

The impact of new electronic communication mode in treatment of SARS-CoV-2 infection

Zhaoxiong Fang

Sun Yat-Sen University

Zhiqiang Gu

Sun Yat-Sen University

Tian Zhang

Sun Yat-Sen University

Junjie Lei

Sun Yat-Sen University

Lu Lin

Sun Yat-Sen University

Zhixiang Yan

Sun Yat-Sen University

Zhigang Liu

Sun Yat-Sen University

Keke Feng

Sun Yat-Sen University

Mengsha Xie

Sun Yat-Sen University

Shuanshuan Guo

Sun Yat-Sen University

Zhongsi Hong

Sun Yat-Sen University

Xiaofeng Li (✉ zdwylyxf@163.com)

1. Department of Gastroenterology, the Fifth Affiliated Hospital, Sun Yat-sen University, Zhuhai, Guangdong Province, China <https://orcid.org/0000-0001-5155-8475>

Research article

Keywords: COVID-19, SARS-CoV-2 infection, electronic communication tool, therapy, physician-patient communication

Posted Date: June 8th, 2020

DOI: <https://doi.org/10.21203/rs.3.rs-29831/v1>

License:  This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Abstract

Background: More than 230,000 cases of coronavirus disease (COVID-19) have been reported worldwide. We sought to discuss the impact of new electronic communication tools with patients in diagnosis and treatment of these cases.

Methods: We recruited adult patients from Jan 20 to Feb 26, 2020, with laboratory-confirmed SARS-CoV-2 infection from The Fifth Affiliated Hospital, Sun Yat-sen University, in Zhuhai, China. 47 eligible patients were enrolled and randomly classified into either a test or control group. All of them were treated with standard therapeutic regimen and routine ward-round. The test group was subdivided into three subgroups. The first subgroup was arranged an extra 5min on-line ward-round by WeChat voice call once daily for basic disease communication. The second subgroup was given an extra 10min voice call once daily for further detail, similarly, the third subgroup was given an extra 10min than the second group every three days. The main end point was the duration of positive-to-negative conversion of SARS-CoV-2 RNA.

Results: 47 patients were included in the final analysis. The median time from disease diagnosed to the endpoint of test group was 7.0 days (interquartile range, 3.8 to 10.8), whereas the control group was 10.0 days (interquartile range, 6.5 to 14.5). It showed significant reduced the duration time of virus from positive to negative by the NAT (nucleic acid testing) ($P=0.032$), especially compared the 10 minutes group (3.0 days, interquartile range, 3.0 to 7.5) to control group ($P=0.0065$).

Conclusions: The patients with SARS-CoV-2 infection might benefit from the use of the new electronic communication mode. It's very valuable to reduce the shortage of medical protection resources and the risk of occupation.

Background

As of March 19, 2020, the coronavirus disease 2019 (COVID-19) has been reported to be responsible for more than 200,000 infections and 8700 deaths worldwide¹⁻². High-throughput sequencing has revealed that severe acute respiratory syndrome coronavirus 2 (SRAS-CoV-2) is similar to the coronavirus responsible for severe acute respiratory syndrome coronavirus (SARS-CoV), a member of the subgenus Sarbecovirus (Beta-CoV lineage B), with which it shares more than 79% of its sequence³⁻⁴. Evidence has revealed that the virus can spread by person-to-person respiratory transmission and contact transmission rapidly. The information regarding the epidemiology and clinical features of COVID-19 is scarce⁵. A few severe patients with COVID-19 have developed severe pneumonia, pulmonary edema, acute respiratory distress syndrome, or multiple organ failure even death⁶. Because of the worldwide shortage of medical resources, it is very important to find a new medical mode to reduce protection resources consumption, what's more, avoid cross-infection among health-care workers and patients.

In our retrospective analysis, we designed a new model of physician-patient communication, aiming to prompt working efficiency in the diagnosis and treatment of COVID-19 and reduce occupational exposure

risk.

