



Evaluation of Post Fitness of Employees in Health Care Enterprises Based on Big Data

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Abstract. Under the background of big data, the structure of health care enterprises is constantly upgrading, and there is a misplaced matching relationship between employees and posts. In order to promote the development of health care enterprises and optimize the allocation of talents, this paper studies the post fitness evaluation of health care enterprises based on big data. Put forward the selection principles and ideas of fitness evaluation indexes, and provide the basis for index selection; Establish an evaluation index system of fitness, screen high-frequency factors and select sequencing parameters; Through index identification and quantification, this paper analyzes the coordination and adaptation relationship between employees and post structure in medical and health care enterprises. Calculate the fitness, divide the fitness grade type according to the fitness evaluation grade type standard, and complete the evaluation. Through empirical analysis, the post coordination fitness of employees in 10 medical and health care enterprises showed a tortuous upward trend from 2016 to 2021, with 5 enterprises suffering from weak degree imbalance and 5 enterprises suffering from weak degree coordination. Among them, the average fitness of enterprise 7 is the highest, which is 0.59, but the overall level still has much room for improvement, and it is necessary to adjust and supplement the appropriate talents in time.

Keywords: Big Data · Enterprise Health Care · Algorithm Fusion · Employee Position · Fitness Evaluation · Evaluation Index Selection

1 Introduction

The 19th National Congress of the Communist Party of China clearly pointed out the transformation of the main social contradictions in our country in the new era—"The main social contradictions in our country have been transformed into the contradiction between the people's growing need for a better life and the unbalanced development". With the development of China's economy and society, people's living standards are constantly improving, and the demand for health is increasing day by day. The quantity and quality of social medical resources have great influence on national physical and mental health, but the quantity and quality of existing medical resources can hardly meet people's growing health needs [1]. Under the situation that supply is less than

demand, a new wave of developing medical technology and resources with the help of information technology industry has arisen, and the development of medical industry has also ushered in the spring. Although the concepts of mobile medical care, artificial intelligence medical care and internet hospital have been put forward until now, a large number of internet medical care trendsetters have emerged. Internet giants such as Ali, Tencent, JD.COM and Baidu have also laid out the internet medical care industry, which has the potential to be shared by the whole world. Various medical and health care enterprises have sprung up. Medical care refers to people who maintain or improve their health through prevention, diagnosis, treatment, improvement or cure of diseases, diseases, injuries and other physical and mental disorders. Health care is provided by health professionals and related health fields. Medicine, dentistry, pharmacy, midwifery, nursing, optometry, audiology, psychology, occupational therapy, physical therapy, sports training and other health professions are all part of medical care. Including its work in providing primary health care, secondary health care, tertiary health care and public health. Under the background of big data, the state has issued a series of policies and measures to promote the healthy development of Internet medical industry, and comprehensively standardized and guided the healthy development of “Internet + medical care” enterprises [2]. Domestic “Internet + Medical” enterprises have successively appeared different modes, such as non-interactive medical health information service, online consultation, medical e-commerce, health monitoring and management, and medical service process optimization. Integrate several departments dedicated to providing health care services and products in the medical industry. As the basic framework for defining this sector, the International Standard Industrial Classification of the United Nations classifies medical care as generally including hospital activities, medical and dental practice activities and “other human health activities”. The last category involves the activities of nurses, midwives, physiotherapists, scientific or diagnostic laboratories, pathological clinics, residential health facilities, patient advocates or other related health professionals or activities under their supervision. In addition, according to industry and market classifications, such as global industry classification standard and industry classification benchmark, medical care includes many categories of medical equipment, instruments and services, including biotechnology, diagnostic laboratories and substances, drug manufacturing and delivery. However, by analyzing the current medical environment, the shortage of medical resources is not only insufficient in quality, but also unevenly distributed in time and space, which is mainly manifested in: asymmetric information among patients, hospitals and doctors, which leads to a large number of patients “voting with their feet” and blindly pouring into second and third-class hospitals, but few grassroots community health institutions are interested in it; Second, the doctors in the third-class hospitals are burdened with heavy tasks and exhausted, and the medical resources are stretched, while the medical resources in the grassroots community hospitals cannot be effectively utilized. Therefore, higher requirements are put forward for the employees of various medical and health care enterprises, and the matching degree between the positions and employees of enterprises has become a hot issue in current research. Under the background of big data era, with the adjustment and change of enterprise structure, the type and level of talent demand should also be continuously optimized in factor allocation to ensure the matching and adaptation between employees and enterprise

