Analyzation on the current situation of informatization talent team based on big data

Ziyan Xu¹, Yong Xiao¹
¹Hubei University of Chinese Medicine, Hubei, China

Corresponding author and e-mail: Yong Xiao, xy1015@hbtcm.edu.cn

Abstract. Big data analysis has always been an important way to plan the development of talents. In recent years, due to the influence of national policies, the flow of talents has been in a high incidence state. In this paper, the big data analysis mode is adopted to analyze the data from the investigation informatization construction in 2019. Compared with the previous data, the development trend of talents is predicted, and the optimization structure and other methods are proposed. AHP is used to judge the current situation. After the big data analysis, the talent construction plan is planned according to the current situation and the methods of talent re-education is put forward to expand the current talent quality.

1. Introduction
The opinions on promoting the inheritance, innovation and development of traditional Chinese medicine (TCM) issued by the CPC Central Committee and the State Council in October 2019 clearly put forward the need to cultivate a number of high-level interdisciplinary innovative leading talents of TCM, and support TCM colleges and universities to jointly cultivate high-level compound TCM talents [1]. Compound talents of medical information play an important role in promoting the construction of TCM health informatization and the innovation and development of TCM inheritance. The construction of hospital informatization is a key step to promote the improvement of medical efficiency and build a "healthy China". The quantity and quality of hospital informatization talents directly affect the process of hospital informatization and determine the development level of medical and health industry. In this paper, through the collation of the survey data of the informatization construction of traditional Chinese medicine in 2019 and the comparative analysis with the survey report of China's Hospital Informatization situation (CHIMA) in 2019, this paper finds out the short board of informatization talent construction and puts forward reasonable suggestions, so as to help the construction of informatization talent team of TCM hospital.

2. Sources and research methods

2.1. Source of data
The data is from the 2019 Chinese medicine information construction survey, which conducted an online survey of 31 hospitals in different provinces. This paper selects the relevant data of informatization talent team construction in the questionnaire of informatization construction of TCM hospitals. This paper selects the effective data of 2021 TCM hospitals with information departments, including 31 provinces (excluding Hong Kong, Macao and Taiwan), including 608 hospitals in 9 provinces in Central China,
742 hospitals in 10 provinces in the west, and 671 hospitals in 12 provinces in the East. There are 484 tertiary hospitals, accounting for 23.95% of the total sample, and 1537 secondary hospitals, accounting for 76.05% of the total sample.

2.2. Research contents
This paper analyzes 2021 hospitals in 31 provinces from macro and micro level. At the macro level, it includes the main work content of the information work department, the situation of the leader in charge of the information work department, etc. At the micro level, it includes the educational background, major and professional title of the information management and technical personnel in the hospital informatization department, and the training times of the information related personnel.

2.3. Research method
In this paper, EXCEL was used to input all the questionnaire data, and the database of hospital information personnel was established. The data were processed and analyzed by using function formula. SPSS 22.0 was used to conduct statistical test on the data, and the results were presented by charts.

3. Result
3.1. Current situation of personnel in information department of TCM hospitals

3.1.1. Number of staff in information department. Based on the analysis of the effective data on the number of personnel in the informatization department of 2021 TCM hospitals, it can be seen that the total number of informatization departments in TCM hospitals is 14249, with an average of 7.05, which is lower than the average number of 9.52 in the National Hospital Informatization survey report of China Hospital Association Information Management Professional Committee (Chima) in 2018-2019 [2].

According to the hierarchical analysis of TCM hospitals, it can be seen that the number of employees in the informatization department of tertiary TCM hospitals is mainly distributed in 4-10 people, with the distribution of 70.25%. Among them, 39.67% of hospitals with 4-6 people and 30.58% of hospitals with 7-10 people. The number of employees in the informatization department of the secondary hospital of traditional Chinese medicine is concentrated in 1-6 people, with a distribution of 96.62%. Most of the hospitals with 1-3 staff are distributed with a distribution of 71.83%.

The average number of informatization departments in tertiary hospitals was 9.06, higher than the overall average (7.05), while the average number of informatization departments in secondary hospitals was 6.42, lower than the overall average. There is a significant difference in the size of staff in the information departments of tertiary hospitals and secondary hospitals. The specific data are shown in Table 1.

