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ORIGINAL ARTICLE

Retrospective Study

"An integrated system, three separated responsibilities", a new fever clinic management model, in prevention and control of novel coronavirus pneumonia

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Author contributions: Shen J and He Q contributed equally to this article and should be considered as co-first authors; Shen J, He Q, Shen T, Wu ZQ, and Zhang J performed the operation; Tan MM and Chen YL designed this retrospective study; Weng Q and Nie LM wrote this paper; Zhang HF and Zheng B were responsible for sorting the data; all authors actively reviewed and revised the manuscript and approved the finally submitted manuscript.

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Abstract

BACKGROUND

Since December 2019, there have been many new cases of coronavirus pneumonia in Wuhan, Hubei Province, which has gradually spread throughout the country.

AIM

To explore our hospital's innovative management system to ensure the efficient operation of fever clinics during the epidemic, since controlling the spread of disease is an important way to prevent and control the epidemic.

METHODS

In total, 200 outpatients with fever at our hospital between November 2019 and July 2020 were selected and allocated into two groups.

RESULTS

The fever clinic in our hospital operated smoothly, and infection with the novel coronavirus disease (COVID-19) has not been reported in our hospital. Additionally, we did not have any cases of missed diagnosis. The awareness regarding COVID-19 infection sources, transmission routes, early symptoms, and preventive measures was significantly higher in our fever clinic than in those of the pre-management group.

Hospital ethics committee (approval No. 2021QT048).

Informed consent statement: Patients were not required to give informed consent to the study because the analysis used anonymous clinical data that were obtained after each patient agreed to treatment by written consent.

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CONCLUSION

"An integrated system, three separate responsibilities" ensured the efficient functioning of our fever outpatient clinic and early screening of COVID-19 cases, which effectively curbed the transmission of COVID-19 and hence prevented COVID-19 pneumonia epidemic in our hospital, ultimately achieving the maximum effect of epidemic prevention and control.

Key Words: Fever clinics; Novel coronavirus; Novel coronavirus pneumonia; Integration of three responsibilities; Epidemic prevention and control

Core Tip: The coronavirus disease 2019 pandemic resulted in a rapid spread of severe acute respiratory syndrome coronavirus 2 in China. It has been the most widespread and difficult to prevent and control among all major public health emergencies experienced in the recent years. We initiated the "wartime" vertical management model and took over the related operation management of the fever clinic in an all-round way.

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INTRODUCTION

Since December 2019, there have been many new cases of coronavirus pneumonia in Wuhan, Hubei Province, and the infection has gradually spread throughout the country. Therefore, the State Health and Health Commission incorporated the coronavirus disease 2019 (COVID-19) into the class B infectious diseases classification, as stipulated in the law of the People's Republic of China on the prevention and control of infectious diseases and took measures to prevent and control class A infectious diseases. At present, COVID-19 infection is rapidly spreading in China since the founding of new China. It has been the most widespread and difficult to prevent and control of any major public health emergency[1].

In the face of the sudden outbreak of the new coronavirus pneumonia, fever clinics are an important tool for prevention and control of related infectious diseases in the hospital[2]. They are the first barrier to prevent infectious disease epidemics in hospitals and an important means to prevent nosocomial infections[3].

The Department of Medical Services of the Zhejiang Provincial People's Hospital analyzed the defects and drawbacks of the original management system of the fever clinic, and took the lead in initiating a "wartime" vertical management model and took over the related operations management of the fever clinic, innovating and constructing the vertical management model, and dynamically adjusting and strengthening the efficiency of this vertical control. These measures ensured the prevention and control of the coronavirus pneumonia epidemic in a timely and effective manner. In this study, we compared the use of epidemic protection measures in the fever clinic under the old and new fever clinic management models. Differences in the effect of education about COVID-19 among medical care professionals and patients, and how to operate and manage fever clinics efficiently during the COVID-19 pandemic are discussed below.

MATERIALS AND METHODS

Information and methods

Information: Patients who visited our hospital between November 2019 and July 2020

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were selected and divided into two groups. Group A was managed under the original operation management model of the fever clinic (November 2019 to January 2020), whereas group B was managed under the "an integrated system, three separate responsibilities" operation management model (February 2020 to July 2020).