positions, thus promoting the sustainable development of the whole industry economy. Therefore, it is an important practical task for the whole industry to guide the fitness between employees and posts in health care industry. Based on big data, this paper studies the evaluation of the fitness of employees in health care enterprises, first, establish the fitness evaluation index system, screen high-frequency factors, and select the order parameters; Then, through the identification and quantification of indicators, it analyzes the coordination and adaptation relationship between the employees and the post structure of the health care enterprise; Finally, the fitness is calculated, and the fitness grade types are divided according to the fitness evaluation grade type standards to complete the evaluation. The conclusions drawn from the empirical analysis provide a basis for promoting the development of health care enterprises and are of practical significance for improving the fitness of the health care industry under big data.

2 Health Care Enterprise Staff Post Fitness Evaluation

2.1 Selection Principles and Ideas of Fitness Evaluation Indicators

In medical and health care enterprises, there are many factors that affect the fitness between employees and posts. To evaluate the fitness of employees in medical and health care enterprises under big data, it is necessary to follow certain scientific criteria and objectively and truly reflect the current status of employees in medical and health care enterprises. The research on the fitness between employees' structure and the structure of health care enterprises is an all-round and multi-dimensional research process, ranging from the top-level design of the industry to the individual's employment choice, which involves many social fields. Therefore, the selection of evaluation indicators should be both systematic and comprehensive, and have certain internal logic [3]. It is easy to quantify, and the selected indicators should have reliable data sources, that is, the selected indicators must be mentioned in the official documents of our country or have corresponding statistical caliber. The selected indicators should not only meet the requirements that different regions in the same period are comparable, but also meet the requirements that the same region is comparable in different periods. The selected indicators should be able to truly reflect the current situation of regional development, or adapt to the actual economic development. Follow the principles of systematicness, scientificity, operability, comparability and timeliness. In order to realize the unity of structure and function between employee structure and health care enterprise structure, the optimization of employee structure is divided into four sequential links: input-generation-allocation-application. Two dimensions including rationalization and upgrading of industrial structure are respectively connected, and the sequence parameters are extracted as evaluation index system. The specific selection process is shown in Fig. 1.

As can be seen from Fig. 1, according to synergetics theory, the necessary condition for the long-term stable existence of a new system is the "orderliness" among the subsystems that make up the system, which is mainly manifested in the regularity of "the combination of elements and functions, the combination of space-time structure and the order of evolution process" in the material system. Only when employees and enterprise structure subsystems are coordinated, that is, orderly, can their parent system,