Methods

Study design and participants

We enrolled patients from Jan 20 to Feb 26, 2020, at Department of Infectious Disease, the Fifth Affiliated Hospital, Sun Yat-sen University, in Zhuhai, Guangdong Province, China. Patients diagnosed with SARS-CoV-2 infection were screened according to WHO interim guidance³. The inclusion criteria were as follows: (1) between 18 and 65 years old, (2) being SARS-CoV-2 RNA positive, (3) willing to provide respiratory swabs, and (4) using WeChat. The criteria for exclusion were as follows: (1) confirmed as severe COVID-19 pneumonia, (2) rapidly deteriorated into severe, (3) complicated with malignant tumors or compromised immune system, and (4) unable to make voice call daily by WeChat.

A confirmed case with SARS-CoV-2 infection was defined as a positive result to high-throughput sequencing or real-time reverse-transcriptase polymerase-chain-reaction (RT-PCR) assay for nasal or pharyngeal swab specimens^{1,7}. The incubation period was defined as the duration from the contact of the transmission source to the onset of symptoms. Exposure history was defined as exposure to people with confirmed SARS-CoV-2 infection or to the Wuhan area. Respiratory samples were collected every 1–2 days until two sequential negative results were obtained.

The study was approved by the Medical Ethical Committee of the Fifth Affiliated Hospital of Sun Yat-sen University (approval number L076-1) and informed consent was obtained from participants. Both of the test and the control groups were treated with standard therapy and routine ward-round, according to the guideline of diagnosis and treatment of SARS-CoV-2 infection (standard version)⁸. All changes in patients' conditions were monitored, recorded and responded timely.

Aiming to explore new electronic communication mode to treat the infectious disease, we grouped patients of the test group into three subgroups, providing additional high-quality on-line ward-round and psychological care using WeChat voice calls.

The first group (5 minutes group) was given an extra on-line ward-round by WeChat voice call for 5 minutes once daily. In the 5 minutes patients could communicate with the doctor in charge about the disease progression. The second group (10 minutes group) was given an extra on-line ward-round by WeChat for 10 minutes once daily. In the 10 minutes patients could communicate with the doctor in charge about the disease progression, and the extent and future outlook of the disease. The third group (10 minutes + minutes group) was given an extra 10 minutes' on-line talk every three days, which could gather more detailed information of the disease. The fourth group, also the blank controlled group, was just treated with standard therapy. Respecting patient consent, all patients were free to choose consent or opting-out.

Data collection

The epidemiological characteristics (including recent exposure history), clinical symptoms and signs and laboratory findings were extracted from electronic medical records. Computed tomography was used as radiologic assessment. Laboratory assessments consisted of complete blood count, blood chemistry, coagulation test, liver and renal function, electrolytes, reactive protein, procalcitonin, lactate dehydrogenase and creatine kinase. All data were checked by two physicians (ZF and ZG) and a third researcher (JL) adjudicated any difference in interpretation between the two primary reviewers.

Primary Outcome

The primary endpoint was the duration of positive-to-negative conversion of SARS-CoV-2 RNA diagnosed by the NAT (nucleic acid testing). It was the time from laboratory conformed positive to negative of SARS-CoV-2 RNA result after two sequential negative respiratory tract sample results. The interval between the two negative results must be more than 24 hours.

Statistical analysis

We used SPSS (version 19.0) for all analyses. Continuous variables were presented as median (interquartile range) and compared with Mann-Whitney U test. Categorical variables were presented as number (%) and compared by Chi-square test or Fisher's exact test.

Results

A total of 47 patients with laboratory-confirmed SARS-CoV-2 infection met the eligibility criteria and completed the baseline assessment before being randomized into the trial. The demographics, clinical, and radiographic findings were shown in Table 1 and they were similar between the test group and control group on admission. There were 21 male and 26 female enrolled, with the median age 36.0 years (interquartile range, 29.0 to 44.0). The incubation period was 6.0 days (interquartile range, 2.0 to 10.0).