Inclusion criteria: Patients with a clear or suspected epidemiological history in accordance with the National Health Council's "New Coronary Pneumonia Diagnosis and Treatment Program (trial 7th edition)" were included. All patients signed the fever clinic's informed consent form.

Exclusion criteria: Patients with severe heart, lung, liver, and kidney dysfunction; mental illness; severe malignancy; and autoimmune disease were excluded.

Questionnaire investigation: We used our self-designed questionnaire and "questionnaire online" to apply a scanning code survey. The patient survey included five questions asking for data regarding the following: The source of infection, transmission route, early symptoms, and preventive measures for COVID-19.

Current situation and defects in management of novel coronavirus epidemic

Loose administrative management mode of fever clinics inCOVID-19 pandemic: At present, the fever clinics in China's general hospitals adhere to the management mode of combining peacetime and wartime models. Their main tasks are the initial diagnosis and treatment of febrile patients and the investigation of infectious diseases. However, in the face of such infectious diseases as COVID-19, the original organizational framework and management model of these clinics is insufficient. The original management structure and personnel organization of the fever clinic are loose, and frontline medical professionals of the fever clinic are generally doctors and nurses from various relevant internal medicine departments, whose response to the scale of the pandemic or epidemic situation and allocation of prevention and control resources are extremely limited. At the beginning of the COVID-19 pandemic, numerous problems in the traditional fever outpatient management mode became apparent, particularly in terms of medical management, diagnosis and treatment training, team cooperation, and protection exercise, among others. The contradiction between the surge of patients and the insufficiencies in medical supplies also became apparent.

Unclear functional orientation of fever clinics in novel coronavirus outbreak: Fever clinics are the outpatient forms of infectious disease departments. Since infectious disease departments are recent additions in general hospitals in China, these departments are usually headed by the director of the hospital infectious diseases department or the director of the respiratory medicine department. These infectious disease departments are also supported by other relevant hospital departments. However, the professional functional positioning of these departments in most hospitals is vague. Is the main professional diagnosis and treatment work or the main function of sensory control management lack clear positioning?

Confusion in management of "wartime" and "non-wartime" fever clinics: The fever clinic belongs to the outpatient category. In general hospitals, it is usually subject to the management by hospital outpatient and emergency department or the outpatient office, and reports are mandatory to the director in charge of the outpatient and emergency departments in order to complete avian influenza, dengue fever, and other infectious disease investigations. However, in the case of infectious diseases such as the novel coronavirus pneumonia (NCP), which has not yet been clearly identified, the fever clinics suddenly required large amounts of resources and material allocation, joint efforts in prevention and control of the infection, as well as liaison and coordination. Therefore, if the "wartime" management mode is used in fever clinics during the COVID-19 pandemic, and the entire hospital is called upon to support the prevention and control work of these fever clinics, it is necessary to explore the systemic structure of fever clinics under this new situation. It is crucial to give importance to infection prevention and control in the fever clinic during the pandemic situation through a strong and effective management system, and build the fever clinic into a "whistle blower" and "vanguard" of the hospital's coronavirus pneumonia epidemic situation.

Exploration of vertical management of fever outpatient clinics

The innovative management mode of "an integrated system, three separate responsibilities" for the fever outpatient service had been implemented in the Zhejiang Provincial People's Hospital during the COVID-19 pandemic. Our hospital further

studied the policies and regulations such as the notice of the general office of the State Health and Health Commission on strengthening the management of fever outpatient services and infection prevention and control in key hospitals in key areas (2020) 102, and took this as the main theoretical basis for the innovative management of the fever outpatient services in our hospital.

Construction of an integrated vertical management system for the fever outpatient clinic: In the face of a severe surge of the NCP cases, in order to strengthen the combat effectiveness and cohesion of the fever clinic, the Zhejiang Provincial People's Hospital took the lead in implementing the innovative management mode of "an integrated system, three separate responsibilities" in fever clinics throughout the province. During the epidemic period, the hospital's fever clinic took the lead in implementing an innovative vertical management model, wherein the administrative management was run by the outpatient department and the business management was run by the infectious disease department, integrating the entire hospital epidemic prevention and control process into an organic whole. During the period of the COVID-19 pandemic, taking the prevention and control of COVID-19 as the main goal, officers from the head office are responsible for the overall management of all administrative matters, business training, and supervision.

