

Research and Applications

What patients “see” doctors in online fever clinics during COVID-19 in Wuhan?

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Received 29 February 2020; Revised 12 April 2020; Editorial Decision 13 April 2020; Accepted 15 April 2020

ABSTRACT

Objective: In December 2019, coronavirus disease 2019 (COVID-19) occurred in Wuhan, China. Online fever clinics were developed by hospitals, largely relieving the hospital's burden. Online fever clinics could help people stay out of crowded hospitals and prevent the risk of cross infections. The objective of our study was to describe the patient characteristics of an online fever clinic and explore the most important concerns and question of online patients.

Materials and Methods: Our study extracted data from fever clinic records in medical information systems from January 24 to February 18, 2020 in a tertiary hospital in Wuhan. We described the characteristics of patients in fever clinic, then we extracted and classified questions of patient consultations through the online fever clinic dataset.

Results: For the 64 487 patients who attended the online fever clinic, the average age was 30.4 years, and 37 665 (58.4%) were female patients. The current state of patients from online were home without isolation (52 360 [81.2%]), home isolated (11 152 [17.29%]), and outpatient observation (975 [1.51%]). From the 594 patient questions analyzed, confirming diagnosis and seeking medical treatment account for 60.61% and 38.05%, respectively, followed by treating (25.59%), preventing (4.38%), and relieving anxiety (1.68%).

Discussion: Online fever clinics can effectively relieve patients' mood of panic, and doctors can guide patients with suspected of COVID-19 to isolate and protect themselves through online fever clinic. Online fever clinics can also help to reduce the pressure of hospital fever clinics and prevent cross infection.

Conclusions: This study indicated the importance of online fever clinics during the COVID-19 outbreak for prevention and control.

Key words: COVID-19, consumer health informatics, online health, online fever clinic, descriptive research

INTRODUCTION

In December 2019, an increasing number of cases of novel coronavirus-infected pneumonia occurred in Wuhan, Hubei Province, China.^{1–3} On January 7, 2020, Chinese authorities confirmed that a

new type of coronavirus, tentatively named by World Health Organization as coronavirus disease 2019 (COVID-19), had caused the outbreak.^{2,4} This disease was linked to a seafood and wet animal wholesale market in Wuhan.⁵ Existing evidence has shown that the COVID-19 could be transmitted from human to human because of

close contact.⁶⁻⁹ Even the Chinese health authorities took prompt public health measures, including intensive surveillance, epidemiological investigations, and closure of the market on January 1, 2020,¹⁰ and Wuhan has been in lockdown since January 23, the disease has rapidly spread from Wuhan to other areas. On January 30, 2020, the World Health Organization declared a public health emergency of international concern over the global outbreak of COVID-19.¹¹ As of May 5, 2020, a total of 84 404 COVID-19 cases in China have been confirmed. In 213 other countries, a total of 3 432 941 COVID-19 cases have been reported.¹²

Owing to the lack of effective therapies or vaccines for COVID-19,¹ the rapid spread of the disease has caused panic, and people are anxious to seek medical help if they have a fever or flu-like symptoms. This panic caused overcrowding in many hospitals in Wuhan with fever clinics. However, there have been many cross-infection cases at hospitals where people running a fever and having common cold flooded in out of concern and were infected by the new coronavirus.

Fortunately, in recent years, China's healthcare industry has made a series of significant improvements, and the use of information and communication technologies to provide remote health services has become increasingly popular.¹³ To relieve the pressure of hospital fever clinics and prevent cross infection, online fever clinics, an Internet-based clinic system, have been utilized by hospitals and third-party service platforms. In total 18 hospitals and platforms provided online fever clinics between January 24th and February 9th, such as JD Online Healthcare (https://care.jd.com/nh_home) and the WeDoctor website (www.guahao.com). On January 24, 2020, Wuhan Tongji Hospital became the first public tertiary hospital to provide online fever clinics aims to help people stay out of crowded hospitals and reduce the risk of further infections. People could obtain appointment diagnosis services through hospitals' APP (Mobile Tongji Hospital) and Tongji hospitals' WeChat public platform. This study aims to describe the characteristics of online fever clinic patients during COVID-19 prevention and control, and explored the most frequent questions of online patients.

MATERIALS AND METHODS

Research context and available data

We drew data from the Wuhan Tongji Hospital in Central China. This 5500-bed hospital is a tertiary referral hospital that covers more than 60 million people and serves patients from all over the country.¹⁴ Tongji Hospital has become the designated hospital in Wuhan for the centralized treatment of severe COVID-19 patients. Meanwhile, Tongji Hospital was the first public tertiary hospital to provide online fever clinics in China.