The duration of positive-to-negative conversion of SARS-CoV-2 RNA of patients were tracked by viral NAT (Figure 1). The median time of the primary endpoint of test group was 7.0 days (interquartile range, 3.8 to 10.8), whereas of the control group was 10.0 days (interquartile range, 6.5 to 14.5), ($P=0.032$) (Table 2). It showed significant reduced the duration of viral positive-to-negative conversion, compared with the 10 minutes group (3.0 days, interquartile range, 3.0 to 7.5 days) to control group ($P=0.0065$). However, the median time of the 5 minutes group was 7.0 days (interquartile range, 5.5 to 13.0), 10 minutes + 10 minutes group was 8.5 days (interquartile range, 4.8 to 16.0), and the two groups were no statistical difference to the control group ($P=0.45$ and 0.56 , respectively).

Discussion

In previous studies, communication tool incorporated into the standard medical consultation was used to improve patients' self-Monitoring and understanding of disease⁹⁻¹⁰. The WeChat-based mobile health (mHealth) intervention via WeChat, which is the most popular social media app in china, was significantly

reduced depressive symptoms among people living with HIV and depression¹¹. In our study, WeChat-based on-line ward-round provided a contactless and effective communication channel in treatment of SARS-CoV-2 infection. Voice calls was chosen because it's more efficient than texting, besides, it keep a higher privacy protection than video calls.

In our study, the duration of respiratory viral RNA positive was ranging from 3.0 to 32.0 days of all the 47 patients. For SARS-CoV, viral RNA was detected in respiratory specimens from about a third of patients as long as 4 weeks after disease onset¹⁰. Similarly, the duration of MERS-CoV RNA detection in lower respiratory specimens persisted for at least 3 weeks¹²⁻¹³. We found that remote doctor-patient communication could help to reduce the duration of positive-to-negative conversion of SARS-CoV-2 RNA. In particular, the 10 minutes group had an advantage over other groups. The duration of viral positive-to-negative conversion was significantly reduced, compared to the control group (P=0.032). High-quality communication and in-time feedback were presumed to be the mechanism of good prognosis.

Further more, the new electronic communication tool via WeChat additional to standard therapy cost less and easy to popularize. It reduced the risk of occupation and supplied a safer working condition for medical staff.

With the COVID-19 spreading worldwide rapidly, the medical resources could be making a run on a bank. It is urgent to find a way to solve the shortage of medical protection resources and reduce the risks of occupational exposure of medicine¹⁴. The new electronic communication mode, which can ease up the shortage of medical protection resources and evaluate therapeutic effect, possibly become a helpful candidate option for the treatment of SARS-CoV-2 infection.

Conclusions

The duration of virus from positive-to-negative conversion of test group was significantly shorter than that of control group. It was suggested that the patients with SARS-CoV-2 infection might benefit from the use of the new electronic communication mode. It's very valuable to reduce the shortage of medical protection resources and the risk of occupation.

Abbreviations

COVID-19: coronavirus disease 2019

SARS-CoV-2: severe acute respiratory syndrome coronavirus 2

SARS-CoV: severe acute respiratory syndrome coronavirus

NAT: nucleic acid testing

Declarations

Availability of data and materials

The data and materials analyzed during the current study available from the corresponding author on reasonable request.

Acknowledgments

We thank all patients involved in the study and all medical staff participating in the antiepidemic of COVID-19.

Funding

This work was supported by the National Key Research and Development Program of China (2020YFC082400), the Task-Force Project on the Prevention and Control of Novel Coronavirus of Guangdong Province (20201113), the Three Major Constructions of Sun Yat-sen University (the Task-Force Project on the Prevention and Control of Novel Coronavirus of Sun Yat-sen University), the Emergency Task-Force Project on the Prevention and Control of Novel Coronavirus of Zhuhai 2020.

Ethics approval and consent to participate

The Medical Ethical Committee of the Fifth Affiliated Hospital of Sun Yat-sen University and informed consent was obtained from participants.

