



Research Article

Research on the Application of Information Tools in Epidemic Prevention and Control Management in Clinical Teaching Base

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Abstract

Background: To retrospectively summarize the application effect of information management tools (hereinafter referred to as "IMT") in clinical teaching base (hereinafter referred to as "base") during the outbreak of COVID-19. To provide reference for the management of similar epidemics in the future. **Methods:** The IMT were implemented according to the scheme of 1 Subject +2 aspects +3 systems +4 Steps +5 channels in the base. Then analyzed and compared the effects before and after the use of IMT. **Results:** There were statistically significant differences in the timeliness, accuracy of information collection, labor cost and time cost of epidemic prevention and control of interns in the base before and after the use of IMT ($p < 0.05$). **Conclusion:** The application of IMT can improve the efficiency of epidemic prevention and control in the base and the awareness of prevention and control of interns, which has practical value for the health protection of interns in the base during the outbreak.

Keywords: Prevention and control of the epidemic; Information management tools; Clinical teaching base; Intern

Methods

Data sources

A total of 821 interns who practiced in the base of the hospital from June to October 2022 during the outbreak period were included as the research objects. The actual effect of using IMT was evaluated by comparing and analyzing the epidemic management without IMT in the base during the same period in 2021.

Exclusion criteria: (1) Non-base interns; (2) Interns who have not experienced the epidemic outbreak in their area. (3) Interns who are not willing to be the research object.

Methods

The IMT were implemented in the base according to the scheme of 1 Subject +2 aspects +3 systems +4 Steps +5 channels. **1. Subject:** Hospitals are the main units responsible for the epidemic prevention and control of interns, and their bases are

Introduction

The general hospital is not only a clinical teaching base receiving a large number of medical students every year, but also a sentinel position in the fight against the epidemic. This dual role has brought many problems to the epidemic prevention and control of interns in the base [1]. On the one hand, interns are relatively weak in self-awareness and ability of epidemic prevention, with scattered accommodation, complex personnel contact and unfixed post rotation, which is a vulnerable group in epidemic prevention and control [2]. On the other hand, due to the suddenness and infectivity of the outbreak, it is necessary to collect timely and accurate information for appropriate intervention. Due to the shortage of time, the task is heavy; therefore, it is necessary to study the application of IMT during the outbreak to help solve the epidemic prevention and control problems in the base.

designated to carry out the specific implementation, and medical colleges assist the bases to manage their interns. **2. Aspects:** IMT were mainly used in the health monitoring and hospital channel management of interns in the base. **3. Systems:** Hospital Information System (hereinafter refer to as “HIS”), Laboratory Information System (hereinafter refer to as “LIS”) and WeChat applet. **4. Steps:** collection and input of basic information, construction and application of WeChat applet, application and management of epidemic related experimental data and handling

of abnormal epidemic information monitoring. **5. Channels:** “three areas and two channels”. The “three areas” were divided into clean areas, potentially contaminated areas and contaminated areas according to the exposure risk of the epidemic. “Dual channel” refers to the medical staff channel and the patient channel [3]. We used face recognition temperature measurement integrated machine (SEWO-M206 CW) to manage the hospital flow channel to prevent cross infection in the hospital. The specific application process is shown in the flowchart (Figure 1).