Our study extracted data from fever clinics records in medical information systems from January 24 to February 18, 2020, including the records of 78 219 online fever clinic assessments and the records of 18 518 in-person fever clinic assessments. Any incomplete or erroneous records such as incomplete medical records (eg, sex, age, or incomplete description of basic symptoms) were removed to ensure the reliability of the results. Because Wuhan went into lockdown on January 23, a large number of patients logged in to the online fever clinic. However, the number of doctors was limited, and most patients had to wait a long time to talk to a doctor, whereas some patients could not bear the long wait online and therefore failed to make an appointment with the doctor. The missing data mainly contain these patients without doctors in the online fever clinic. After

removing invalid samples, we obtained an actual sample size of 81 024, including the records of 64 487 online fever clinic assessments and the records of 16 537 in-person fever clinic assessments. Then, we used a random number generator to randomly select 594 patient questions from the complete record of online doctor-patient communication in order to explore the patient concerns, and we coded patient questions manually. We grouped the coded questions into 5 categories: (1) confirming diagnosis, (2) seeking medical treatment, (3) treating, (4) preventing, and (5) relieving anxiety. Our study had Institutional Review Board approval (ID: TJ-C20200149) provided by Tongji Hospital, Tongji Medical College, Huazhong University of Science and Technology.

Data analysis

Data are reported as frequency and percentage for each categorical variable and mean \pm SD for each continuous variable. For this study, our analysis comprised 3 steps. First, we summarized the patient number in online and in-person fever clinics per day between January 24 and February 18, 2020. Then, we described the characteristics of patients in online fever clinics in Tongji Hospital. Third, we classified the questions of patient consultations through the online fever clinic, and in order to give a comprehensive understanding of patients' concerns, we also described the characteristics of in-person fever clinic patients' diagnostic results.

RESULTS

Characteristics of online fever clinic patients

In order to give a comprehensive assessment of the patient numbers in fever clinics, we used the initial dataset (including 78 219 online fever clinic and the records of 18 518 in-person fever clinic before we removed the invalid samples) to plot a line chart. From Figure 1, a drop can be witnessed from January 24 ($n = 10\,577$) to February 18 ($n = 438$). As for an in-person fever clinic, the number of patient number at in-person fever clinics has been stable at around 700 between January 24 and February 18. In order to prevent the spread of COVID-19, Wuhan was closed on January 23, but various policies and safeguards were not immediately followed up, which led to the lack of medical resources in Wuhan. The hospital was overcrowded, and it was difficult for patients to go in person to the hospital to get medical treatment, so patients started seeking medical services through the online fever clinic. With the initial control of the epidemic, the patient numbers in the online fever clinic gradually decreased.

From Table 1, our study included 64 487 patients with complete records of online consultations through the Tongji Hospital online fever clinic. For those patients, the average age was 30.4 years, and 37 665 (58.4%) were female patients, and the 5 age groups (≤ 15 , 16-30, 31-45, 46-60, and > 60 years of age) account for 2.1%, 52.5%, 39.2%, 5.5%, and 0.7%, respectively. The current state of patients from the online fever clinic were home without isolation (52 360 [81.2%]), home isolated (11 152 [17.29%]), and outpatient observation (975 [1.51%]), with hospitalization and concentrated isolated were not included (Table 1). The possible reason for this situation is that the role of online consultation is mainly to understand and judge the condition, which is usually a preconsultation for in-person fever clinic consultation. The number of patients from the online clinic who had Wuhan exposure was 34 478 (53.47%), and there were only 199 (0.3%) online fever clinic patients with Huanan seafood wholesale market exposure. The waiting time is the amount