The three separate responsibilities of the fever clinic: Above all, the fever clinic is responsible for differential diagnosis and treatment of patients with fever. The etiology of a fever depends on a number of diseases. Infectious fever remains a common disease in outpatients and emergency diagnosis. Often, it is difficult to distinguish a fever from a bacterial or viral infection. The sensitivity or specificity of routine examinations (such as routine blood tests) is poor, and it is difficult to distinguish the cause of fever quickly and effectively. Fever outpatient doctors should evaluate the patient's condition in time to carry out correct diagnosis, avoid cross-infection to protect patients, and accomplish the role of fever clinics in early warning, so that patients can receive timely and effective treatment[4]. Based on the existing literature, symptom monitoring in fever clinics has a more effective early warning value for respiratory infectious diseases[5]. Second, the fever clinic is responsible for the investigation of suspected patients with COVID-19. The Zhejiang Provincial People's Hospital strictly implemented the principles of "early detection, early reporting, early isolation, and early treatment" as stipulated by the State Health and Health Commission[6] and formulated corresponding measures to strengthen the surveillance of the pneumonia epidemic in the fever clinic, and to strengthen the centralized isolation and observation of suspected patients, to effectively control the source of infection, cut off the transmission route, and protect the susceptible population. Third, the fever clinic is responsible for epidemic prevention and control guidance. In accordance with the requirements of the Zhejiang Health and Health Commission, our hospital had set up the "clinic No. 1 reporting mechanism" during the pneumonia epidemic and set up a fever clinic inpatient service with designated personnel to solve the issues in the diagnosis and treatment process as well as other COVID-19-related problems. Upon encountering special situations during the COVID-19 pandemic in our hospital, reports should be sent directly to the hospital leaders.

Statistical analysis

IBM SPSS statistics software (version 22.0) was used for data analyses. Numerical data are expressed as percentages, and calculated data are expressed as the mean ± SD if the data had a skewed distribution. Variables were compared between groups using the independent sample *t*-test and paired variable group *t*-test, and multi-group comparisons were performed using single factor analysis of variance. The correlation between continuous variables was analyzed using Pearson's test. Statistical significance was set at $P < 0.05$.

RESULTS

Demographics of outpatients with fever who were included in the study

No significant differences were observed in terms of patient composition (age, sex, place of origin, and education level) between the patients under the original and the new operations management model of the fever clinic ($P > 0.05$). Detailed data are presented in Table 1.

Table 1 Comparison of knowledge of COVID-19 between the two groups (mean ± SD, *n* = 100)

Group	Age (yr)	Sex (M, %)	Native (%)	Education level (above university, %)
Original management mode	43.06 ± 17.51	54	73	61
New management mode	43.05 ± 16.18	56	73	64
χ^2/F value	0.000	0.1818	0.0254	0.6010
P value	0.993	0.6698	0.8735	0.4382

Comparison of the use of materials in fever cases

A significant difference in terms of disposable protective clothing, shoe cover, and isolation clothing was observed between the two patient groups (F = 173.104 and 12.956, P = 0.000 and 0.009, respectively). The results are presented in Table 2.

Knowledge regarding COVID-19 infection in the fever clinic

Comparison of knowledge regarding COVID-19 infection in outpatients with fever under the original and new management models: The score of awareness regarding prevention of COVID-19 in outpatients with fever under the new management model was 4.74 ± 0.56, which was significantly higher than that of outpatients with fever under the old management model (3.40 ± 1.10, F = 58.175). The results are presented in Table 3.

Comparison of knowledge regarding COVID-19 between two groups: The score of awareness regarding the prevention of COVID-19 in the new management mode group was 4.04 ± 0.85, which was significantly higher than that in the old management mode group (1.84 ± 1.03, F = 133.77). The results are presented in Table 4.

