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Effect of "Trinity" Service in Tuberculosis Prevention and Control

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Abstract: *Objective*: To analyze the role of "trinity" service in the prevention and control of tuberculosis. *Methods*: From January 2020 to June 2021, routine tuberculosis prevention and control was carried out, and 40 newly diagnosed tuberculosis patients were included in the routine group. From July 2021 to December 2022, the "trinity" mode of prevention and control was carried out, and 40 newly diagnosed tuberculosis patients were included in the research group. The differences in referral follow-up, tuberculosis control, hospitalization rate, medical costs, etc. of both groups were compared. *Results:* The referral rate of 90.00% and follow-up rate of 87.50% in the research group were higher than those of the control group, and the delay rate of seeing a doctor was 7.50% lower than that of the control group, $P < 0.05$; the incidence of tuberculosis in the research group was 30.00%, the rate of smear-positive tuberculosis was 20.00%, the rate of smear-negative tuberculosis was 7.50%, and the rate of new smear-positive tuberculosis rate of 2.50%, all of which were was lower than those of the control group, $P < 0.05$; the hospitalization rate of newly diagnosed tuberculosis patients in the research group was 35.00%, which was higher than that of the control group (10.00%), $P < 0.05$; the medicine expenses (1019.04 ± 62.42 yuan) and examination expenses (1687.48 ± 75.36 yuan in the research group were higher than those of the control group, $P < 0.05$. *Conclusion*: After implementing the "trinity" service, infection can be effectively prevented and controlled, and the hospitalization rate and referral follow-up rate can also be increased, but the overall medical expenses are still relatively high.

Keywords: Tuberculosis; "Trinity" service; Tuberculosis prevention and control

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1. Introduction

Tuberculosis is a high-burden disease that can affect patients' daily life and cause death. Therefore, it is extremely important to do a good job in the prevention and control of tuberculosis. China had started tuberculosis prevention and control since the 1990s, but it only applies to patients that are diagnosed with tuberculosis. Besides, the procedure for the diagnosis and the treatment for tuberculosis in village hospitals and general hospitals were rather underdeveloped, resulting in a high incidence of tuberculosis in China and increasing social security risk [1]. Therefore, in order to improve tuberculosis diagnosis and treatment, it is necessary to actively build a prevention and control system for the disease control and prevention centers,

tuberculosis designated hospitals, and grassroots medical institutions, that is, to implement the "trinity" service to reduce the risk of tuberculosis incidence. In this study, 80 newly diagnosed tuberculosis patients were treated from January 2020 to December 2022 to explore the application value of the "trinity" service.

2. Materials and methods

2.1. General information

80 newly diagnosed tuberculosis patients from January 2020 to December 2022 were selected for this study. The research group consisted of 23 males and 17 females, aged 22–68 years old, with an average of 45.16 ± 2.81 years old. The control group consisted of 24 males and 16 females, aged 23–67 years old, with an average of 45.19 ± 2.79 years old. There was no difference between the baseline data of tuberculosis patients in the research group and the control group, $P > 0.05$.

2.2. Methods

Research group ("trinity" service"): (i) A tuberculosis prevention and control system was established through the collaborative efforts of disease control centers, designated tuberculosis hospitals, and grassroots medical institutions. Among them, the disease control and prevention centers were mainly responsible for publicity and education, monitoring, and prevention and control of tuberculosis, etc.; designated hospitals were mainly responsible for inputting the patients' information, diagnosing and treating tuberculosis, and handling tuberculosis adverse reactions; primary medical institutions were mainly responsible for reporting and referral of suspected tuberculosis cases, etc., while supervising the diagnosis of tuberculosis patients. (ii) 1–2 physicians were allocated for the prevention and control of tuberculosis, with training provided; they were also responsible for liaising with other units to ensure that the patients received proper care. (iii)

Each unit carried out its designated responsibilities in accordance with the "trinity" model, enhancing the daily tuberculosis prevention and control plan and assessment framework. Only those who pass the assessment can participate in the "trinity" service. (iv) The medical institutions were supervised quarterly, in which the progress of the "trinity" service was evaluated, and problems were addressed in a timely manner. (v) Monitoring service quality: check and combine patient information, evaluate tuberculosis patient case information records, review records, and ensure tuberculosis patients receive standardized diagnosis and treatment services.

Routine tuberculosis prevention and control in the control group: after the first diagnosis of tuberculosis, the staff of the CDC (Center for Disease Control) entered the patient data, and carried out tuberculosis education to the patients, carried out prevention and control based on the guidelines for tuberculosis diagnosis and treatment, and screened the family members of tuberculosis patients. At the same time, urge patients to receive anti-tuberculosis drug treatment, and actively prescribe negative reactions, monitor the anti-tuberculosis efficacy, and record the results of sputum examination reexamination and treatment course.