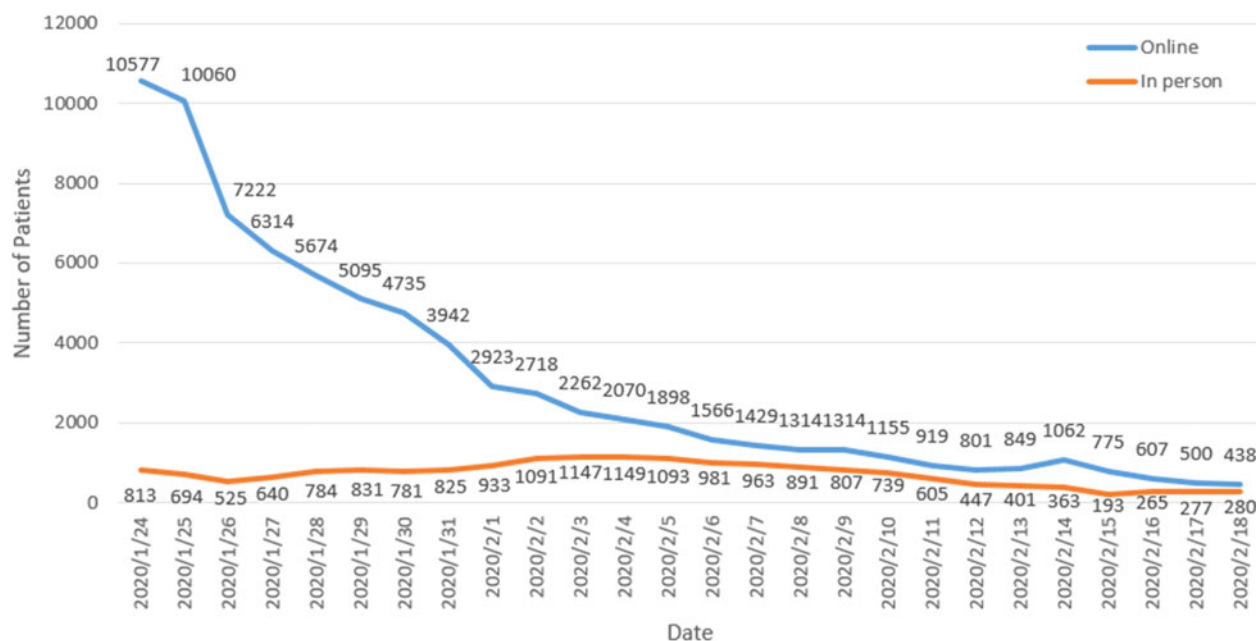


Figure 1. The patient number for online and in-person fever clinics.

Table 1. Descriptive statistics of the online fever clinic (n = 64 487)

Variable	Data
Age, y	30.4 ± 25.62
≤15	1348 (2.1)
16-30	33 865 (52.5)
31-45	25 239 (39.2)
46-60	3569 (5.5)
>60	466 (0.7)
Sex	
Female	37 665 (58.4)
Male	26 822 (41.6)
Current state	
Outpatient observation	975 (1.51)
Home isolated	11 152 (17.29)
Home without isolation	52 360 (81.2)
Wuhan exposure	34 478 (53.47)
Huanan Seafood Wholesale Market exposure	199 (0.3)
Waiting time, h	7.19 ± 8.99
Consultation time, h	1.21 ± 3.79
Total time, h	8.41 ± 9.2
Signs and symptoms	
Fever	26 975 (41.83)
Headache	12 562 (19.48)
Cough	22 965 (35.61)
Expectoration	10 208 (15.83)
Abdominal pain	7238 (11.22)
Myalgia	4708 (7.3)
Diarrhea	3831 (5.94)
Fatigue	5744 (8.9)
Runny nose	10 728 (16.64)
Pharyngalgia	17 120 (26.55)
Chest distress	8562 (13.28)
Pant	2853 (4.42)
Others	11 367 (17.63)

Values are mean ± SD or n (%).

patients need to wait for the doctor, with an average waiting time of 7.19 hours, as the number of patients was very large and doctor resources were limited, and thus many patients were not able to get an assessment. The average consultation time was 1.21 hours, and the average total time for patients to consult online, including the waiting and consultation time, was 8.41 hours.

The main symptoms self-described by patients from the online fever clinic were fever (26 975 [41.83%]), cough (22 965 [35.61%]), pharyngalgia (17 120 [26.55%]), headache (12 562 [19.48%]), runny nose (10 728 [16.64%]), expectoration (10 208 [15.83%]), chest distress (8562 [13.28%]), and abdominal pain (7238 [11.22%]). It can be seen that patients from the online fever clinic had more than 1 symptom and were more likely to ask for consultation and help because of some major symptoms. Also, the doctor in the online fever clinic had the COVID-19 diagnosis and treatment plan and related diagnosis and treatment guidelines issued by the National Health Commission of the People's Republic of China, which stated that if the patient in the online fever clinic had a fever, and other symptoms such as headache, runny nose, cough, gasping, chest tightness, diarrhea, nausea, and vomiting, and had a history of epidemiological exposure, they were to be advised to immediately visit a fever clinic and wear a mask for protection.