According to the survey of China's Hospital Informatization in 2018-2019 (Chima), the staff size of tertiary hospitals is mainly distributed in 7-15 people, with a distribution of 53.08%. However, the number of full-time employees in hospitals below the third level was mainly distributed in 1-6 people, accounting for 78.06%. Compared with the data of the survey report of China's Hospital Informatization situation in 2018-2019, the scale of informatization personnel in TCM hospitals is smaller.

| Number of employees in the information sector | Tertiary hospital (N=484) | Secondary hospital (N=484) |
|---------------------------------------------|--------------------------|---------------------------|
| Number of hospitals                         | Percentage               | Number of hospitals       | Percentage               |
| More than 30                                | 3                        | 0                         | 0.62%                    | 0.00%                    |
| 21-30                                       | 11                       | 2                         | 2.27%                    | 0.13%                    |
| 16-20                                       | 20                       | 2                         | 4.13%                    | 0.13%                    |

Table 1. Staff size distribution of information department in TCM hospital.
3.1.2. The professionalism of the staff in the information department. In this paper, the personnel of information department in TCM hospital were investigated from three aspects of educational background, specialty and professional title.

In terms of educational level. Most of the staff in the information department of TCM hospitals have bachelor's degree, accounting for 48.64%, nearly half of them. The proportion of graduate students or above is relatively small, accounting for 3.48%. The educational background of information department in tertiary hospital was significantly higher than that in secondary hospital. 67.47% of the tertiary hospitals had bachelor's degree, while 58.66% of the tertiary and secondary school graduates and below accounted for 58.66%. The detailed data are shown in Table 2.

From the perspective of major, the major of information personnel in TCM hospital is computer and engineering specialty, clinical medicine or related specialty, accounting for the largest proportion of computer and engineering specialty, accounting for 38.10%, followed by clinical and medical, accounting for 35.33%. The number of students majoring in computer and engineering was the second, accounting for 35.6% of the total, and medical information was the least, accounting for 3.78%. In the tertiary hospitals, the major of information personnel are computer and engineering, accounting for 62.61%, which is absolutely dominant in quantity, far higher than that of clinical and medical departments (17.04%). The major of information personnel in secondary hospitals is mainly clinical and medical, accounting for 43.45%, higher than that of computer and engineering, accounting for 27.21%. The specific distribution data are shown in Table 2.

From the distribution of personnel titles, the proportion of personnel with primary professional titles is the largest, accounting for 69.51%, the number of personnel with intermediate titles accounts for 22.38%, and the number of personnel with senior professional titles accounts for 8.11%. According to the level of information technology department personnel hierarchical analysis, the proportion of personnel with senior and intermediate professional titles in tertiary hospitals is slightly higher than that in secondary hospitals, which indicates that the professional titles of personnel in TCM hospitals are mainly primary titles, and the titles of personnel in tertiary hospitals are slightly higher than those in secondary hospitals. The specific distribution is shown in Table 2.

According to the level of TCM hospital information department personnel hierarchical analysis, we used chi square test, the results of chi square analysis showed that the significant P values were all less than 0.01, which showed that there were significant differences in the distribution of educational background, specialty and professional title between the tertiary hospital and the secondary hospital. The test results of education distribution are shown in Figure 1.
Table 2. Distribution of educational background, specialty and professional title of informatization personnel in TCM hospital.

|                      | Tertiary hospitals | Percentage of hospitals at the same level | Secondary hospitals | Percentage of hospitals at the same level |
|----------------------|--------------------|------------------------------------------|---------------------|------------------------------------------|
| **Education**        |                    |                                          |                     |                                          |
| Graduate and above   | 391                | 8.92%                                    | 105                 | 1.06%                                    |
| Undergraduate students | 2957             | 67.47%                                   | 3974                | 40.28%                                   |
| College and below    | 1035               | 23.61%                                   | 5787                | 58.66%                                   |
| **Title**            |                    |                                          |                     |                                          |
| Senior Title         | 430                | 9.81%                                    | 703                 | 7.33%                                    |
| Intermediate title   | 1273               | 29.04%                                   | 1856                | 19.34%                                   |
| Primary title        | 2680               | 61.15%                                   | 7037                | 73.33%                                   |

<0.01

![Chi-Square Tests](image)

Figure 1. Chi square test results of education distribution.

