-sorting Electronic Pass System**(Fig. 1).** This system was mainly used for information registration and epidemiological screening of patients, patients' families, accompanying persons and other visitors entering hospital. The collected information includes health status, travel history, and whether they contacted people from high-risk areas like Wuhan. These pieces of information with present illness filled through mobile Apps by patients themselves prior to the visit can be automatically synchronized to physicians through EMR, thus reducing the visit time to mitigate exposure risk in the consultation room. If the patient had been to fever clinic within a month, an automatic warning will pop up from the outpatient EMR system for a thorough inspection and careful differential diagnosis with COVID-19. Furthermore, we also connected our hospital database with the health status code system run by the Chinese government based on big data and national mobile operator systems, which ensures the authenticity of a patient's journey in the last two weeks. Patients can receive either a green, red, or yellow code on the hospital pass. For patients assigned a red code meaning high risk, special staff will escort them to the fever clinic on a designated route. For patients with

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a yellow code meaning moderate risk, hospital entrance inspectors will be aware of further inspection. In addition, patients with a green code will be allowed to enter the outpatient area. Till April 30, over 380,000 patients had used the Pre-sorting Electronic Pass System in our center. Other than that, radiologists could finish 75 percent of CT scan reports at home by VPN, cloud desktop, plus Certificate Authority and digital signatures. By conducting these measures, we minimized the potential risks of COVID-19 contact exposure for both patients and hospital staffs.

Lastly, for patients in Wuhan hospital(Sino–French New City Branch of Tongji Hospital) supported by PUMCH dispatched medical team, we conducted close and frequent multidisciplinary experts' real-time telemedicine consultation using 5G technique. The close cooperation between the Beijing campus and Wuhan team through the internet effectively facilitated works in the following aspects. First, we organized experts from various departments in the Beijing campus to discuss with our Wuhan team about the diagnosis and treatment of seriously ill patients **(Fig. 2)** .[3, 4]For example, our clinical immunologists in Beijing participated in multi-rounds of MDT discussion on the anti-inflammation management of COVID-19 patients, and providing important professional advice.[3] Second, our administration work was adjusted according to the findings on the remote round in time. For instance, PUMCH adjusted the dispatch plan and sent cardiology experts in the second batch of medical team to Wuhan as soon as we realized that COVID-19 viral infection was a potential contributing factor or cause of myocardial injury through online discussion.[5] Third, through close remote cooperation between Wuhan and Beijing campus, many scientific researches were conducted to identify significant mechanisms of COVID-19 virus function. Our findings of antiphospholipid antibodies in COVID-19 patients [6]were exactly the results of both the guidance of the senior experts in Beijing campus and the implementation of the research plan by junior doctors working in Wuhan.

In summary, we offer our experience here adopting internet technologies into the prehospital, intrahospital, and interhospital service in fighting against the epidemic, for the benefit of other hospitals around the world still involved in the COVID-19 pandemic now. We believe that it will be indispensable not only for COVID-19, but also for the similar outbreak in the future though we all hope it never happens.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

References:

1. The L. Emerging understandings of 2019-ncov. *Lancet* . 2020;395:311

2. Yang Y, Li W, Zhang Q, Zhang L, Cheung T, Xiang YT. Mental health services for older adults in china during the covid-19 outbreak. *The lancet. Psychiatry* . 2020;7:e19

3. Zhang W, Zhao Y, Zhang F, Wang Q, Li T, Liu Z, et al. The use of anti-inflammatory drugs in the treatment of people with severe coronavirus disease 2019 (covid-19): The perspectives of clinical immunologists from china. *Clinical immunology* . 2020;214:108393

4. Ma J, Xia P, Zhou Y, Liu Z, Zhou X, Wang J, et al. Potential effect of blood purification therapy in reducing cytokine storm as a late complication of critically ill covid-19. *Clinical immunology* . 2020;214:108408

5. Jing ZC, Zhu HD, Yan XW, Chai WZ, Zhang S. Recommendations from the peking union medical college hospital for the management of acute myocardial infarction during the covid-19 outbreak. *European heart journal* . 2020

6. Zhang Y, Xiao M, Zhang S, Xia P, Cao W, Jiang W, et al. Coagulopathy and antiphospholipid antibodies in patients with covid-19. *The New England journal of medicine* . 2020;382:e38

PUMCH Pre-sorting Pass Permit

JUDY | Female | 35
11******00
18′ ■ 106

【Visiting purpose】
Seek medical treatment
【Itinerary】
I have been in Beijing in the past 2 weeks
【Acquired time】
04/30 19:31
【Expire time】
05/01 18:00

I have:High temperature;Runny nose or sore throat;Traveled in Hubei;Contacted with fever patients;Vlose contact with suspected people;Been abroad。

This card is valid on the day. Please save this card on your mobile phone and present it to the staff when necessary. Thank you !

Save

PUMCH Pre-sorting Pass Permit

JUDY | Female | 35
11******00
18 ■ 106

【Visiting purpose】
Accompany others
【Itinerary】
I have returned or come to Beijing in the past 2 weeks
【Acquired time】
04/30 19:36
【Expire time】
05/01 18:00

I have:Runny nose or sore throat;Contacted with fever patients。

This card is valid on the day. Please save this card on your mobile phone and present it to the staff when necessary. Thank you !

Save

PUMCH Pre-sorting Pass Permit

JUDY | Female | 35
11******00
18 ■ 106

【Visiting purpose】
Seek medical treatment
【Itinerary】
I have been in Beijing in the past 2 weeks
【Acquired time】
04/30 19:33
【Expire time】
05/01 18:00

This card is valid on the day. Please save this card on your mobile phone and present it to the staff when necessary. Thank you !

Save