Effective treatment of COVID-19 pneumonia with the Chinese herbal decoction FeiDuQing: A retrospective cohort study

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Research

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Abstract

Background

The coronavirus disease (COVID-19) pandemic has had catastrophic consequences globally. Nevertheless, the majority of the global population has not been vaccinated against the disease, and available treatments are limited. *FeiDuQing* (FDQ), a Chinese medicinal decoction widely used for COVID-19 pneumonia in Xianning City, China, has a cure rate of 98.21%. Therefore, evaluating the role of FDQ in successfully treating patients with COVID-19 is crucial.

Methods

In this retrospective cohort study, 355 consecutive patients who developed COVID-19 pneumonia between January 15 and February 18, 2020 were included; among them, 213 received FDQ. Data on the demographic characteristics, length of hospitalizations, symptoms at admission and discharge, adverse events, and laboratory parameters were analyzed.

Results

In contrast to patients who received FDQ, 12 patients who did not receive FDQ (8.45%) developed severe conditions, and one of them died. Furthermore, FDQ treatment was associated with a shortened duration of hospitalization (18.2 vs. 22.1 days, \( P < 0.0001 \)), even in elderly patients aged > 60 years (18.0 days vs. 26.1 days, \( P < 0.0001 \)). At discharge, three (1.40%) patients treated with FDQ had mild symptoms, whereas 16 (11.19%) patients not treated with FDQ had various symptoms. The cumulative survival rates of patients treated with FDQ and those not treated with FDQ were 79.04% and 32.60%, respectively (hazard ratio: 0.210, 95% confidence interval: 0.123–0.357, \( P < 0.001 \)). Additionally, FDQ had no severe adverse effects.

Conclusions

Our findings suggest that FDQ is a potential therapeutic candidate for fighting COVID-19.

Background

The coronavirus disease (COVID-19) pandemic caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has become a serious global health threat. As of May 27, 2021, COVID-19 had spread to 220 countries and territories and caused 3,524,490 deaths worldwide [1]. Currently, no drug has been approved by the Food and Drug Administration for the treatment of COVID-19, except remdesivir, which was authorized only for emergency use in hospitalized patients [2]. However, a recent review of
pharmacological, preclinical, and clinical studies has revealed mixed results and various side effects associated with remdesivir [3].

In China, the pandemic has been controlled through strict control measures, vast surveillance systems, and integrated treatment with both Western and traditional Chinese medicine. Although the theories underlying traditional Chinese medicine may appear obscure or complicated by the standards of Western medicine, it has played an important role in controlling epidemics since ancient China [4] and was used extensively during the outbreaks of severe acute respiratory syndrome [5] and influenza A H1N1 [6].

In this study, we retrospectively examined the use of FeiDuQing (FDQ), a Chinese herbal decoction, for treating hospitalized patients with COVID-19 in Xianning City, Hubei Province, China, using historical data. Xianning City, known as the South Gate of Wuhan, is a prefecture-level city located 50 miles away from Wuhan, where the original SARS-CoV-2 infections were first reported. Xianning City has 3 million permanent residents [7], with 200,000 migrant workers who returned from Wuhan before the lockdown [8].

FDQ is composed of 12 herbal components, including divaricate Shaposhnikov root, stir-fried Atractylodes macrocephala, Houttuynia cordata Thunb, Radix Paeoniae Rubra, Chinese thorowax root, Platycodon grandiflorum, Fritillaria acuminate, winter mulberry leaf, Ramulus cinnamomi, stir-fried white paeony root, Radix isatidis, and Glycyrrhiza uralensis [9]. It was first developed at the beginning of the COVID-19 outbreak in Wuhan on January 20, 2020. After successfully curing a 70-year-old woman with a long history of diabetes and a cluster of infection involving five people, use of FDQ was included in the official COVID-19 treatment guidelines in several counties of Xianning City [10].

