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Study on the Construction of Mental Disease Monitoring and Evaluation Index System based on Delphi Method

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Abstract: As a major public health and prominent social problem, the establishment of community early warning system for mental illness is an effective prevention strategy, which can discover the early signs of mental illness occurrence and recurrence and early signs of dangerous behaviors such as accidents and disasters in time, win time for early intervention, comprehensive prevention and emergency treatment of mental illness in the community and take effective prevention and control measures. This paper discusses the exploration and application of early warning strategies in community prevention and control of mental diseases, points out the importance of early warning strategies in the development of community mental health services, introduces early warning classification, operation mechanism and management mode, symptom indicators and evaluation indicators of early warning monitoring, and points out the problems that need to be solved in the application of early warning model in community prevention and control of mental diseases And limitations, in order to provide reference for promoting the development of community mental health services.

Keywords: Delphi method; Mental disease; Evaluation index

1. Introduction

The community mental health service in the western developed countries started earlier, and was attached great importance by the government. In China, the community mental health service started late, and various regions have explored the mode of community mental health service one after another, as well as the distinctive mode of community mental health service [1]. The research of mental health service performance evaluation abroad is more in-depth. Some developed countries have established a scientific and comprehensive evaluation index system for mental health service. In China, the literature of mental health service performance evaluation, especially the research on community mental health service evaluation, is relatively lacking, and there is no recognized, scientific and comprehensive mental health service performance evaluation index system [2]. Due to the uneven distribution of mental health resources and incomplete mental health system in China, it is of great significance to explore the evaluation index system of mental health services at different levels of mental health service development [3]. It is the key to carry out disease control and management to carry out disease monitoring and accurately grasp its epidemiological characteristics. The objective and true evaluation of monitoring results is the key to improve the quality of monitoring. Mental health monitoring refers to the activities of collecting and analyzing the mental health of the population, the factors

affecting mental health and related mental health service information systematically and continuously. The monitoring contents include mental disorders, psychological behavior problems and risk factors, as well as mental health service [4]. There are many monitoring elements, so comprehensive evaluation of monitoring results is particularly important. Explore the application of comprehensive evaluation method in the quality evaluation of mental disorders monitoring.

2. The Construction of Monitoring and Evaluation Index System of Mental Illness

2.1. Collection of mental disease monitoring indicators

Delphi method is used to evaluate the importance of the indicators. The mean and coefficient of variation of importance score were calculated and the index was selected. The authority coefficient and coordination coefficient are calculated, and the problem is organized and stratified, and a hierarchical structure model is constructed. When complex problems are decomposed into components of elements, elements form several levels according to their attributes and relations [5]. The number of layers in the hierarchical structure is related to the complexity of the problem and the level of detail that needs to be analyzed. Generally, the number of layers is not limited [6]. In this study, it is equivalent to evaluation

framework, evaluation category, and evaluation item and evaluation index.

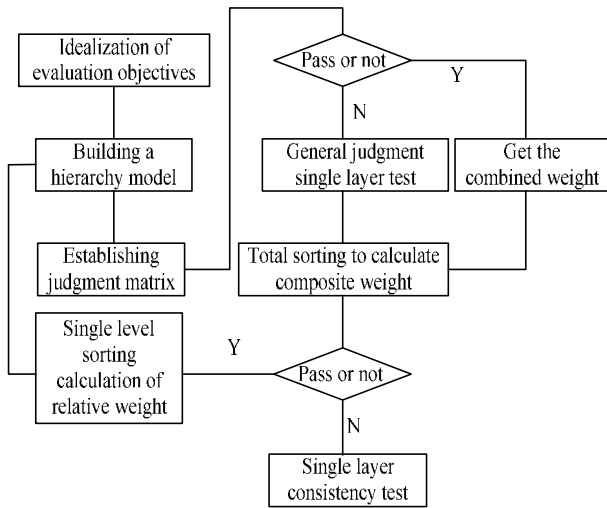


Figure 1. Hierarchy analysis structure layer and division

In order to control bias as much as possible, we took strict quality control measures in the research process. First of all, in the aspect of selection bias control, in the

selection of research sites, stratified sampling was conducted according to urban and rural areas [7]. A district was randomly selected from urban areas, and B county and C City were randomly selected from rural areas to reduce the selection bias caused by regional differences; In terms of the selection of investigation cases, the sampling proportion shall be determined according to the number of cases in the reporting system of each responsible reporting unit, so as to reduce the bias caused by the difference of responsible reporting units. Secondly, in the aspect of information bias control, in order to reduce the recall bias of patients or their guardians, the access to patient identity information and disease information shall be subject to the household register / ID card and medical record data provided by patients [8]. At the same time, in order to obtain the cooperation of patients and their guardians, the whole process of the investigation was accompanied by the fine Prevention Specialist of the responsible reporting unit where the patients were located, so as to eliminate the concerns of patients [9]. Normalize the data of the same trend and establish the normalization matrix Z. see the table for the data after the normalization formula processing.