Online fever clinic consultations of patient concerns

We further explored the number and proportion of question categories for patients in online fever clinics. The sample size was 594, and a patient's query can have multiple intents, it could be classified into more than 1 category, so the sum of proportion is not 1. Confirming diagnosis is primarily associated with some symptoms appearing to the patients as COVID-19. Seeking medical treatment contains a series of questions that based on the current situation of the patient, should they take measures to go to the hospital or isolation? Treating concerns regards whether patients should pay attention to diet and medication when they feel any physical discomfort in this spe-

Table 2. Categories of patient consultations (n = 594)

Categories of consultation	Data
Confirming diagnosis	360 (60.61)
Seeking medical treatment	226 (38.05)
Treating	152 (25.59)
Preventing	26 (4.38)
Relieving anxiety	10 (1.68)

Values are n (%). A consultation could have multiple intents.

Table 3. Illustrations of patient consultations

Categories of consultation	Representative questions
Confirming diagnosis	I don't know why I have a fever. I've been at home all week, and I'm wearing protective clothing when I go out. Is my temperature abnormal because of infection or menstruation, or I didn't take a good rest last night? Still caused by diarrhea! I'm so worried now.
Seeking medical treatment	I have a fever for two days, and my throat is irritated and diarrhea. What should I do? Should I stay at home or go to the hospital for a chest radio graph?
Treating	I have been home from Wuhan for four days. What medicine should I take for this symptom? At present, according to the treatment plan in Photo 2, I have made a tea drink, taken pharyngitis tablets and cough tablets for cough, do I need other operations or take other medicine?
Preventing	I had Wuhan exposure briefly 14 days ago, and have no symptoms to this day. May I ask if I am still in the incubation period? What precautions will be taken in the next day?
Relieving anxiety	I have a fever for two days, and the highest temperature is 37.5°C. Taking the medicine orally can lower the temperature. When I came into contact with a person from epidemic area, he had been away from Wuhan for a month (Over the incubation period of 14 days), and he has no symptoms to this day. May I have the possibility of infection?

cial epidemic period. Preventing is about how patients can prevent infection and patients hope to get some relevant knowledge about new coronavirus pneumonia such as incubation period and infectious. Relieving anxiety, appearing in patients' consulting questions, indicates that patients are without any symptoms but are in a state of anxiety and want to be reassured by the doctor. From the 594 patients' questions, confirming diagnosis and seeking medical treatment accounted for 60.61% and 38.05%, respectively, followed by treating (25.59%), preventing (4.38%), and relieving anxiety (1.68%). **Table 2** presents more details on these categories. Our study found that confirming diagnosis was the most frequent patient concern. Although the other 3 types of questions were relatively less frequent, they are still areas that patients have paid attention to during the epidemic. **Table 3** provides representative patient questions among the 5 categories.

From **Table 4**, the study also reported the characteristics of 16 537 in-person fever clinic patients in Tongji Hospital in order to provide a comprehensive picture. For these patients, the average age was 49.2 years, and 8471 (51.2%) were female patients. The 5 age groups accounted for 0.5%, 10.6%, 30.4%, 32.6%, and 25.9%, re-

Table 4. Descriptive statistics of the in-person fever clinic (n = 16 537)

Variable	Data
Age, y	49.2 ± 14.89
≤15	92 (0.5)
16-30	1755 (10.6)
31-45	5025 (30.4)
46-60	5388 (32.6)
60	4277 (25.9)
Sex	
Female	8471 (51.2)
Male	8066 (48.8)
Diagnostic results	
Fever	7589 (45.9)
Pulmonary infections	4254 (25.72)
Cough	1172 (7.08)
Viral pneumonia	838 (5.07)
Others	2684 (16.23)

Values are mean ± SD or n (%).

spectively. The diagnostic results of patients from the in-person fever clinic were fever (7589 [45.9%]), pulmonary infections (4254 [25.72%]), cough (1172 [7.08%]), viral pneumonia (838 [5.07%]), and others (2684 [16.23%]). Others included a number of conditions causing discomfort that were excluded from the previous diagnostic results. Confirmed viral pneumonia accounted for a relatively small proportion. Patients diagnosed with viral pneumonia just can be served as suspected COVID-19 or flu or another infection, and they need further testing.

DISCUSSION

We investigated the importance of online fever clinics during COVID-19. By using data from Tongji Hospital, we explored the characteristics of patients from an online fever clinic and sought to better further understand the questions and patient concerns in online fever clinics. As of February 18, 2020, the 64 487 online fever clinic patients were included in this study; 1.51% were outpatient observation, 17.29% were isolated at home, and 81.2% were at home and were not isolated. Compared with patients from the in-person fever clinic, online patients were younger (average age 30.4 years vs 49.2 years) and more likely to report multiple signs and symptoms.