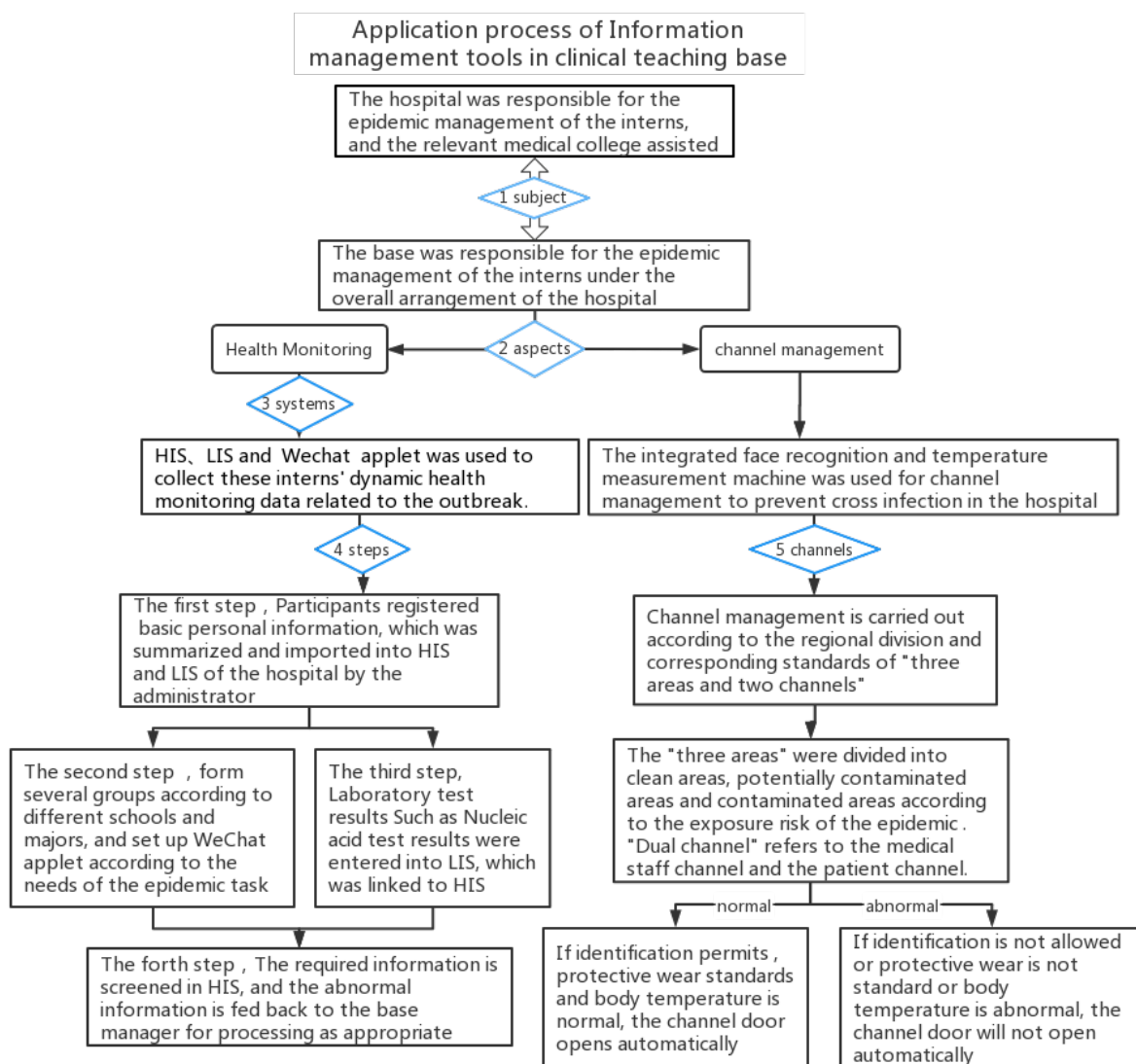


Figure 1: The flowchart of application of IMT in clinical teaching base.

Statistical method

SPSS 26.0 was used for statistical analysis. We counted and compared the timeliness and accuracy of information collection, manpower cost and time cost of epidemic prevention and control before and after the use of IMT.

Results

Comparison of effects before and after the application of IMT

In 2021, the base mainly used paper registration, WeChat group, personnel collection and other methods to gradually collect and submit interns' health information related to the epidemic. In 2022, the base was fully managed by information tools, analyzed and compared the health information related to epidemic prevention and control (The number of missed cases in nucleic acid testing, the number of missed information, the number of false information, the average time of daily health monitoring work for interns, and the average time of emergency hazard screening) in the base during the same period (June to October, during when the number of interns in the base reached the highest) of the two years.