3.1.3. The number of times of information department staff participation in training. The training and continuing education of informatization talents is the key to improve the skills of hospital informatization personnel. The total training times of 2021 TCM hospitals participating in the survey were 9463, and the average training times per person was 0.66. Among them, 484 tertiary hospitals trained 0.91 times per person on average, and 1537 secondary hospitals trained 0.56 times per person on average (see Table 3). 9.5% of the staff in tertiary hospitals did not participate in IT training, and 18.93% of the secondary hospitals did not participate in IT training (see Table 3). It can be seen that the number of training for information personnel in TCM hospital is quite small, less than 1 time per person per year (except in hospital training).
Table 3. Personnel participation in training of informatization departments in different levels of hospitals.

| Level          | Total number (person) | Total training times (Times) | Average times per person | Total number of hospitals | Number of hospitals not participating in training | Proportion of hospitals not participating in training |
|---------------|-----------------------|------------------------------|--------------------------|---------------------------|-----------------------------------------------|---------------------------------------------------|
| Tertiary hospital | 4383                  | 3981                         | 0.91                     | 484                       | 46                                            | 9.50%                                             |
| Secondary hospital | 9866                  | 5482                         | 0.56                     | 1537                      | 291                                           | 18.93%                                            |

3.2. General situation of information department of TCM hospital

3.2.1. Basic information of the superior supervisor of the information department. There are various leaders in the informatization department of TCM hospitals. Some hospitals have clear leaders in charge and some hospitals are managed by multiple leaders. In 2021 TCM hospitals, 75.56% of the hospital information departments have one leader in charge, 18.21% of the hospitals have two leaders in charge, and 6.23% of the hospital information departments have three or more leaders in charge. The specific distribution of the number of leaders is shown in Table 4. There are 1527 hospitals with a single clear leader in charge. Most hospitals are in charge of hospital level leaders, accounting for 59.33%, 27.05% of the hospitals are in charge of the president, and 4.91% of the hospitals are in the charge of the secretary. The specific distribution of leadership is shown in Table 5.

Table 4. The number of leaders in TCM hospitals.

| Number of leaders | Number of hospitals | Proportion |
|-------------------|---------------------|------------|
| 8                 | 4                   | 0.20%      |
| 7                 | 0                   | 0.00%      |
| 6                 | 5                   | 0.25%      |
| 5                 | 6                   | 0.30%      |
| 4                 | 15                  | 0.74%      |
| 3                 | 96                  | 4.75%      |
| 2                 | 368                 | 18.21%     |
| 1                 | 1527                | 75.56%     |
| Total             | 2021                | 100.00%    |

Table 5. Leadership categories of TCM hospitals.

| Leadership category     | Number of hospitals | Proportion |
|-------------------------|---------------------|------------|
| secretary               | 75                  | 4.91%      |
| dean                    | 413                 | 27.05%     |
| Other hospital level leaders | 906               | 59.33%     |
| Hospital office         | 76                  | 4.98%      |
| Equipment department    | 8                   | 0.52%      |
| Finance department      | 25                  | 1.64%      |
| Medical department      | 15                  | 0.98%      |
| Other department        | 9                   | 0.59%      |
| Total                   | 1527                | 100.00%    |
3.2.2. **Main business scope of informatization department.** The business scope of information department personnel can effectively reflect the level of information personnel and the status of information department in the hospital. In the investigation of the work content of the information center of TCM hospital, the business scope of the information department is divided into nine categories according to the discipline application nature of the business.

According to the hierarchical analysis of hospital level, the business scope of TCM Hospital Information Department is mainly the daily operation and maintenance of hospital network and other hardware equipment and the construction of hospital information system, accounting for more than 90%, significantly higher than other business scope. Some information departments are also responsible for hospital information strategic planning, telemedicine and other businesses, while a few take into account the library (room) and medical record statistical management. Among them, for telemedicine and equipment management, tertiary hospitals choose the former as the work content, while secondary hospitals choose the latter more. The survey results are basically consistent with the survey report data of China Hospital Information Management Professional Committee (Chima) in 2018-2019. The distribution frequency of specific business scope is shown in Figure 2.