Table 1. Normalized values of the same trend data

Regionalization (x, y)	x ₁ %	x ₂ %	x ₃ %	x ₄ %	x ₅ %	x ₆ %	x ₇ %
y ₁	90.02	82.39	64.35	59.64	66.82	100.00	84.63
y ₂	75.98	100.00	66.82	60.36	86.46	88.54	100.00
y ₃	59.64	86.46	67.95	72.49	59.64	72.49	90.41
y ₄	90.41	100.00	60.36	84.44	88.54	66.82	76.95
A ₅	88.54	84.49	75.84	59.64	75.84	84.49	100.00
y ₆	76.95	84.63	70.34	75.84	76.95	86.46	60.62
y ₇	59.46	72.49	80.12	70.34	84.49	66.82	88.54
y ₈	60.62	70.12	88.96	80.65	70.12	70.34	70.34

Based on the information in the above table, the best and worst vectors are determined according to the normalization matrix, and $Z^+ = (Z + x_1 + Z + x_2 + Z + x_8)$ and worst vector $Z^- = (Z - x_1 + Z - x_2 + Z - x_8)$, $Z^+ = (0.49, 0.35, 0.35, 0.36, 0.64, 0.33, 0.37, 0.48)$, $Z^- = (0.12, 0.20, 0.29, 0.24, 0.00, 0.33, 0.27, 0.20)$. Determine the distance between the evaluation index and the best and worst vectors. Calculate the weighted Euclidean distance (d) between the evaluation index and the best and worst vectors according to Z^+ and Z^- .

$$D^+ = \sqrt{\sum \lim_{0 \rightarrow \infty} [X(Z^+ - Z^-)^2]} \quad (1)$$

$$D^- = \sqrt{\sum \lim_{0 \rightarrow \infty} [Y(Z^+ + Z^-)^2]} \quad (2)$$

According to the magnitude of the relative approach coefficient (C_i), the order of the relative approach degree between each evaluation index and the optimal and the worst vector is calculated. The closer the C_i value is to 1, the closer the monitoring quality is to the positive ideal value. Calculation formula:

$$C_{ij} = \frac{D^+ - D^-}{2(D^+ + D^-)} \quad (3)$$

From the sorting results, the quality of zone a is the best, and that of zone f is the worst [10]. See the table for the specific calculation results:

Table 2. Regional level numerical division of evaluation matrix

Regionalization	D ⁺		D ⁻		C _{ij}	
	X ₁ %	X ₂ %	X ₃ %	X ₄ %	X ₅ %	X ₆ %
A	0.44	0.51	0.36	0.44	0.33	0.35
B	0.36	0.32	0.44	0.58	0.46	0.49
C	0.33	0.21	0.30	0.62	0.41	0.51
D	0.41	0.46	0.28	0.60	0.52	0.62
E	0.25	0.33	0.52	0.44	0.66	0.68
F	0.34	0.28	0.39	0.41	0.69	0.70
Sort	1	3	5	3	5	1

Taking the authority coefficient as the initial weight, the index weighted weight and normalized weight is calculated step by step [11]. The sum of the weight coefficients of the first level indicators, the second level indicators of the same level-1 indicators and the third level indicators of the same level-2 indicators is 1 respectively. Then, the combination weight coefficients of each two-level and three-level index are calculated respectively, and the combination weight is taken as the final weight of the index.

Secondary index weight = primary index weight × secondary index weight

Three level indicator weight = two level indicator combination weight × three level indicator normalization weight [12].