Our study indicated that the online fever clinics can effectively relieve patients' mood of panic. A previous study had suggested that rapid person-to-person transmission of COVID-19 may have occurred.⁶ This fact caused panic among the general public. From the characteristics of online patients, most patients' current state was home without isolation (52 360 [81.2%]), and those patients seeking medical services due to a mood of panic. Through online fever clinics, patients can communicate directly with the doctor at home, thereby helping them have a better understanding of their own health status and relieve their panic. In this study, most patients did not have the main symptoms of COVID-19 demonstrated in the questions of confirming diagnosis in online fever clinics. The largest number of patients was the second day after the online fever clinic was provided in Tongji Hospital, and then gradually decreased. Thus, in online fever clinics doctors can help relieve patients' mood of panic and guide them to treat their symptoms correctly. Only 0.3% (n = 199) of patients in the online fever clinic had exposure to the Huanan Seafood Wholesale Market, and this may be because

many COVID-19 patients with a history of Huanan Seafood Wholesale Market exposure had already been identified by the relevant authorities.

During the continuation of the COVID-19, many hospitals in Wuhan that provided fever clinics were overcrowded. From January 24 to February 18, 2020, there were 78 219 patients who consulted with doctors through the Tongji Hospital online fever clinic. Online fever clinics can effectively assist in-person fever clinics and play an important role in diverting patient load from in-person fever clinics, helping to reduce the pressure at in-person fever clinics and reducing the possibility of cross infection. Through an online fever clinic, some patients who are not COVID-19-positive can get corresponding diagnosis and treatment advice at home, avoiding the risk of infection from attending the in-person fever clinic. At the same time, the in-person fever clinic can focus on the COVID-19-positive patients, which helps the fever clinic to efficiently treat the patients with COVID-19 and maintain the normal order of medical treatment in the hospital.

As for patient concerns, confirming their diagnosis was the most common concern in online fever clinic consultation, followed by seeking medical treatment (38.05%). However, the assessment of the doctors was that the vast majority of the patients had simply panicked. Some patients had ordinary fever, common cold, or just underlying illnesses. Many people were vulnerable to the common flu in winter, but they thought that they were infected by the new virus, and thus many patients sought an online consultation due to the panic; most online patients did not have the suspected symptoms of COVID-19.

For patients suspected of having COVID-19, doctors could guide them to isolate and protect themselves through the online fever clinic, and also advise them to go to the hospital as soon as possible. In order to control the epidemic as soon as quickly, many cities in China have begun to regulate traffic. This may lead to difficulties for patient living in areas with limited medical resources; however, the online fever clinic can overcome geographical boundaries and provide effective access to medical services for patients with suspected of COVID-19 in rural and remote areas. Owing to their particularity, online fever clinics can also help to relieve the pressure of medical personnel and supplies while reducing the pressure on the in-person fever clinic.

Limitations

First, the data used in this study were provided by 1 specific hospital. The representation of patients in online fever clinic may be limited. Also, owing to the limitation of data collection time, we did not confirm the future health status of the patients with suspected of COVID-19. Also, our understanding of the symptoms of COVID-19 has evolved substantially since January 2020, and current diagnostic guidelines are likely more accurate.

CONCLUSION

We used the dataset from Tongji Hospital and explored the characteristics of patients in an online fever clinic; we subsequently explored the questions and most concerns of online clinic patients. We found that compared with patients from in-person fever clinic, the patients from the online fever clinic were younger and more likely to report multiple signs and symptoms. However, most patients in the online fever clinic were not considered to have obvious symptoms of COVID-19. We also indicated the importance of online fever clinics

in supporting COVID-19 prevention and control, especially as the number of cases rapidly expanded.

FUNDING

This work was supported by the National Natural Science Foundation Program of China (NO.71671073, NO.71971092 and NO.71804050).

AUTHOR CONTRIBUTIONS

GL, GF, YC, and ZD discussed and designed the study. GL, GF, and ZD participated in data analysis. GF and ZD performed the statistical analysis and drafted the manuscript. GL, YC, and ZD helped to revise the draft. All authors read and approved the final manuscript.

ACKNOWLEDGMENTS

The authors thank Tongji Hospital, Tongji Medical College, Huazhong University of Science and Technology, for providing data used for this study.

CONFLICT OF INTEREST STATEMENT

None declared.

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