SPSS 26.0 software was used to test the normality of the working data in the data of Table 1 in different time periods (June to October 2021 and June to October 2022). The test results show that except for the average time (X5) of emergency hazard screening from June to October 2021, which does not follow the normal distribution (skewness Z-score=2.35 > 1.96, kurtosis Z-score=2.32 > 1.96), the other variable data follow the normal distribution [4]. The data of the results of the detailed analysis are shown in Table 2.

Time	Number of missed cases in nucleic acid testing(person-time)	The number of missed information	The number of false information	The average time of daily health monitoring work (hour)	The average time of emergency hazard screening per hour
Before using the information tool - Item number	X1	X2	X3	X4	X5
June 2021	9	196	9	7.5	8.9
July 2021	21	281	12	9	4.5
August 2021	12	223	16	8.3	4.8
September 2021	15	156	14	7.2	5.1
October 2021	8	169	8	7	4.5
After using the informational tool - Item No	Y1	Y2	Y3	Y4	Y5
June 2022	3	35	2	2.3	1.2
July 2022	2	26	1	2.5	0.8
August 2022	5	41	1	2.1	0.8
September 2022	3	21	0	2	1.6

October 2022	2	19	2	2.1	1.1
Ratio(X/Y)	4.3	7.2	9.8	3.5	5.1

Table 1: Summary of epidemic prevention and control data of interns in the base from 2021 to 2022.

		X1	X2	X3	X4	X5	Y1	Y2	Y3	Y4	Y5
Number of cases	Valid	5	5	5	5	5	5	5	5	5	5
	Missing	0	0	0	0	0	0	0	0	0	0
Skewness		0.953	0.95	0.088	0.79	2.141	1.361	0.526	-0.512	0.937	0.822
Standard error of skewness		0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Z-score for skewness		1.04	1.04	0.10	0.87	2.35	1.49	0.58	-0.56	1.03	0.90
kurtosis		0.255	0.387	-1.975	-1.056	4.646	2	-1.848	-0.612	-0.188	0.14
Standard error of kurtosis		2	2	2	2	2	2	2	2	2	2
Kurtosis Z-score		0.13	0.19	-0.99	-0.53	2.32	1.00	-0.92	-0.31	-0.09	0.07

Table 2: Summary of normality test results.

Comparison of data differences: In order to understand the actual application effect of IMT in the epidemic prevention and control management of interns in the base, this study compared the data of missed detection, missed reporting, false reporting, and time cost on epidemic prevention and control management in the corresponding five months of 2021 and 2022. The number of missed nucleic acid tests, the number of missed information reports, the number of false information reports, the average time of daily health monitoring work, and the average time of emergency hazard screening work were set as X1-Y1, X2-Y2, X3-Y3, X4-Y4, X5-Y5. As the first four groups of data followed the normal distribution, the independent sample T test was used for comparison. Because X5 does not follow the normal distribution, the rank sum test is used for X5-Y5 comparison [5]. The results showed that the differences between the five groups of data were statistically significant ($P < 0.05$). The application of information tools has effectively improved the efficiency and quality of epidemic prevention and control of interns in clinical teaching bases (Tables 3-7).

Grouping	$\bar{X} \pm S$	<i>t</i>	<i>P</i>	95%CI for difference
2021 (before the use of information tools)	13.00±5.24	4.15	0.003	4.45~15.55
2022 (after using information tools)	3.00±1.23			

Table 3: Independent sample t-test results of missed nucleic acid tests (X1-Y1).

Grouping	$\bar{X} \pm S$	<i>t</i>	<i>P</i>	95%CI for difference
2021 (before the use of information tools)	205.00±5.24	7.81	<0.001	124.45~228.75
2022 (after using information tools)	28.40±1.23			

Table 4: Results of independent sample T test for the number of missing information (X2-Y2).

Grouping	$\bar{X} \pm S$	<i>t</i>	<i>P</i>	95%CI for difference
2021 (before the use of information tools)	11.80±3.35	7.81	<0.001	7.04~14.16
2022 (after using information tools)	1.20±0.84			

Table 5: Independent sample t-test results of the number of false information (X3-Y3).