Consent for publication

Not applicable

Competing interests

We declare no competing interests.

Authors' contributors

XL, and ZH designed the study. TZ and LL wrote the manuscript. ZF, ZG, and JL analyzed the data. All authors contributed to the data collection and interpretation of results. All authors read and approved the final manuscript.

References

1. Huang C, Wang Y, Li X, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet*. 2020; 395: 497-506.
2. Callaway E, Cyranoski D, Mallapaty S, et al. The coronavirus pandemic in five powerful charts. *Nature*. 2020; 579: 482-483.

3. Lu R, Zhao X, Li J, et al. Genomic characterisation and epidemiology of 2019 novel coronavirus: implications for virus origins and receptor binding. *Lancet*. 2020; 395: 565-574.
4. van Doremalen N, Bushmaker T, Morris DH, et al. Aerosol and surface stability of SARS-CoV-2 as compared with SARS-CoV-1. *N Engl J Med*. 2020; 382: 1564-1567.
5. Shimizu K. 2019-nCoV, fake news, and racism. *Lancet*. 2020; 395: 685-686.
6. Wang D, Hu B, Hu C, et al. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus-infected pneumonia in Wuhan, China. *JAMA*. 2020; e201585.
7. Chen L, Liu W, Zhang Q, et al. RNA based mNGS approach identifies a novel human coronavirus from two individual pneumonia cases in 2019 Wuhan outbreak. *Emerg Microbes Infect*. 2020; 9: 313-319.
8. Jin YH, Cai L, Cheng ZS, et al. A rapid advice guideline for the diagnosis and treatment of 2019 novel coronavirus (2019-nCoV) infected pneumonia (standard version). *Mil Med Res*. 2020; 7: 4.
9. Soh JY, Lee SU, Lee I, et al. A mobile phone-based self-monitoring tool for perioperative gastric cancer patients with incentive spirometer: randomized controlled trial. *JMIR Mhealth Uhealth*. 2019; 7: e12204.
10. Xu D, Zhang Z, Jin L, et al. Persistent shedding of viable SARS-CoV in urine and stool of SARS patients during the convalescent phase. *Eur J Clin Microbiol Infect Dis*. 2005; 24: 165-171.
11. Guo Y, Hong YA, Cai W, et al. Effect of a WeChat-based intervention (Run4Love) on depressive symptoms among people living with HIV in China: a randomized controlled trial. *J Med Internet Res*. 2020; 22: e16715.
12. Oh MD, Park WB, Choe PG, et al. Viral load kinetics of MERS coronavirus infection. *N Engl J Med*. 2016; 375: 1303-1305.
13. Corman VM, Albarak AM, Omrani AS, et al. Viral shedding and antibody response in 37 patients with Middle East respiratory syndrome coronavirus infection. *Clin Infect Dis*. 2016; 62: 477-483.
14. Liu Y, Li J, Feng Y. Critical care response to a hospital outbreak of the 2019-nCoV infection in Shenzhen, China. *Crit Care*. 2020; 24: 56.

Tables

Table 1. Demographic, clinical, and radiographic findings of 47 patients with SARS-CoV-2 infection on admission