On March 17, 2020, Xianning City became the first prefecture-level city in Hubei Province to discharge all of its patients diagnosed with COVID-19, with a cure rate as high as 98.21% [10]. There are seven tertiary-level hospitals in Xianning City, and more than half of the patients managed at these hospitals were treated with FDQ. This cohort study aimed to assess the role of FDQ in treating COVID-19 pneumonia and to investigate whether it may be an effective therapy for COVID-19.

**Methods**

**Study design and patients**

In this retrospective cohort study, we reviewed all patients with COVID-19 pneumonia who were admitted to the seven tertiary hospitals in Xianning City, Hubei Province, China, between January 15, 2020 and February 18, 2020. The study duration was not predetermined but represents the period between the first COVID-19 pneumonia admission to our hospitals and the initiation of FDQ treatment in all patients with NCP in Xianning City. After February 18, 2020, no control patients (non-FDQ treated) were available for the cohort study.

Our inclusion criteria included patients aged 10–90 years who were diagnosed with COVID-19 according to the World Health Organization's interim guidelines [11] and had at least one COVID-19 pneumonia-
related symptom. Patients in the FDQ treatment group were required to have received in-hospital FDQ treatment for at least five consecutive days. We excluded patients who were infected but without signs and symptoms, pregnant, those who received FDQ treatment for < 5 days, and those who were critically ill with organ dysfunction due to other underlying medical conditions.

Based on these eligibility criteria, 355 patients with COVID-19 pneumonia were included in this cohort study, with 213 in the FDQ-treatment group and 142 in the non-FDQ-treatment group. All patients provided written informed consent for data collection. The Ethics Committee of The Second Affiliated Hospital of Hubei College of Science and Technology granted ethical approval for the study (approval # 202002005). The study was performed in accordance with the tenets of the Declaration of Helsinki.

Procedures

At the time of hospital admission, all patients in both groups received the recommended standard treatments based on the Diagnosis and Treatment Protocol for COVID-19 published by the Chinese National Health Commission (4th to 7th editions) [12]. In addition, FDQ, an herbal decoction composed of 12 herbs, was administered orally twice daily (150 mL per dose) to patients in the FDQ-treatment group. FDQ was provided by the Department of Medication Preparation of each hospital with a Decoctable Packaging Machine (Samyam, LCK2000).

Upon discharge, the patients were required to have met the following criteria: no fever for > 3 days, significantly improved respiratory symptoms, obvious resolution of inflammation on chest radiography or computed tomography, and two consecutive negative results for COVID-19 reverse transcription polymerase chain reaction tests performed at > 24-h interval.

Study variables and assessments

We retrospectively collected data related to patient demographics, symptoms, admission and discharge dates, laboratory values, and therapies from patients’ medical records. For symptom assessments and laboratory examinations, only values at admission and discharge were available for analyses.

The following features were analyzed: age, sex, hospitalization days, ratio of patients who developed severe conditions and required ventilator support during the treatment course, and symptoms and laboratory values at admission and at discharge.

Statistical analyses

Continuous variables are reported as means and standard deviations if they were normally distributed or as medians and interquartile ranges if they were non-normally distributed. Categorical variables are described as numbers (%) and compared using the chi-square test.

The Kaplan–Meier method and Cox proportional-hazard model were used to analyze the effects of each variable on the outcome of interest (discharged or not discharged by February 26, 2020). Hazard ratios
(HR) with 95% confidence intervals (CI) were reported. The differences in the outcome between the two groups were assessed using a Cox regression survival curve and HR.

The threshold for significance was set at a $P$-value of $\leq 0.05$. Statistical analyses were performed with SPSS version 24.0 (IBM Corp, Armonk, NY, USA), and graphs were plotted using Prism version 8.0 (GraphPad Software Inc, La Jolla, CA, USA).