Grouping	$\bar{X} \pm S$	<i>t</i>	<i>P</i>	95%CI for difference
2021 (before the use of information tools)	7.80±0.83	14.61	<0.001	4.72~6.48
2022 (after using information tools)	2.20±0.20			

Table 6: Results of independent sample t-test of average time cost on daily health monitoring work (X4-Y4).

Summary of Hypothesis Testing			
Null Hypothesis	Checkout	Significance	Decision
In the category of X7-Y7, 1 has the same distribution.	Mann-whitney U test for independent samples	0.008	The null hypothesis was rejected.

Table 7: Results of rank sum test for average time of emergency hazard screening (X7-Y7).

The application of face recognition and temperature measurement integrated machine in the security system in the epidemic prevention and control of the base (Figures 2-4).



Figure 2: Unauthorized or incorrect information, showing “stranger”, the channel door will not open.



Figure 3: Unqualified protection, if you do not wear a mask, it will show “please wear a mask”, and the door will not open.



Figure 4: If the body temperature is normal and the protection is correct, the channel door will open automatically in the authorized area.

Discussion

During the outbreak, the human resources of medical institutions are facing a major challenge. Hospitals should not only undertake the tasks of medical treatment and on-site rescue of patients, accounting and collection, but also ensure that the virus does not spread in the hospital and carry out various medical services safely and orderly [6,7].

An effective control and prevention strategy highly relies on the IT-infrastructure [8]. A well-designed informationization support scheme was critical to respond to key characteristics and essential functions of hospital against the disease. This practice should protect the medical staff, engineers and all relevant personnel from infection [9].

IT capabilities were critical during the COVID-19 outbreak. Practical experience demonstrates that various aspects of information technologies were overlooked. To combat this pandemic, the government and decision makers of this country should consider strategic planning that incorporates successful experiences against COVID-19 and the most advanced IT capabilities[10].

However, when the epidemic suddenly broke out, it was difficult to do a lot of information infrastructure reconstruction. This study is to add an epidemic related information collection function module on the basis of the hospital's existing HIS, LIS, cooperate with the WeChat applet and face recognition temperature measurement integrated machine to solve the main difficulties of epidemic prevention and control in the base.

The key points and difficulties of epidemic prevention and control in clinical teaching base during the outbreak

The key points are: (1) To accurately grasp the health information related to the epidemic and intervene in advance for possible health problems. (2) It is necessary to control the human flow channels of the hospital to prevent cross infection in the hospital.

Main difficulties: On the one hand, it is very difficult to grasp the health information related to the epidemic of these interns in time and accurately. The main reasons are as follows: (1) The situation of epidemic prevention and control is rapidly changing, prevention and control measures need to be adjusted accordingly. The task is arduous and the time is short. (2) Insufficient teaching management personnel in the base. In general, there are few teaching administrators at the base, and they hold multiple positions at the same time; but there are hundreds of interns to manage. (3) Students' accommodation and jobs are scattered and unfix, and their contact with people is complex, which is difficult to manage centrally. (4) Students had insufficient self-discipline for epidemic prevention and control, and there were relatively many problems such as late reporting, missing reporting, and false reporting. Therefore, only with the help of scientific management tools can the problems of manpower, timeliness and accuracy be solved. On the other hand, respiratory infectious diseases are easy to spread and lead to cross infection outside the hospital.

Application effect of using IMT

The results of this study showed that after the use of IMT, the missed detection rate of nucleic acid testing among interns in the base decreased by 4.3 times, the missing rate of information decreased by 7.2 times, and the false reports such as not having

been tested or sending their health code to other students to scan the code for testing decreased by 9.8 times. The accuracy of epidemic related information collection was greatly improved. At the same time, the time for information collection was reduced by 3.5 times, and the time for emergency risk screening was reduced by 5.1 times, which greatly saved manpower.

Advantages and limitations of the scheme of “1 subject +2 aspects +3 systems +4 steps +5 channels” in epidemic prevention and control in base.

The main advantage of this scheme is its conciseness, which can quickly grasp the key points and solve the difficulties of the base in epidemic prevention and control.