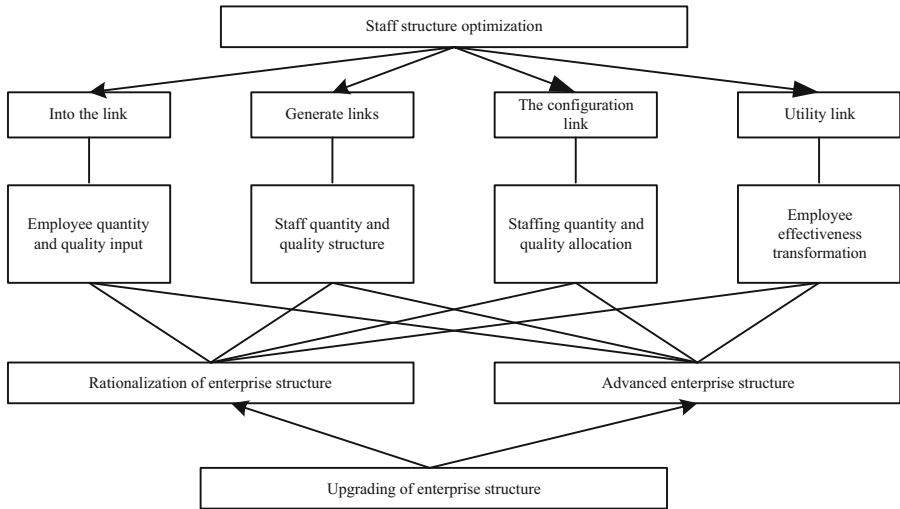


Fig. 1. Schematic diagram of docking extraction sequence parameters of employee structure optimization and enterprise structure upgrading

the economic system, develop sustainably for a long time. Therefore, the research on the theme of this paper can be transformed into a measure of the orderliness of the composite system formed by employees and enterprise structure subsystems. In the synergetic thought, only when the employee structure and the enterprise structure are realized from disorder to order can the coordination between the two systems be ensured, thus making the economic parent system develop sustainably. The measurement mark of two systems from disorder to order is “order parameter”, which can quantify the degree of order. Order is derived from the cooperation between subsystems and plays an important role. Therefore, in order to quantify the degree of coordination between employees and enterprise structure, it is necessary to extract the order parameters that meet the requirements [4, 5]. The order degree of the composite system formed by the two subsystems can be divided into three levels from low to high, and the highest level is the unity of the structure and function of the subsystems, which means that the two systems are highly ordered. Based on this, when quantitatively studying the coordination and adaptation relationship between employees and enterprise structure, it is necessary to unify their functions and structures, and on this basis, complete the extraction of order parameters.

2.2 Establish a Fitness Evaluation Index System

According to the above principles and ideas of index selection, this paper divides the employee structure into four links: input-generation-allocation-utility, and divides the enterprise structure into two levels: structure scale and structure quality, which are coupled and docked to extract sequence parameters. The evaluation system is established from four levels: system level-target level-criterion level-index level, and the quantitative formula of each index is calculated to form the evaluation index system, as shown in Table 1.

Table 1. Framework of evaluation index system

System level	Target layer	The standard layer	Index layer
Adaptability of employees to enterprise positions	Input link	Number of employees and quality input of enterprises	The proportion of education investment in GDP a1
			Growth rate of education expenditure per student in higher education a2
			Location entropy of educational expenditure per student in higher education a3
			Share of R & D input in GDP a4
			Location entropy of R & D input in GDP a5
			The R & D input growth rate a6
			Generation link
	The ratio of talent to employees b2		
	Location entropy of talent ratio to employees b3		
	Under the big data, the number of talents in healthcare enterprises has increased highly b4		
	In terms of big data, the proportion of talents in healthcare enterprises is highly proportional b5		
	Configuration link	Productivity of post employees in enterprises	Static coordination degree of traditional healthcare enterprises c1

(continued)

Table 1. (continued)

System level	Target layer	The standard layer	Index layer
			Static coordination degree of healthcare enterprises under big data c2
			The whole enterprise static coordination degree c3
	Utility link	Employee's utility play	Number of patent applications d1
			Location entropy of patent application quantity d2
			Patent authorization d3
			Location entropy of patent authorization quantity d4
			The increase rate of the number of patent invention applications granted d5
			Number of contracts traded in the technology market d6
			The number of contracts traded in the technology market is in the national proportion d7
			Technical market transaction contract amount d8
			The contract amount of transactions in the technology market is represented in the whole country d9
			Enterprise employee productivity d10

By sorting out the evaluation indexes in the collaborative system of employee structure and enterprise post structure, the high-frequency factors are screened out, and a reasonable weight is determined for each attribute. To study the coordination and adaptation of the two subsystems of enterprise post and employee structure, according to the above evaluation index system, it is necessary to select the order parameters for quantitative calculation [6].