## Results

### Demographic characteristics

A total of 355 patients with COVID-19 pneumonia were included in this study. Among the patients, 142 received only the standard treatment recommended in the Diagnosis and Treatment Protocol for COVID-19, provided by the Chinese National Health Commission [9]. A total of 213 patients were treated with FDQ in addition to the standard treatment protocol. The demographic characteristics of both groups are summarized in Table 1. The average ages and sexes of patients in the FDQ and non-FDQ groups were similar. The average age of the FDQ group was $45.65 \pm 14.22$ years (range, 13–82 years), and 60.1% were men. The average age of the non-FDQ group was $47.74 \pm 13.44$ years (range, 15–79 years,) and 60.6% were men (Table 1). We further divided the patients into the following three subgroups by age: $\leq 30$ years, 31–60 years, and $\geq 61$ years, and there were no significant differences in age or sex observed between these subgroups.

![Table 1](image)

| Characteristics | FDQ (n = 213) | non-FDQ (n = 142) | $P$-value |
|-----------------|--------------|-------------------|-----------|
| Age (years), mean ± SD | $45.65 \pm 14.22$ | $47.74 \pm 13.44$ | 0.166 |
| $\leq 30$ | $25.59 \pm 4.68$ | $26.05 \pm 3.98$ | 0.710 |
| 31–60 | $45.44 \pm 8.414$ | $47.47 \pm 8.02$ | 0.067 |
| $\geq 61$ | $67.06 \pm 4.87$ | $65.56 \pm 5.22$ | 0.245 |
| Sex (male), n (%) | 128 (60.1%) | 86 (60.6%) | 1.000 |
| $\leq 30$ | 25 (67.6%) | 13 (61.9%) | 0.776 |
| 31–60 | 83 (59.3%) | 57 (60.6%) | 0.892 |
| $\geq 61$ | 20 (55.6%) | 16 (59.3%) | 0.802 |

FDQ: FeiDuQing; SD: standard deviation

### Clinical presentations
At admission, the most common symptoms were fever, cough, fatigue, and poor appetite. The prevalence rates of these common symptoms (such as fever and cough) were either similar in the FDQ and non-FDQ groups or higher in the FDQ group (such as fatigue and poor appetite) (Table 2). Less common symptoms included chest pain or pressure, soreness, chills, headache, diarrhea, congested or runny nose, throat discomfort, dizziness, and nausea or vomiting. Other symptoms, including abdominal pain and palpitation, were rare (< 1%).

Table 2  
Comparison of signs and symptoms at admission and at discharge

| Signs and symptoms, n (%) | FDQ (n = 213) | non-FDQ (n = 142) |
|--------------------------|--------------|-------------------|
|                          | Admission (%)| Discharge (%)      | Admission (%) | Discharge (%) |
| Fever                    | 155 (72.8)   | 0 (0)             | 101 (71.1)    | 0 (0)         |
| Cough                    | 148 (69.5)   | 1 (0.5)           | 102 (71.8)    | 10 (7.0)      |
| Fatigue                  | 70 (32.9)    | 1 (0.5)           | 35 (24.6)     | 4 (2.8)       |
| Poor appetite            | 39 (18.3)    | 0 (0)             | 15 (10.6)     | 1 (0.7)       |
| Pain or pressure in the chest | 34 (16.0) | 0 (0)             | 11 (7.7)      | 0 (0)         |
| Sore body                | 23 (10.8)    | 0 (0)             | 11 (7.7)      | 0 (0)         |
| Chills                   | 24 (11.3)    | 0 (0)             | 23 (16.2)     | 0 (0)         |
| Headache                 | 17 (8.0)     | 0 (0)             | 5 (3.5)       | 0 (0)         |
| Shortness of breath      | 10 (4.7)     | 0 (0)             | 7 (4.9)       | 2 (1.4)       |
| Congestion or runny nose | 10 (4.7)     | 1 (0.5)           | 5 (3.5)       | 0 (0)         |
| Diarrhea                 | 8 (3.8)      | 0 (0)             | 11 (7.7)      | 0 (0)         |
| Sore throat              | 6 (2.8)      | 0 (0)             | 10 (7.0)      | 0 (0)         |
| Dizziness                | 7 (3.3)      | 0 (0)             | 6 (4.2)       | 0 (0)         |
| Nausea or vomiting       | 5 (2.3)      | 0 (0)             | 10 (7.0)      | 1 (0.7)       |
| Abdominal pain           | 2 (0.9)      | 0 (0)             | 2 (1.4)       | 0 (0)         |
| Palpitation              | 1 (0.5)      | 0 (0)             | 1 (0.7)       | 1 (0.7)       |
| Excessive sweating       | 1 (0.5)      | 0 (0)             | 0 (0)         | 0 (0)         |
| Insomnia                 | 0 (0)        | 0 (0)             | 2 (1.4)       | 1 (0.7)       |