“1 subject” means: first of all, for public health emergencies, it is necessary to clarify the main responsibility of epidemic prevention and control and give full play to the accountability mechanism to ensure the implementation of all measures [11]. The management of interns involves the base, the hospital and the medical college. Among them, the base is subject to the arrangement of the hospital, and the medical college students are in the base. Therefore, only hospitals are responsible for the prevention and control of the epidemic among interns, and relevant measures can be implemented [12].

“2 aspects” refers to the application of IMT in the prevention and control of the epidemic in the base, which is mainly used for the collection and screening of health monitoring information related to the epidemic of the interns and the management of each channel in the hospital. During the epidemic, in order to ensure the safety of interns, it is necessary to collect the health information related to the epidemic timely and accurately, and screen them as needed, so as to take corresponding intervention measures in a targeted manner. Regional channel management is a necessary measure to prevent hospital cross infection.

“3 systems”: We used HIS, LIS and WeChat applet to collect COVID-19 related health information of interns. HIS and LIS are commonly used information management systems in hospitals, which can be loaded through software upgrades during the outbreak and used to collect health information of interns related to the outbreak. From the HIS and LIS systems of the hospital, abnormal data in a certain period or a specific population can be screened out. Based on these data, the managers of the base can quickly and accurately classify and query the relevant situation, and take corresponding remedial measures.

WeChat applet is through the “Jinshan form” set up visual information collection small program. Before its use, multiple WeChat groups can be established according to different medical colleges or different specialties, and the number of each group should be 10-50. Too many people will delay information summary

time; too few will delay the next step of information summary. The applet can set different information collection requirements according to different tasks such as “daily hazard screening”, “emergency hazard screening”, “vaccination” and so on. It can be distributed in each WeChat group to complete the information collection task quickly and accurately. The disadvantage is that the capacity is limited, which is not suitable for a large number of people to transmit visual picture information within a specified time. It is more suitable for the rapid collection of periodic or temporary information on a given population.

Through “3 systems” and “4 steps”, we can quickly and accurately collect the health information related to the epidemic of the interns in the base, and make positive intervention based on this information.

“5 channels” include the “three areas and two channels” management, we used face recognition temperature measurement integrated machine to set up physical barriers, and stipulated and reminded medical staff, including interns, to take appropriate protective measures and specific diagnosis and treatment activities in the corresponding areas and channels. Reasonable setting of “three areas and two channels” and its standardized management are the most important and basic support for all other comprehensive prevention and control measures to prevent nosocomial cross infection and achieve satisfactory prevention and control effects.

Conclusion

During the outbreak of the epidemic, the tasks of fighting against the epidemic, medical treatment, and self-protection of medical staff are numerous. The number of teaching administrators in the base is very few, and most of them hold multiple positions. The hospital’s normalized information management tool was used to add functional modules related to epidemic prevention and control. The scheme of 1 subject +2 aspects +3 systems +4 steps +5 channels was adopted to carry out the information management of the base. It not only improves the efficiency of epidemic prevention and control in the base and the awareness of epidemic prevention of interns, but also greatly reduces the cost of human resources.

The main values of this study are as follows: (1) using the normalized information management tools of the hospital to manage the epidemic situation can avoid the risk of equipment idling after the event; this is because the outbreak is phased and transient. (2) The scheme of IMT is concise and practical.

Limitations of the study: This study only included research subjects from one clinical teaching base in China, and there may be selection bias, which needs to be confirmed by multi-center and large sample research.

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Availability of Data and Materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethics Guideline Statement

This study involving human participants was reviewed and approved by the Ethics Committee of Wenjiang District People's Hospital of Chengdu, Sichuan Province in China. Granted No. WJQYY-2022-03-18. This study explored ways to use IMT to safeguard the health of base interns during the outbreak. Informed consent was obtained from all participants prior to participation. The survey data were all anonymized and personal information was guaranteed not to be divulged. We confirm that all study procedures were performed in accordance with relevant guidelines and ethical regulations.

Competing Interests

The authors declare that they have no competing interests.

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