![Figure 2. Business scope of information department of TCM hospitals.](image)

4. Main problems in the construction of informatization talent team in TCM hospital

4.1. **Insufficient number of personnel and unreasonable personnel structure**

According to the survey results of TCM hospital informatization data in China, the average number of informatization workers in TCM hospitals is far lower than that in general hospitals in China. In terms of the composition of health informatization personnel in China, there is a lack of medical informatization talents who have both informatization ability and medical knowledge. Most of them are non-comprehensive talents with clinical medical knowledge or computer ability, and there are few talents with high educational level and professional talents with high professional title and experience. Compared with the national hospitals, this phenomenon is even more severe. Most of the informatization personnel in the secondary public hospitals of traditional Chinese medicine are college and secondary school education or below, and most of them are clinical and medical specialties. This will greatly hinder the development of information technology in grass-roots hospitals of traditional Chinese medicine. The lack of talents will lead to the slow development of hospital information management, which will seriously restrict the development of modern and intelligent management of hospitals.

4.2. **The leaders in charge are not clear, and the status of information departments is not high**

From the data survey results, about 1/4 of TCM hospitals have multiple leaders in charge, and there are even as many as 8 leaders of hospital information departments; some hospitals have unclear and
overlapping information competent departments, which are in the lower level branches of hospital administrative and technical departments, and few hospitals set the informatization departments as branches of logistics management departments [3]. The business scope of informatization personnel focuses on the operation and maintenance of network hardware equipment, and has less business in hospital informatization strategic planning and telemedicine. This shows that the hospital leaders do not pay enough attention to the status of the information department. Putting the information department at the bottom of the hospital does not realize that the hospital information department is related to the development speed of the hospital, which will further lead to the loss of hospital informatization talents. This problem also exists in hospitals all over the country, but the form of TCM hospitals is more severe.

4.3. Training frequency is less, training is a mere formality
According to the data survey results, in TCM hospitals with information departments, no matter the secondary hospitals or tertiary hospitals, the average number of participants in the training is less than once (except in hospital training), among which, 9.50% of the hospitals in the tertiary hospitals have not participated in the information-based training; in the secondary hospitals, 18.93% of the hospitals have not participated in the information-based training. It can be seen that TCM hospitals do not pay enough attention to information-based training, and the situation of grass-roots hospitals is more severe. This part of the hospital itself has a low level of informatization, and still does not actively participate in training and learning, which is very unfavorable to the development of information technology in grass-roots Chinese medicine hospitals.

Some of the existing TCM hospitals will have corresponding information personnel training system, but in practical application, these training systems are mainly for the formal training system of new employees. At the same time, there is a lack of deep-seated communication and learning between hospitals. Such training can not achieve the purpose of training compound talents, but also cause a waste of resources to a certain extent [4].

The lack of continuing education of information personnel will lead to the development of information technology department. Nowadays, informatization has been involved in the daily work of the hospital from all aspects. However, the slow update of the software and hardware of hospital informatization is in sharp contrast with the rapid development of information technology. If the continuing education of information talents is not paid enough attention, the development of hospital informatization of traditional Chinese medicine will be far behind the world stage.

5. Conclusions

5.1. Optimizing the professional structure of informatization personnel and training medical informatization talents
At present, the medical information talents trained in medical colleges and universities can not fully meet the needs of TCM hospitals, and the course content taught by the school can not fully adapt to the actual work [5].

This requires medical colleges and universities in the way of personnel training and curriculum design reform, should fully understand the needs of the hospital after improving the curriculum. Therefore, TCM hospitals should set up a long-term goal in the aspects of talent introduction, training and development, and establish a complete, high-quality and efficient training chain of medical information professionals with "Government University Hospital".

Hospitals report to the government according to the needs of talents, then the government gives training tasks to colleges and universities according to the needs, hospitals and schools jointly train talents, and the government and universities establish a sound health information talent education system according to the feedback from the hospital.

TCM hospitals should set a long-term goal in the introduction, training and development of information-based talents, they should pay attention to the introduction and training of compound talents
in medical and health informatization, colleges and universities should strengthen basic medical courses and basic courses such as computer programming language, database, network technology, management and multimedia technology, and at the same time, strengthening the professional education of information management, medical informatics and medical literature retrieval, and integrate the technology and methods actually used in the hospital into the curriculum system.

Colleges and universities should allow students to enter the hospital as soon as possible to learn the information skills literacy and the specific clinical medical operation process needed in the actual work, so as to improve the information skills from the actual work.