DISCUSSION

The fever clinic is not only the first destination for the prevention and treatment of COVID-19, but also a high-risk area for cross-infection. At the beginning of the pandemic, the Zhejiang Provincial People's Hospital issued the technical guide for the prevention and control of COVID-19 in medical institutions (first edition)[7,8]. Due to the different characteristics of infectious diseases in pandemic and epidemic situations, a new diagnosis and treatment plan for pneumonia with coronavirus infection had been developed[9,10] to determine the functional orientation, medical examination method, diagnosis, and treatment strategy of fever clinics that would be suitable for our hospital. In terms of professional attributes, the plan included general guidelines for visiting the fever clinic, performing the duties of the director of the clinical department[11], strengthening the team building of the temporary team in the fever clinic, and strengthening the epidemic prevention management of the fever clinic personnel[12,13].

This study demonstrated three points. First, the "integrated" management mode through the "one integrated system, three separate responsibilities" required fixed personnel and posts to reduce the flow of personnel in the hospital, further strengthening the health monitoring of the medical staff in the fever clinic, improving administrative efficiency, and streamlining communication in case of an emergency. Second, in terms of the depth of management, after implementing the "one integrated system" management, the fever clinic was placed under the management of the medical department for 24 h to complete the administrative command tasks. The medical department helped identify the details of prevention and control, and improve the efficiency of fever clinics. Under the overall supervisory responsibilities of fever clinics, as part of the first-line medical care of the patients, measurements were performed twice a day to monitor patient health status in real time. The fever clinic also carried out unified personnel management and attendance. The temporary transfer of a patient from their original department to the fever clinic had been strictly prohibited. Because of the management mode of the clinical department, the fever clinic in our hospital fulfilled the functional orientation of professional diagnosis and treatment, taking epidemic prevention and control management as its goals. Third, the "one integrated system" management achieved relative stability in terms of personnel and materials. The hospital fully guaranteed the training of fever outpatient personnel and the availability of protective materials and had established a regular reporting

Table 2 Comparison of substance use between the two groups (mean ± SD, *n* = 100)

Group	Protection mask(s)	Medical gloves (units)	One-time ear; instrument probe sleeve (units)	Disposable protective clothing (sets)	Disposable shoe cover(s)	Disposable (sets)
Original management mode	1615 ± 127	1262 ± 290	936 ± 70	83 ± 63	57 ± 80	114 ± 89
New management mode	336.4 ± 121	716 ± 120	1603.6 ± 604	230 ± 111	190 ± 73	98 ± 14
F value	173.104	12.956	3.624	1.877	2.675	0.216
P value	0.000[a]	0.009[a]	0.099	0.213	0.146	0.656

[a]*P* < 0.05.

Table 3 Comparison of knowledge of COVID-19 between the two groups before and after management mode (mean ± SD, *n* = 50)

Group	Total	Transmission; source	Dissemination; approach	Early symptoms	Prevention; measures	Popularity; history	Middle /high-risk areas; regional distribution	Prevention in our hospital; control measures	Hospital sense; protection
Original management mode	3.40 ± 1.10	0.70 ± 0.46	0.70 ± 0.46	0.74 ± 0.44	0.62 ± 0.49	0.64 ± 0.48	0.48 ± 0.50	0.50 ± 0.50	0.78 ± 0.41
New management mode	4.74 ± 0.56	0.96 ± 0.20	0.92 ± 0.27	0.94 ± 0.24	0.96 ± 0.20	0.96 ± 0.20	0.94 ± 0.24	0.96 ± 0.20	0.94 ± -0.24
F value	58.175	13.335	8.362	7.818	20.673	18.667	33.884	35.951	5.502
P value	0.000[a]	0.000[a]	0.005[a]	0.006[a]	0.000[a]	0.000[a]	0.000[a]	0.000[a]	0.021[a]

[a]*P* < 0.05.