2.3. Observation indicators

The referral tracking situation was compared as follows: The referral rate was calculated, indicating the percentage of suspected tuberculosis patients who received diagnosis and treatment at the nearest facility. Additionally, the tracking rate was calculated, reflecting the percentage of patients suspected of tuberculosis who could be contacted at any time to monitor their status.

The comparison of prevention and control effects involved calculating various rates, including the tuberculosis incidence rate, smear-positive tuberculosis rate (indicating positive results in sputum tuberculosis smear tests), smear-negative tuberculosis rate (indicating negative results in sputum tuberculosis smear tests),

and the new smear-positive tuberculosis rate (indicating newly discovered positive cases in sputum tuberculosis smear examinations).

The hospitalization rates of newly diagnosed tuberculosis patients in the two groups were recorded. Besides, the medical expenses were calculated, which includes examination expenses, medication expenses, and other medical expenses.

2.4. Statistical analysis

The patients' data were analyzed using SPSS 21.0. Count data and measurement data were expressed as percentages (%) and mean ± standard deviation, respectively. χ^2 test was performed for count data and *t*-test for measurement data, with $P < 0.05$ indicating statistical significance.

3. Results

3.1. Analysis of referral tracking

The research group exhibited a higher referral rate (90.00%) and follow-up rate (87.50%) compared to the control group, with a 7.50% lower rate of delayed medical consultations, and the differences were statistically significant ($P < 0.05$). Further details are shown in **Table 1**.

Table 1. Comparison of referral follow-up (%)

Group	Referral rate	Follow-up rate	Delay rate
Research group ($n = 40$)	36 (90.00)	35 (87.50)	3 (7.50)
Control group ($n = 40$)	29 (72.50)	27 (67.50)	11 (27.50)
χ^2	4.0205	4.5878	5.5411
P	0.0450	0.0322	0.0186

3.2. Analysis of tuberculosis prevention and control

In the research group, the tuberculosis incidence rate was 30.00%, the smear-positive tuberculosis rate was 20.00%, the smear-negative tuberculosis rate was 7.50%, and the new smear-positive tuberculosis rate was 7.50%. These rates were all lower than those observed in the control group ($P < 0.05$). Further details are shown in **Table 1**.

Table 2. Comparison of tuberculosis prevention and control (%)

Group	Tuberculosis incidence	Smear-positive tuberculosis rate	Smear-negative tuberculosis rate	New smear-positive tuberculosis rate
Research group ($n = 40$)	12 (30.00)	8 (20.00)	3 (7.50)	1 (2.50)
Control group ($n = 40$)	35 (87.50)	19 (47.50)	10 (25.00)	6 (15.00)
χ^2	27.2856	6.7645	4.5006	3.9139
P	0.0003	0.0093	0.0339	0.0479

3.3. Analysis of tuberculosis hospitalization

In the research group, 14 cases of newly diagnosed tuberculosis patients were hospitalized, which accounted for 35.00%. In the control group, 4 cases of newly diagnosed tuberculosis patients were hospitalized, accounting for 10.00%. The comparison of hospitalization rates between the two groups showed that the χ^2 value was 7.1685 ($P < 0.05$).

3.4. Analysis of medical expenses

The medicine expenses (1019.04 ± 62.42 yuan) and examination expenses (1687.48 ± 75.36 yuan) of the research group were higher than those of the control group ($P < 0.05$), as shown in **Table 3**.

Table 3. Comparison of medical expenses (mean ± standard deviation, yuan)

Group	Medicine expenses	Examination expenses
Research group ($n = 40$)	1019.04 ± 62.42	1687.48 ± 75.36
Control group ($n = 40$)	371.61±17.85	498.16 ± 18.49
t	103.2518	96.9380
P	0.0000	0.0000