2.3 Index Identification and Quantification

In order to objectively study the coordination status of talents in enterprises, the index of “static coordination degree” is introduced. Taking the index of “static coordination degree of healthcare enterprises under big data” as an example, its formula can be set as follows:

$$Q_I = \frac{w_i}{W} - \frac{s_i}{S} \tag{1}$$

where, W is the labor productivity of each department of health care enterprise, S is the proportion of post talents, and w_i and s_i are the labor productivity and the proportion of post talents of i departments respectively [7]. If $Q_i = 0$, it means that the coordination and adaptation degree of this department is consistent with that of the enterprise; if $Q_i > 0$, it means that the proportion of talented employees in this department is relatively high but the output is relatively low, indicating that the employees in this department are not fully functioning; if $Q_i < 0$, it means that the proportion of talented employees in this department is relatively low but the output is relatively high; when there are more talented employees, structural transfer to this enterprise can help the growth of the enterprise. The quantitative calculation formulas of each index are shown in Table 2.

The quantification of each evaluation index is realized by the quantification method in Table 2. In order to more accurately analyze the coordination and adaptation relationship between employees and post structures in medical and health care enterprises, this paper quantitatively analyzes the indicators extracted by coupling and docking of the two systems [8]. Each index in the system has a development target value. Compared with the actual development value of the index, the ratio obtained is the efficacy coefficient. The mathematical expression of the efficacy function of index e_i is:

$$F_i = f(e_i) \tag{2}$$

where, F_i is the efficacy coefficient, and when the value ranges from $0 \leq F_i < 1$, $i = 1, 2, \dots, n$, when $F_i = 1$, the target value is the best, which means the target value is the worst. According to the synergetic theory, if the synergetic system is stable and orderly, the efficiency function presents a linear relationship, and the maximum or minimum value of the efficiency function is the critical point of the system without qualitative change. Based on this, the following efficacy function is established:

$$\begin{cases} F(e_i) = (x_i - \alpha_i)/(y_i - \alpha_i), \alpha_i \leq x_i \leq y_i, \text{ When } F(e_i) \text{ is positive} \\ F(e_i) = (\alpha_i - x_i)/(y_i - \alpha_i), y_i \leq x_i \leq \alpha_i, \text{ When } F(e_i) \text{ is negative} \end{cases} \tag{3}$$

Table 2. Quantitative calculation method of evaluation index

Index layer	Quantitative calculation formula
a1	= Education investment funds/ GDP
a2	= Higher education students average education expenditure in that year/Higher education students are all spent on education in the previous year-1
a3	= Higher education per student education expenditure/Enterprise education expenditure per student in higher education
a4	= R&D Investment funds/GDP
a5	= The proportion of departmental R & D investment in GDP /The proportion of enterprise R & D investment in GDP
a6	= R & D is spent on the current year/ R & D invested for the previous year-1
b1	= The number of talent/Number of employees
b2	= The ratio of talent to the department's employees/The ratio of enterprise talent to employees
b3	= The ratio of department talent to employees/The ratio of enterprise employees to employees
b4	= The number of talents in healthcare enterprises has increased under departmental big data/The number of traditional healthcare professionals in the sector has increased
b5	= The number of talents in health care enterprises under departmental big data/The number of the traditional health care personnel in the enterprise
c1	= Department of the traditional industry talent ratio/Department talent ratio-Labor productivity ratio of sector traditional industries / sector labor productivity
c2	= Department of high-tech industry talent ratio/Department talent ratio-Labor productivity ratio of regional high-tech industries/Department of labor productivity
c3	= 1/2(Static coordination degree of traditional healthcare enterprises + Static coordination degree of healthcare enterprises under big data)
d1	straight forward calculation
d2	= The number of departmental patent applications/Number of enterprise patent applications
d3	straight forward calculation
d4	= Amount of departmental patents granted/Enterprise patent authorization amount
d5	= The department of invention application for the current year of authorization quantity/Department invention application for the last year of authorization amount-1
d6	straight forward calculation