Table 4 Comparison of knowledge of COVID-19 between the two groups before and after management mode (mean ± SD, *n* = 100)

Group	Total score	Source of infection	Transmission	Early symptoms	Preventive measures	Epidemiological history
Original management mode	1.84 ± 1.03	0.34 ± 0.47	0.48 ± 0.50	0.54 ± 0.50	0.28 ± 0.45	0.20 ± 0.40
New management mode	4.04 ± 0.85	0.82 ± 0.38	0.82 ± 0.38	0.78 ± 0.41	0.84 ± 0.37	0.78 ± 0.41
F value	133.77	30.348	14.261	6.720	45.733	49.709
P value	0.000[a]	0.000[a]	0.000[a]	0.011	0.000[a]	0.000[a]

[a]*P* < 0.05.

mechanism for fever outpatient data, including the number of outpatient registrations, the number of visits, the number of people remaining in the clinic, the number of patients highly suspected of having infection, and other data, to dynamically adjust the proportion of fever outpatient care, prevention and control grade, and hospital emergency response speed[14,15]. After management, the patients' awareness of COVID-19 infection sources, transmission routes, early symptoms, and preventive measures became significantly higher compared to the patients in the pre-management group, demonstrating an improved protection of the individuals from COVID-19, thereby reducing the spread of this infectious disease[16,17]. Correct implementation of prevention and control measures such as attaching importance to the health of medical personnel at all levels, encouraging personnel to take appropriate isolation measures to minimize high-risk factors, and monitoring the occurrence of nosocomial

infections can effectively prevent and control nosocomial infections and improve prevention consciousness[18-20].

The practice of this management model showed that in the innovative management mode of the "one integrated system, three separate responsibilities," "an integrated system" is the foundation and guarantee of the "three responsibilities." The integrated construction and management of hardware and software ensured that the fever clinic fully performed the duties of fever diagnosis and treatment, epidemic investigation, and prevention and control guidance. Starting from the practice of prevention and control of the epidemic situation in our hospital, we suggest that fever clinics in medical institutions should establish two sets of management models that should be managed by outpatient and emergency departments, or outpatient offices in non-epidemic situations, to facilitate the integrated design, deployment, and data analysis of the entire outpatient service. During the COVID-19 pandemic, our hospital established a center for the pre-diagnosis of fever with respiratory symptoms at the entrance of the general outpatient clinic, shunted patients with fever and respiratory symptoms away from other patients, and took timely protective measures to reduce the flow of patients suspected of being infected in the hospital to protect other patients and prevent the spread of the epidemic. The interdisciplinary consultation and the consultation system policy consisted of the following: The medical department set up a fever clinic with a novel coronavirus expert consultation group, divided into internal medicine, surgery, severe infection, and COVID-19 expert consultation; our hospital senior deputy chief physician implemented a shift system, mainly through telephone consultation; and the shift system and our hospital routine consultation services were operated in parallel[21].

CONCLUSION

The current trend of the COVID-19 pandemic in China remains grim, and the establishment of scientific and reasonable management modes and operation mechanisms is the key to the proper operation of fever clinics. In the future, we will continue to explore and evaluate our experience; dynamically adjust the norms of diagnosis, treatment, and control of fever outpatient clinics; and form a management system that is better suited to the real-world clinical situation and the need for disease prevention and control, giving full acknowledgment to the importance of the fever clinic in the diagnosis and treatment of the NCP.

ARTICLE HIGHLIGHTS

Research background

Since December 2019, there have been many new cases of coronavirus pneumonia in Wuhan, Hubei Province, which gradually spread to the whole country.

Research motivation

We took the lead in initiating the "wartime" vertical management model and taking over the related operation management of the fever clinic in an all-round way, innovating and constructing the vertical management model of the fever clinic, and dynamically adjusting and strengthening the efficiency of the vertical control in wartime.

Research objectives

To explore the new methods for efficient operation of fever clinics.

Research methods

Fever clinic patients were selected and divided into two groups. Group A was the original operation and management mode group, and group B was the new operation and management mode group ("one integrated system, three separated responsibilities").

Research results

The awareness of novel coronavirus infection sources, transmission routes, early symptoms and preventive measures was significantly higher in the new operation and

management mode group than that of the original operation and management mode group.

Research conclusions

The method of "an integrated system, three separated responsibilities" improves the efficiency of fever clinics.

Research perspectives

Innovative hospital management methods can improve clinical work efficiency.

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