4. Discussion

Tuberculosis prevention and control is a key task of disease prevention. With the continuous reform of the medical system, the original tuberculosis prevention and control model is no longer suitable for the current social development needs. Therefore, it is necessary to further improve the tuberculosis prevention and control strategy [2]. In this study, the "trinity" model was applied in the prevention and control of tuberculosis based on the requirements stated in the "13th Five-Year Plan," and has achieved certain results [3]. The "trinity" model represents a shift from the traditional disease prevention and control approach, wherein distinct medical institutions assume respective responsibilities for disease reporting, diagnosis and treatment, management, information entry, and tracking. This model essentially reorganizes tuberculosis prevention and control strategies according to the specific functions of each medical institution [4]. During the period of this study, the disease prevention and control centers were the core department of tuberculosis prevention and control, responsible for many tasks such as tuberculosis education, monitoring, prevention, and control; designated tuberculosis hospitals were responsible for the diagnosis and treatment of tuberculosis patients, handling adverse reactions, inputting the patients' information, etc.; grassroots medical institutions were responsible for reporting and transporting suspected tuberculosis patients, and urging confirmed tuberculosis patients to comply with medical diagnosis and treatment [5,6]. Following the implementation of the aforementioned healthcare system, it is mandatory for all organizations to designate dedicated tuberculosis diagnosis and treatment staff. Their responsibilities include effective management of confirmed tuberculosis patients, rigorous assessment, and the continuous monitoring of treatment quality. In this way, the demand for "three-in-one" service can be fulfilled and the treatment process for tuberculosis can be standardized. Besides, the "trinity" model can also optimize the resources of each medical institution, strengthen the prevention and control measures of medical institutions, thus avoiding the waste of medical resources and enhancing the quality of tuberculosis control [7].

Based on the results of this study, the referral rate (90.00%) and follow-up rate (87.50%) of the research group were higher than those of the control group; the delay rate of medical consultation of the research group was 7.50% lower than that of the control group, and the differences were statistically significant ($P < 0.05$). Therefore, it is suggested that the "trinity" mode can improve the referral and follow-up rate, and also reduces the problem of delayed treatment, making the referrals and treatment more effective. This is because the "trinity" model facilitates the registration and reporting of tuberculosis patients at primary medical centers. It helps patients complete clinical diagnosis and treatment while maximizing the role of primary medical institutions. This encourages tuberculosis patients to seek timely diagnosis and treatment, effectively contributing to tuberculosis prevention and control efforts [8]. Another set of data showed that the tuberculosis incidence

rate of 30.00%, smear-positive tuberculosis rate of 20.00%, smear-negative tuberculosis rate of 7.50%, and new smear-positive tuberculosis rate of 2.50% in the research group, which were all significantly lower than those of the control group ($P < 0.05$). Therefore, it is suggested that the "trinity" model can reduce the risk of tuberculosis. This the "trinity" model includes training the personnel of various medical institutions, optimizing the allocation of medical resources, and assigning special personnel to supervise the diagnosis and treatment of tuberculosis. All of these ensure that the patients can receive proper care, making tuberculosis prevention and control more effective [9]. In addition, encouraging grass-roots hospitals to participate in tuberculosis prevention and control and setting up designated tuberculosis diagnosis and treatment institutions has the following effects: it can ensure that TB patients can receive high-quality medical services, and it can also enhance the compliance of tuberculosis patients with diagnosis and treatment, thereby increasing the detection rate of tuberculosis. Systematic prevention and control strategies and early diagnosis and treatment of suspected tuberculosis pathology can reduce the rate of newly diagnosed tuberculosis patients. The results of this study also showed that the hospitalization rate of newly diagnosed tuberculosis patients in the research group was 35.00% higher than that the control group (10.00%), with statistical significance ($P < 0.05$). However, the medicine expenses (1019.04 ± 62.42 yuan) and examination expenses (1687.48 ± 75.36 yuan) were higher than those of the control group ($P < 0.05$). It is suggested that the "trinity" model can increase the hospitalization rate of newly diagnosed pulmonary tuberculosis patients, but the overall medical expenses was also higher. This is because the "trinity" model provides convenient medical services for newly diagnosed tuberculosis patients, so suspected cases could be hospitalized easily. Medical insurance policies also contributed to reducing the financial burden of the patients, therefore increasing the hospitalization rate. However, as excellent diagnosis and treatment environment was provided for the patients with the "trinity" model, and that medical intervention was provided immediately after abnormalities were detected, so the medical expenses were slightly higher. This indicates that the "trinity" service still has certain limitations and requires further improvements [10]. Furthermore, in the practical execution of the "trinity" service, it is crucial to ignite the enthusiasm of personnel across different medical institutions. Besides, it is crucial to optimize the tuberculosis treatment model and promptly address any adverse reactions experienced by patients to enhance patient compliance. Additionally, improving the conditions for sputum tuberculosis smear examinations is essential to ensure the accuracy of the tests.

5. Conclusion

In summary, the "trinity" model plays a crucial role in tuberculosis prevention and control. It helps track newly diagnosed tuberculosis patients promptly, provides timely medical intervention for suspected cases, ultimately reducing the risk of tuberculosis transmission, increasing patient hospitalization rates, and bolstering the effectiveness of prevention and control efforts. Nevertheless, there is a pressing need to refine the "trinity" service strategy in clinical practice due to the high medical expenses associated with it.

Disclosure statement

The author declares no conflicts of interest.

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