FDQ: FeiDuQing
At discharge, the rate of symptomatic improvement was significantly different between the FDQ and non-FDQ groups \((P = 0.000)\). While only three (1.41%) of the 213 patients treated with FDQ had symptoms, 16 (11.19%) patients in the non-FDQ group continued to experience symptoms, including cough (10; 7.0%), fatigue (4; 2.8%), poor appetite (1; 0.7%), shortness of breath (2; 1.4%), nausea (1; 0.7%), palpitation (1; 0.7%), and insomnia (1, 0.7%) (Table 2). In addition, during the treatment course, 12 (8.45%) of the 142 patients who did not receive FDQ treatment became severely ill, and one patient died. However, no patients in the FDQ group developed any severe conditions, although their clinical manifestations at admission did not significantly differ from those who did not receive FDQ treatment (Table 3).

| Adverse event, n (%) | FDQ (n = 213) | non-FDQ (n = 142) |
|----------------------|---------------|-------------------|
| Clinical worsening   | 0 (0)         | 12 (8.45)         |
| Death                | 0 (0)         | 1 (0.70)          |

FDQ: *FeiDuQin.*

Laboratory tests were performed at admission and discharge. The white blood cell count, lymphocyte count, and neutrophil count were within the normal ranges in most patients in both groups. The C-reactive protein (CRP) and high-sensitivity CRP levels varied widely between individuals, especially at admission (Table 4).
Table 4
Laboratory examination values at admission and at discharge

|                                | FDQ (n = 213) | non-FDQ (n = 142) |
|--------------------------------|---------------|-------------------|
|                                | Normal range  | Admission         | Discharge        | Admission         | Discharge        |
| Increased in COVID-19          |               |                   |                  |                   |
| White blood cell count, ×10⁹/L | 3.50–9.50     | 5.01 (3.74–6.08)  | 5.41 (4.40–6.63) | 4.13 (3.40–5.51)  | 5.29 (4.21–6.66) |
| Decreased in COVID-19          |               |                   |                  |                   |
| Lymphocyte count, × 10⁹/L      | 1.10–3.20     | 1.16 (0.96–1.60)  | 1.58 (1.28–1.83) | 1.08 (0.77–1.42)  | 1.44 (1.20–1.73) |
| Decreased in COVID-19          |               |                   |                  |                   |
| Neutrophil count, × 10⁹/L      | 1.80–6.30     | 3.31 (2.17–4.35)  | 3.38 (2.60–4.49) | 2.62 (2.11–3.54)  | 3.20 (2.40–4.32) |
| CRP, mg/L                      | 0.00–5.00     | 24.00 (11.70–44.25) | 3.40 (2.60–7.35) | 22.45 (10.95–41.10) | 6.40 (2.93–7.75) |
| hs-CRP, mg/L                   | < 4.00        | 4.70 (2.08–9.26)  | 1.43 (0.86–2.49) | 2.50 (1.30–4.20)  | 2.20 (1.60–3.30) |

Data are presented as means (interquartile ranges). *Higher levels of CRP may be a predictive marker for determining which patients with mild COVID-19 will progress to more severe disease according to study results published in the Open Forum of Infectious Diseases. FDQ: *FeiDuQing;* COVID-19: coronavirus disease; CRP: C-reactive protein

At admission, 29 (13.55%) patients who received FDQ treatment and 23 (16.20%) patients who did not receive FDQ treatment had CRP levels > 50 mg/L. However, none of the patients who received FDQ treatment developed severe conditions, while 12 patients (8.45%) who received standard treatment developed severe conditions during the treatment course. Upon discharge, CRP and high-sensitivity CRP levels were dramatically decreased in most patients, indicating recovery from NCP.