5.2. Clarify the leaders in charge and attach importance to the position of information department

Clarity in the position of the leader responsible for hospital informatization is a key driver of hospital informatization. Nowadays, in TCM hospitals, 1/4 of the hospital informatization departments are led by multiple leaders, and the departments in charge of informatization are not clear and cross. Some hospitals even set the informatization department as a branch of the logistics support department. 45.58% of the total investment in hospital informatization is made by hospital informatization departments. Article 7 of the basic norms for informatization construction of TCM hospitals issued by the State Administration of traditional Chinese medicine in 2011 proposes that TCM hospitals should include the funds for informatization construction into the annual budget of hospitals, and the average annual investment should reach 1% - 5% of the total annual medical business income. The number of TCM hospitals meeting this standard is less than 1/3 of that in China.

The daily operation and maintenance of the hospital network and other hardware equipment is still the highest in the scope of business of the information department, which shows that the construction of the information department in the hospital has not received the same attention as other departments; the traditional idea that information personnel come to repair computers needs to be changed.

The hospital information construction needs the information department to have the corresponding discourse power, decision-making power and organizational structure level to have stronger executive power in the implementation of the project.

All hospitals need to establish full-time information departments, further optimize the functions of information departments, and enhance the authority of information competent departments and leaders in charge, focusing on optimizing the knowledge structure of information directors and leaders in charge, learning enterprise project management experience, and improving the scientific and forward-looking strategic planning of hospital information construction. TCM hospitals should attach importance to the status of information departments and increase the investment in information departments.

5.3. Improve the training mechanism and carry out targeted training

The level of information personnel determines the development speed of hospital informatization to a certain extent. The thinking of information personnel needs to be expanded through continuous learning, so it is necessary to strengthen the continuing education of information personnel. At present, the staff of Information Department of TCM hospital are lack of training times, the hospital does not pay enough attention to personnel training, so the level of informatization is relatively low compared with the national hospitals.

TCM hospital should strengthen the cultivation of information personnel's ideas, knowledge structure and operation technology, and establish a perfect training mechanism.

In order to improve the communication ability of information technology personnel, it is necessary to enhance the ability of information technology professionals to communicate with clinical information technology.

The existing computer and engineering professionals should deeply participate in the use of clinical medical information system, observe the experience of doctors in the use process, explore the defects in the use of the system, and explore innovation and improvement methods.

In terms of information-based training methods, avoid the "full house" training of expert lectures. It is necessary to carry out small-scale training for a small number of people in batches, strengthen...
communication and learning between hospitals, and create channels for learning from benchmarking hospitals. At the same time, the practice assessment and implement the training results after the training should also be strengthened.

References
[1] Opinions of the CPC Central Committee and the State Council on promoting the inheritance, innovation and development of traditional Chinese medicine [EB/OL] http://www.gov.cn/zhengce/2019-10/26/content_5445336.htm. (In Chinese)
[2] Information Professional Committee of China Hospital Association. Survey of China's Hospital Informatization in 2018-2019 [R]. 2019, 9. (In Chinese)
[3] Wang Lu, Zhou Dian, Huang Xinli, Tian Di. Analysis on the current situation and Countermeasures of hospital informatization talent team construction in Anhui Province [J]. Health economics research, 2019, 36 (08): 59-61 + 65. (In Chinese)
[4] Fang Yanan. Analysis on the construction of health and medical informatization compound talents team [J]. Science and technology entrepreneurship monthly, 2018, 31 (12): 144-146. (In Chinese)
[5] Wu Zheng. Analysis of the current situation of information-based personnel training in small and medium-sized hospitals [J]. World latest medical information abstracts, 2018, 18 (91): 177 + 186. (In Chinese)
[6] Zhu Ming, Zhang Weixin, Wang Ting, Zhang Weiwei, Shen Gongjian, Kou Jianqiu. Thinking on hospital informatization construction, management and future development [J]. Medical information, 2018, 31 (08): 23-24 + 27. (In Chinese)
[7] Yang Jianlan, Tan Yuanyuan, Lin Shuyuan, Wei Caibing. Analysis of the results of the general survey on the informatization construction of traditional Chinese medicine hospitals in Fujian Province [J]. Chinese Journal of health information management, 2017,14 (02): 205-211(In Chinese)
[8] Liang Na. Analysis and Reflection on the current situation of informatization development in TCM hospitals [J]. Journal of medical informatics, 2016, 37 (04): 70-73. (In Chinese)