(continued)

Table 2. (continued)

Index layer	Quantitative calculation formula
d7	= Number of contracts traded in the enterprise technology market/Number of contracts traded in the national technology market
d8	straight forward calculation
d9	= Enterprise technology market contract amount/Contract amount traded in the national technology market
d10	= enterprise GDP/The number of enterprise employees

In the formula, x_i is the actual value of e_i , and α_i and y_i are the extreme values of e_i when the system is stable. The function value reflects the measurement of the degree of coordination and adaptation of a single index to the whole system. According to the above various calculations, the efficacy function value can be obtained.

2.4 Calculate Fitness

In order to comprehensively describe the efficacy and benefits of system indicators and comprehensively reflect the fitness of the whole system, a single efficacy function value cannot be used, so it is necessary to establish a functional relationship that takes efficacy coefficient as an independent variable and can reflect the coordination and fitness between the two subsystems. In this paper, the fitness function is used to judge the employee's post fitness, and the range of fitness function value is $0 \leq HD \leq 1$. The larger the fitness function value is, the higher the fitness of employees in medical care enterprises is, and vice versa [9].The efficacy of each index on the coordination and fitness evaluation system is regarded as the goal of the system's own development. It is assumed that there are N goals, of which N_0 are negative indicators and N_1 are positive indicators. The larger the index value, the better. The other $N - N_0 - N_1$ goals are close to a certain value. Then, a total efficacy function is established with a certain efficacy coefficient. The total efficacy function value is that the coordination and fitness of this complex system is easy to get results and ensure accuracy.

$$HD = \sum_{i=1}^n w_{ij} * Fe(v_{ij}) \tag{4}$$

where, $\sum_{i=1}^n w_{ij} = 1$, w_{ij} is the weight coefficient of $Fe(v_{ij})$, the coordination fitness is the calculated weighted sum. Next, determine the weight of each evaluation index. Subjective weighting method and objective weighting method are the main two ways to establish the weight evaluation index. Ring comparison analysis, analytic hierarchy process, Delphi and fuzzy comprehensive evaluation are the main calculation methods of subjective weighting method; Factor analysis, correlation coefficient, variation coefficient, principal component analysis and entropy are the main calculation methods of objective weighting method. Through comprehensive analysis, this paper selects the

entropy method in the objective weighting method to establish the weight of each index [10]. A method to measure uncertainty is called entropy. The smaller the amount of information, the greater the uncertainty and entropy; The greater the amount of information, the smaller the uncertainty and the smaller the entropy. Entropy can not only judge the randomness and disorder degree of an event, but also can be used to judge the dispersion degree of an index. If the index with greater dispersion degree is selected, it will have a greater impact on the comprehensive evaluation [11]. The steps of calculating entropy and establishing weight are as follows: Set n observation values and k indicators, then x_{ij} is the j th indicator of the i th observation value. The greater the difference between x_{ij} , the more information this indicator contains and transmits, and the greater the comparative effect of this indicator on complex systems. Entropy can be used to measure the amount of information [12], that is, the increase of information represents the decrease of entropy. Calculate the specific gravity value of the characteristic index, and set x_{ij} as the initial value and x_{ij} as k_{ij} , then the calculation formula of the specific gravity value of the i th observation value under the j th index is:

$$k_{ij} = x_{ij} / \sum_{i=1}^n x_{ij} \tag{5}$$

If the information entropy of the j st index is d_j , the calculation formula of information entropy is:

$$d_j = -\gamma \sum_{i=1}^n k_{ij} * \ln k_{ij} \tag{6}$$

Among them, $\gamma > 0$, if x_{ij} are all equal to the given j , there are $k_{ij} = 1/n, d_j = \gamma \ln n$. For a given j, x_{ij} , the smaller the difference is, the greater is d_j . When x_{ij} are all equal, $d_j = d_{\max} = 1(\gamma = 1/\ln n)$. At this time, as the comparison between observed values, index x_{ij} has no effect, and it is necessary to calculate the difference coefficient. The greater the difference between x_{ij} and d_j , the greater the comparison effect of index on observed values. Therefore, the difference coefficient is defined as:

$$l_i = 1 - d_i \tag{7}$$

l_i the larger, the more attention should be paid to the role of this indicator, and finally determine the weight, whose formula is:

$$w_j = l_i / \sum_{j=1}^k l_i, j = 1, 2, \dots, k \tag{8}$$

After the above calculations, the weight of each index is calculated. Finally, for the classification standard of fitness grade, 0.00–1.00 is divided into 10 continuous grade intervals [13]. It can be seen that the coordination adaptation grade is a continuous ladder, then a coordination grade represents an interval, and each grade is a kind of coordination state. Among them, the fitness value greater than 0.50 is the coordination interval, and

Table 3. Standard table for evaluation grade type of coordination fitness

Coordination level	Coordinate the adaptation value	Coordination degree
1	0.00—0.10	extreme disorder
2	0.11—0.20	High disorder
3	0.21—0.30	Moderate disorder
4	0.31—0.40	low disorder
5	0.41—0.50	weak disorder
6	0.51—0.60	weak coordination
7	0.61—0.70	low coordination
8	0.71—0.80	Moderate coordinatio
9	0.81—0.90	High coordinatio
10	0.91—1.00	extreme coordinatio

the fitness value less than or equal to 0.50 is the imbalance interval. The specific division of the standard is shown in Table 3.

According to Table 3, the post suitability of employees in healthcare enterprises based on big data in this paper is evaluated.

3 Empirical Analysis

3.1 Experimental Preparation

In order to analyze the fitness of employees' positions in healthcare enterprises under big data in more detail, this paper selects 10 healthcare enterprises as parameter objects, and selects the relevant index data from 2016 to 2021 to evaluate the fitness of employees' positions in healthcare enterprises. The weight calculation results of each index calculated above are shown in Table 4.

After obtaining the index values and their weights from Table 4, the post fitness and average value of employees in 10 medical and health care enterprises are calculated, and the coordination fitness curve is drawn in turn. According to the standard table of fitness evaluation grade type, the grade of post fitness of employees in each enterprise is judged, the evaluation of post fitness of employees in medical and health care enterprises is completed, and the evaluation results are counted.

3.2 Overall Analysis of Fitness

According to the calculation results of job fitness and average value of employees in 10 health care enterprises, the coordination fitness curve is drawn, and the change trend of fitness of different enterprises in 2016–2021 is analyzed, as shown in Fig. 2.

According to the results of Fig. 2, the time series comparison and analysis of the position coordination and adaptability of employees in 10 medical and health care enterprises shows that the adaptability of each enterprise shows a tortuous upward trend. It

Table 4. Weight value of each index

Metric	Weight	Metric	Weight
a1	0.0156	c2	0.0601
a2	0.0432	c3	0.0610
a3	0.0141	d1	0.0523
a4	0.0285	d2	0.0603
a5	0.0416	d3	0.0421
a6	0.0187	d4	0.0612
b1	0.0453	d5	0.0401
b2	0.0385	d6	0.0254
b3	0.0299	d7	0.0264
b4	0.0164	d8	0.0293
b5	0.0180	d9	0.0415
c1	0.0159	d10	0.0288