### Duration of hospitalization

Compared with that in patients who did not receive FDQ treatment, the length of hospitalization in patients who received FDQ was significantly shorter (18.2 days vs. 22.1 days, P < 0.0001) (Fig. 1A, Table 5). To investigate whether age impacted the length of the hospital stay, we further divided patients into three age groups: ≤30 years, 31–60 years, and ≥61 years. In these age groups, the hospital stay was significantly shorter in patients who received FDQ treatment, with 16.1 days in patients aged ≤30 years, 18.7 days in patients aged 31–60 years, and 18.0 days in patients aged ≥61 years (Fig. 1B, Table 5). With or without FDQ treatment, the ≤30-year-old population had the shortest hospital stays, suggesting that young people recovered faster from COVID-19 than did older individuals. There was a notable positive relationship between age and the length of hospital stay in patients not treated with FDQ; 20.1
days in patients aged \( \leq 30 \) years, 21.3 days in patients aged 31–60 years, and up to 26.1 days in patients aged \( \geq 61 \) years. However, this positive correlation was not observed in patients treated with FDQ aged \( \geq 30 \) years (\( P = 0.525 \)). Remarkably, the average length of hospital stay among patients treated with FDQ and \( \geq 61 \) years of age was only 18.0 days (Table 5).

Table 5
Average duration of hospitalization

| Age groups          | All patients |
|---------------------|--------------|
|                     | \( \leq 30 \) years | 31–60 years | \( \geq 61 \) years |
| FDQ (n = 213), days | 16.1 \( \pm \) 4.6  | 18.7 \( \pm \) 5.4 | 18.0 \( \pm \) 6.7 | 18.2 \( \pm \) 5.6 |
| non-FDQ (n = 142), days | 20.1 \( \pm \) 5.8 | 21.3 \( \pm \) 5.7 | 26.1 \( \pm \) 4.9 | 22.1 \( \pm \) 5.9 |
| \( P \)-value       | 0.0101        | 0.0006       | < 0.0001          | < 0.0001          |

FDQ: FeiDuQing

Cox proportional-hazard model analysis

We conducted univariate and multivariate Cox proportional-hazard model analyses to further assess the impact of various factors on the event outcome. We defined the event outcome as “not discharged” from the hospital as of February 26, 2020. Our analysis identified treatment without FDQ as the only risk factor for the event outcome in this study (univariate analysis: HR, 0.20; 95% CI: 0.13–0.32; multivariate analysis: HR, 0.21; 95% CI: 0.12–0.36) (Table 6).

Table 6
Hazard ratios of factors affecting the event outcome

| Factor                  | Univariate analysis | Multivariate analysis |
|-------------------------|---------------------|-----------------------|
|                         | HR (95% CI)         | P-value | HR (95% CI) | P-value |
| Age                     | 1.02 (1.00–1.03)    | 0.052   | 1.02 (1.00–1.03) | 0.053 |
| Sex (male vs. female)   | 0.99 (0.67–1.48)    | 0.971   | 1.02 (0.68–1.53) | 0.938 |
| Treatment (FDQ vs. non-FDQ) | 0.20 (0.13–0.32) | 0.000   | 0.21 (0.12–0.36) | 0.000 |
| White blood cell count  | 1.05 (1.02–1.09)    | 0.078   | 1.04 (1.00–1.09) | 0.074 |
| Lymphocyte count        | 1.03 (0.78–1.36)    | 0.839   | 1.09 (0.83–1.42) | 0.547 |
| Neutrophil count        | 1.13 (1.01–1.25)    | 0.289   | 1.06 (0.94–1.19) | 0.364 |
| C-reactive protein      | 1.01 (1.00–1.02)    | 0.169   | 1.00 (0.99–1.01) | 0.960 |
| hs-CRP                  | 1.00 (0.95–1.06)    | 0.998   | 1.00 (0.95–1.06) | 0.915 |