| | All patients (n=47) | Test group (n=14) | Control group (n=33) | <i>P</i> value |
|--|------------------------|----------------------|----------------------------|-------------------|
| Characteristics | | | | |
| Age, years | 36.0 (29.0-44.0) | 33.0 (28.8-45.8) | 36.0 (30.5-44.5) | 0.40 |
| Male | 21 (44.7) | 7 (50.0) | 14 (42.4) | 0.93 |
| Exposure to source of transmission within 14 days | | | | 0.063 |
| Local residents of Wuhan | 30 (63.8) | 7 (50.0) | 23 (69.7) | |
| Non local residents: recently been to Wuhan | 10 (21.3) | 2 (14.3) | 8 (24.2) | |
| Non local residents: contacted with people from Wuhan | 6 (12.8) | 4 (28.6) | 2 (6.1) | |
| Non local residents: no contacted with people from Wuhan | 1 (2.1) | 1 (7.1) | 0 | |
| Comorbidity | | | | |
| Chronic obstructive pulmonary disease | 0 | 0 | 0 | |
| Diabetes | 1 (2.1) | 1 (7.1) | 0 | 0.33 |
| Hypertension | 2 (4.3) | 2 (14.3) | 0 | 0.10 |
| Coronary heart disease | 0 | 0 | 0 | |
| Cerebral vascular disease | 0 | 0 | 0 | |
| Hepatitis B | 0 | 0 | 0 | |
| Chronic kidney disease | 0 | 0 | 0 | |
| Incubation period | 6.0 (2.0-10.0) | 4.0 (1.0-11.3) | 6.0 (3.0-9.0) | 0.40 |
| Signs and symptoms | | | | |
| Fever | 26 (55.3) | 9 (64.3) | 17 (51.5) | 0.53 |
| Cough | 11 (23.4) | 2 (14.3) | 9 (27.3) | 0.46 |
| Little phlegm | 15 (31.9) | 4 (28.6) | 11 (33.3) | 1.00 |
| Hemoptysis | 0 | 0 | 0 | |
| Conjunctiva injection | 1 (2.1) | 0 | 1 (3.0) | 1.00 |
| Muscular Soreness | 4 (8.5) | 0 | 4 (12.1) | 0.30 |

| | | | | |
|---|-----------|-----------|-----------|-------|
| Lacking in strength | 4 (8.5) | 2 (14.3) | 2 (6.1) | 0.57 |
| Headache or dizzy | 6 (12.8) | 2 (14.3) | 4 (12.1) | 1.00 |
| Anorexia | 4 (8.5) | 3 (21.4) | 1 (3.0) | 0.073 |
| Diarrhea | 1 (2.1) | 1 (7.1) | 0 | 0.30 |
| Stuffy or runny nose | 8 (17.0) | 3 (21.4) | 5 (15.2) | 0.68 |
| Sore throat | 9 (19.1) | 2 (14.3) | 7 (21.2) | 0.70 |
| Nausea and vomit | 2 (4.3) | 0 | 2 (6.1) | 1.00 |
| CT manifestation | | | | 0.52 |
| Viral pneumonia | 29 (61.7) | 10 (71.4) | 19 (57.6) | |
| Non viral pneumonia | 18 (38.3) | 4 (28.6) | 14 (42.4) | |
| Loss of leukocyte/lymphocyte in blood routine examination | 7 (14.9) | 3 (21.4) | 4 (12.1) | 0.41 |

Data are presented as median (interquartile range) and n (%).

Table 2. The duration of positive-to-negative conversion of SARS-CoV-2 among the groups

| | Duration of PTN | vs. | Duration of PTN | <i>P</i> value |
|--------------------|-----------------|------------|--------------------------|----------------------|
| Control | 10.0 (6.5-14.5) | vs. | Test group | 7.0 (3.8-10.8) 0.032 |
| | | | 5min group | 7.0 (5.5-13.0) 0.45 |
| | | | 10min group | 3.0 (3.0-7.5) 0.0065 |
| | | | 10min+10min group | 8.5 (4.8-16.0) 0.56 |
| 5min group | 7.0 (5.5-13.0) | vs. | 10min group | 3.0 (3.0-7.5) 0.064 |
| | | | 10min+10min group | 8.5 (4.8-16.0) >0.99 |
| 10min group | 3.0 (3.0-7.5) | vs. | 10min+10min group | 8.5 (4.8-16.0) 0.12 |

Data are presented as median (interquartile range).

PTN is short for positive-to negative.