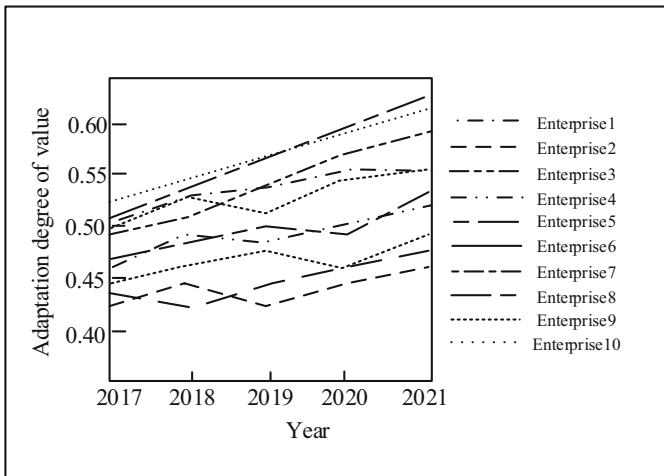


Fig. 2. Change trend of job fitness of employees in 10 health care enterprises from 2017 to 2021

can be seen that from 2017 to 2021, the position structure and employee talents of each enterprise are constantly optimized, so that the adaptability is improved. The position order of the fitness degree of each enterprise changes little, showing a trend of alternating fluctuations. According to the trend chart of fitness change, the change range of enterprise 7 is small and shows a slow growth trend, but the annual level has always been the highest among the 10 healthcare enterprises.

According to the average value of the fitness degree of each enterprise, the grade type of the post coordination fitness degree of employees in 10 medical and health care enterprises is determined, as shown in Table 5.

Table 5. Grade types of post coordination adaptability of employees in 10 medical and health care enterprises

Enterprise	Grade	Level	Average fit
1	6	weak coordination	0.52
2	5	weak disorder	0.44
3	6	weak coordination	0.51
4	5	weak disorder	0.48
5	5	weak disorder	0.46
6	6	weak coordination	0.51
7	6	weak coordination	0.59
8	5	weak disorder	0.45
9	5	weak disorder	0.43
10	6	weak coordination	0.56

Table 5 clearly shows the grade types of the job fitness of employees in various medical and health care enterprises. It can be seen that the job fitness grades of employees in these 10 enterprises are not high. Five enterprises are weak degree maladjustment and five enterprises are weak degree coordination. Among them, the average value of the fitness of enterprise 7 and enterprise 10 is high, ranging from 0.51 to 0.60. Although the coordination level is the same, and it is also in the weak degree imbalance level, the average fitness of enterprise 4 is the highest, and the average fitness of enterprise 9 is the lowest, indicating that enterprise 9 has obvious disadvantages in fitness, and the overall level still needs to be improved. The range of fitness level needs to be substantially changed, which proves that there is a large room to improve the fitness of employees in health care enterprises, and it needs to adjust and supplement appropriate talents in time.

4 Concluding Remarks

In this paper, by proposing the principles and ideas for the selection of fitness evaluation indicators, establishing the fitness evaluation indicator system, identifying and quantifying indicators, and calculating fitness, we have completed the research on the evaluation of job fitness of employees in healthcare enterprises under big data, and achieved certain research results. The details are as follows:

- (1) This paper uses the basic theory of collaboration to bring the post structure of employees and enterprises into the scope of enterprise economic system, and uses the principle of synergy correlation as a support to build a connection channel - order

parameter, which describes the interaction between the post structure of employees and enterprises.

- (2) The position order of the fitness of each enterprise does not change much, showing a trend of alternating fluctuations.
- (3) There is much room for improvement in the fitness of employees in medical and health care enterprises, and it is necessary to timely adjust and supplement the appropriate talents.

At present, there is still a misplaced supporting relationship between posts and employees in healthcare enterprises under big data. In the future, we should also change our development ideas, increase talent input, give full play to employee communication, and promote the transformation of achievements. In the future research, evaluation indicators can also be continuously optimized to provide a more scientific and effective basis for the development of health care enterprises. The healthcare industry under big data will certainly become a very vibrant industry, promote the medical and health level to a new level with healthy and stable development, and share the achievements of social development.

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