HR: hazard ratio; CI: confidence interval; FDQ: FeiDuQing, hs-CRP: high-sensitivity CRP
Treatment groups were also compared using a Cox regression survival curve. Survival curves were plotted for all patients, as well as for those in different age subgroups. This analysis showed a significantly higher survival rate in patients treated with FDQ than in patients not treated with FDQ ($P < 0.001$) (Fig. 2A). The cumulative probabilities estimated for all patients who received or did not receive FDQ treatment were 79.04% and 32.60%, respectively. The same conclusions were drawn in the age subgroups: 98.36% vs. 86.11% ($P = 0.041$) in patients aged $\leq 30$ years (Fig. 2B); 80.56% vs. 36.17% ($P < 0.001$) in patients aged 31–60 years (Fig. 2C); and 51.19% vs. 7.36% ($P = 0.017$) in patients aged $\geq 61$ years (Fig. 2D).

**Discussion**

This retrospective study evaluated the safety and efficacy of FDQ, a Chinese herbal decoction, in the treatment of patients with NCP. Clinical data showed an association between FDQ treatment and symptomatic improvement, as well as a shortened duration of hospitalization. Symptomatic improvement has also been observed in a separate study, which examined the use of FDQ to treat a big cluster infection in a special population (manuscript submitted for publication by Wang W and Fu B [unpublished data]), in which the most common COVID-19 related symptoms, such as cough and fever, improved or disappeared within 48 hours of FDQ administration. Additionally, FDQ treatment was well tolerated and was not associated with any serious adverse events during the study period. Some patients reported mild diarrhea or abdominal pain, which usually disappeared within 2–3 days.

Several studies have suggested that the risk of severe illness in patients with COVID-19 increases with age, with the highest risk in older adults [13, 14]. Consistent with the results of other studies [15, 16], we found that the duration of hospitalization increased with age, especially in patients who were not treated with FDQ. However, a similar trend was not observed in patients treated with FDQ who were aged $\geq 31$ years. With FDQ treatment, the average length of hospital stay among patients aged $\geq 61$ years was only 18.0 days, which did not significantly differ from that of 18.7 days in patients aged 31–60 years ($P = 0.525$), indicating the effectiveness of FDQ for treating NCP. However, the overall duration of hospitalization observed in this cohort study was longer than the median length of 10–13 days that has been reported previously [15]. This discrepancy may have been due to differences in the thresholds for hospitalization.

In addition, on Cox proportional-hazard model analysis, a higher estimated survival rate was observed in patients of all age groups who received FDQ treatment versus those who did not receive FDQ. Moreover, the effects of FDQ were more notable in elderly patients than in young patients, which is important to consider when establishing an effective therapeutic plan for the former patient population.

Recent studies have associated elevated CRP levels with poor outcomes [17, 18]. However, we did not find a correlation between high CRP levels and an increased risk of developing more severe disease in our study. This discrepancy may have been due to the limited sample size or the benefits of FDQ treatment.
Our study had some limitations because of its retrospective, observational design. First, we did not perform a randomized comparison; therefore, assignment of treatment and patient biases cannot be ruled out. Second, the study population only included patients within Xianning City, Hubei Province, China. Third, most cases were diagnosed in outpatient settings with limited documentation of medical information, resulting in inadequate laboratory data. Fourth, clinical features during the disease course were not available, and the data for some important COVID-19 biomarkers, such as interleukin-6 and D-dimer levels [16], were absent due to a shortage of laboratory supplies and medical staff. This prevented the monitoring of changes in results over time, along with other clinical indicators. Additionally, our findings were limited by the absence of knowledge regarding confounding factors, such as the prevalence of chronic health conditions. Therefore, other unrecognized potential factors may have influenced our results. Nonetheless, a significantly shortened length of hospital stay and symptomatic improvement after FDQ treatment can be considered as extremely good surrogate indicators of both drug efficacy and safety in clinical practice.