Figures

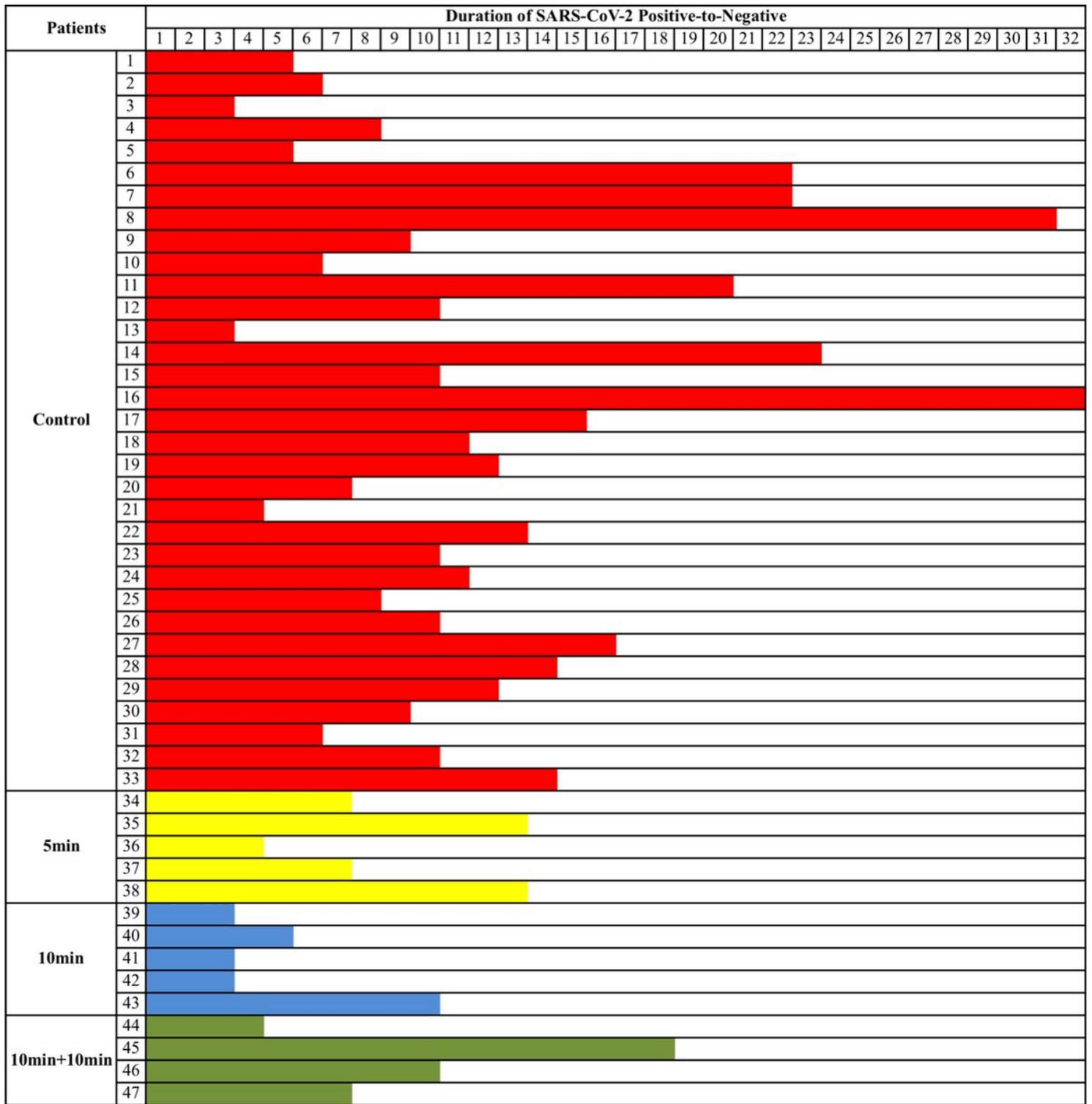


Figure 1

The duration of positive-to-negative conversion of SARS-CoV-2 of 47 patients. It was the time from laboratory conformed positive to negative of SARS-CoV-2 RNA result after two sequential negative respiratory tract sample results. The interval between the two negative results must be more than 24 hours.