To the best of our knowledge, this is the first large-scale cohort study that specifically examined the use of a traditional Chinese medicine in the treatment of COVID-19, although traditional Chinese medicine has been widely applied in China with satisfactory results. Despite the limitations of this study, FDQ appears to be an effective and safe treatment option for patients with NCP, even in the elderly. Indeed, because of its remarkable clinical efficacy, FDQ has been widely used by outpatients at home and in senior care and mental health centers. Xianning City achieved a 98.21% cure rate in treating COVID-19 patients [19, 20]. In addition, FDQ is inexpensive and easy to administer (drinking twice daily), and only minimal side effects have been observed as a result of its use. This observational study suggests that the use of FDQ may provide clinical benefit, although these findings require validation by randomized controlled trials in the future.

Conclusions

In conclusion, although we cannot rule out the impact of potentially important confounding factors, it is noteworthy that patients who received FDQ recovered faster and had a lower risk of a severe prognosis than did those who did not receive FDQ. We believe that this study shows that FDQ is a promising alternative treatment for battling the COVID-19 pandemic. However, additional basic research and rigorously designed clinical studies investigating FDQ therapy are necessary in the future.

Abbreviations

CI
confidence interval
COVID-19
coronavirus disease
CRP
C-reactive protein
Declarations

Ethics approval and consent to participate: All patients provided written informed consent for data collection. The Ethics Committee of The Second Affiliated Hospital of Hubei College of Science and Technology granted ethical approval for this study (approval # 202002005). The study was performed in accordance with the Declaration of Helsinki.

Consent for publication: Not applicable.

Availability of data and materials: The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests: The authors declare that they have no competing interests.

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Authors' contributions: WW and XM conceived and designed the study. WW, BF, WX, SC, TL, GC, GL, RZ, WZ, TC, PL, PC, and XM performed the research. WW analyzed the data and wrote the paper. All authors read and approved the final manuscript.

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References
1. Worldometer. Countries where COVID-19 has spread. 2020. https://www.worldometers.info/coronavirus/countries-where-coronavirus-has-spread/?rel=outbound. Accessed 27 May 2021.

2. Food and Drug Administration. Coronavirus (COVID-19) update: FDA issues emergency use authorization for potential COVID-19 treatment. 2020. https://www.fda.gov/news-events/press-announcements/coronavirus-covid-19-update-fda-issues-emergency-use-authorization-potential-covid-19-treatment. Accessed 20 Oct 2020.

3. Singh AK, Singh A, Singh R, Misra A. Remdesivir in COVID-19: a critical review of pharmacology, pre-clinical and clinical studies. Diabetes Metab Syndr. 2020;14:641–8. doi:10.1016/j.dsx.2020.05.018.

4. Ping-chung L. Epidemic diseases and Chinese medicine - from ancient to current time. J Trop Med Infect Dis. 2020;1:001. doi:10.29011/JTMID-101.100001.

5. World Health Organization. SARS: clinical trials on treatment using a combination of traditional Chinese medicine and western medicine. 2020. https://apps.who.int/iris/handle/10665/43029. Accessed 20 Oct 2020.

6. Wang C, Cao B, Liu QQ, Zou ZQ, Liang ZA, Gu L, et al. Oseltamivir compared with the Chinese traditional therapy maxingshigan-yinqiaosan in the treatment of H1N1 influenza: a randomized trial. Ann Intern Med. 2011;155:217–25. doi:10.7326/0003-4819-155-4-201108160-00005.

7. Wikipedia X. 2020. https://en.wikipedia.org/wiki/Xianning. Accessed 20 Oct 2020.

8. Li SJSF. The Economic Observer. The 5 million people who left Wuhan: who are they? Where did they go? 2020. http://www.eeo.com.cn/2020/0128/375098.shtml. Accessed Oct 2020.

9. Jiayu Express. Chinese medicine expert Wang Weiwu contributed the prescription of "FeiDuQing" for COVID-19. 2020. http://www.yidianzixun.com/article/0OiLYxLT. Accessed 20 Oct 2020.

10. China CNR. Xianning became the first prefecture-level city in Hubei Province that cured all COVID-19 patients (in Chinese). 2020. http://china.cnr.cn/NewsFeeds/20200318/t20200318_525021474.shtml. Accessed 20 Oct 2020.

11. World Health Organization. Laboratory testing strategy recommendations for COVID-19: interim guidance. Updated March 21 2020. https://www.who.int/publications/i/item/laboratory-testing-strategy-recommendations-for-covid-19-interim-guidance. Accessed 20 Oct 2020.

12. National Health Commission of the People's Republic of China. Diagnosis and Treatment Protocol for COVID-19 (Trial Version 7). Updated March 29 2020. Available at http://en.nhc.gov.cn/2020-03/29/c_78469.htm. Accessed 20 Oct 2020.

13. Ioannidis JPA, Axfors C, Contopoulos-Ioannidis DG. Population-level COVID-19 mortality risk for non-elderly individuals overall and for non-elderly individuals without underlying diseases in pandemic epicenters. Environ Res. 2020;188:109890. doi:10.1016/j.envres.2020.109890.

14. Leung C. Risk factors for predicting mortality in elderly patients with COVID-19: A review of clinical data in China. Mech Ageing Dev. 2020;188:111255. doi:10.1016/j.mad.2020.111255.

15. Gold JAW, Wong KK, Szablewski CM, Patel PR, Rossow J, da Silva J, et al. Characteristics and clinical outcomes of adult patients hospitalized with COVID-19 - Georgia, March 2020. MMWR Morb Mortal
16. Kermali M, Khalsa RK, Pillai K, Ismail Z, Harky A. The role of biomarkers in diagnosis of COVID-19 - a systematic review. Life Sci. 2020;254:117788. doi:10.1016/j.lfs.2020.117788.

17. Wang K, Zuo P, Liu Y, Zhang M, Zhao X, Xie S, et al. Clinical and laboratory predictors of in-hospital mortality in patients with coronavirus disease-2019: a cohort study in Wuhan, China. Clin Infect Dis. 2020;71:2079–88. doi:10.1093/cid/ciaa538.

18. Huang I, Pranata R, Lim MA, Oehadian A, Alisjahbana B. C-reactive protein, procalcitonin, D-dimer, and ferritin in severe coronavirus disease-2019: a meta-analysis. Ther Adv Respir Dis. 2020;14:1753466620937175. doi:10.1177/1753466620937175.

19. Yangfei Z. China Daily. TCM proving potent force in contagion fight. 2020. https://www.chinadaily.com.cn/a/202003/07/WS5e62fceba31012821727d198.html. Accessed 20 Oct 2020.

20. Xinhuanet. TCM has proved effective in fighting COVID-19 in Xianning city. 2020. http://www.xinhuanet.com/local/2020-03/04/c_1125659745.htm. Accessed 20 Oct 2020.

Figures
Figure 1

Comparison of the lengths of hospitalization between patients treated and those not treated with FDQ. (A) All patients treated or not treated with FDQ; (B) All patients treated or not treated with FDQ within age-stratified subgroups: patients aged ≤30 years, 31–60 years, and ≥61 years. FDQ: FeiDuQing
Figure 2

Overall survival curves of patients treated versus patients not treated with FDQ. (A) All patients treated or not treated with FDQ; (B) patients aged ≤30 years; (C) patients aged 31–60 years; and (D) patients aged ≥61 years. FDQ: FeiDuQing