Combined with the theory of hierarchical structure analysis, the evaluation object or problem is regarded as a system [13]. According to the nature of the problem and the general goal to be achieved, the problem is divided into

different components. According to the interrelation and subordination between the elements, the elements are grouped according to different levels to form a multi-level analysis structure system and an orderly hierarchical structure to make the problem more hierarchical and organized [14]. Under the guidance of this method, this study regards the disease prevention and control system as a system. Guided by the functions and general objectives of the system, it decomposes the evaluation framework into different elements - Evaluation categories, and decomposes the evaluation categories into more detailed evaluation items. According to the interrelation and subordination among the elements in different levels, the elements are grouped according to different levels [15]. Thus, a multi-level evaluation structure system of evaluation dimension, evaluation category, and evaluation item and evaluation index is formed, and the evaluation is organized and hierarchical. Based on this, authoritative index coefficients are calculated and recorded as follows:

Table 3. Authority index reference value

Index classification	Judgment basis	Familiarity	Authority coefficient
First level indicators	0.54	0.72	0.93
Second level indicators	0.54	0.72	0.93
Third level indicators	0.54	0.72	0.93
Four level indicators	0.54	0.72	0.93
Five level indicators	0.54	0.72	0.93

2.2. Standard of mental disease detection index

The standard value of mental disease detection index is a comprehensive system, called early warning system, which is composed of institutions, systems, networks, measures, etc. to timely provide warning, to achieve ahead feedback of information, and to take preventive measures to minimize the possible loss caused by the danger. Based on the theory of early warning system, the community prevention and control early warning model of mental illness is a scientific and forward-looking early warning team composed of the staff and volunteers of fine prevention institutions, community health service institutions, neighborhood committees and other institutions, which integrates early warning monitoring, reporting, information verification and disposal. Its focus is on the community. For suspected cases, recurrent cases and

(Easy) in the whole process intervention mode of rapid, accurate and comprehensive monitoring, early warning

and disposal of potential hidden dangers or possible sudden mental health events, such as accident causing and disaster causing cases, in the general population, the suspected mental illness patients with precursor symptoms but without clear diagnosis are the early warning objects; in the mental illness patients registered, the patients with recurrence precursor symptoms or potential symptoms are the early warning objects The patients at risk of causing accidents and disasters are the objects of early warning. The first level early warning: suspected early warning. By monitoring the precursor symptoms of mental disorders of the general population or the population with abnormal conditions but not diagnosed in the community, suspected cases are found early. Second level early warning: that is, early warning of recurrence, screening and monitoring of the symptoms of relapse of the registered mental patients, early detection of relapse seedlings. Three levels of early warning: that is to say, early warning of accidents and disasters, monitoring and evaluating

the risk of speech and behavior of registered mental patients, and early detection of patients with the tendency

of accidents and disasters. Based on this, the evaluation index grade value is standardized as follows:

Table 4. Evaluation index grade value

First level indicators	Second level indicators	Third level indicators
Quasi premonitory index	Clue performance	Some psychiatric hospitals have been in hospital for mental disorders and are often locked in the mirror. They often talk nonsense at home. When they say something that others can't understand or don't conform to the reality without drinking, they often quarrel with each other for no reason, magnetize things, hit people, often talk to themselves and laugh, or their expressions are dull, or they behave strangely in public, their clothes are not neat, or even they are naked and suspicious, I suspect that people around me are talking about him or causing him to talk too much, to move too much, to run around, to meddle in his own business and so on. They are too cold, silent, slow, and do nothing. They commit suicide, self injury or self mutilation and so on. They don't go to school or work without any reason. They don't go out of the house and don't touch anyone
Premonitory index of recurrent prelight symptoms	Sleep disorders	It's hard to sleep in the picture. It's easy to have a dream
	Autonomic nervous dysfunction table	Head, head weakness, poor desire for soft food, etc
	Abnormal emotional performance	From the original complex of stability and peace, to emotional uncertainty excited, sometimes because of small face big licensing gas language increase individual steps appear relationship delusion, and the Zhou people are not satisfied with anxiety, depression. Fruiting
	Abnormal behavior	Fidgety, sometimes walking around or working ability reduced to taking medicine, etc
	Previous psychiatric symptoms	In the early stage of relapse, the symptoms similar to the previous onset, such as hallucinations such as auditory hallucinations, hallucinations, relationship delusions, physical influence delusions, victims' delusions, etc., are relatively disordered. Columns are fragmentary, sporadic, and occasionally unsystematic
	Other performance	Attention is not focused, sometimes mental talk is also action, or physical discomfort is poor response to external adaptability is late and pure, sometimes disease can be seen, etc
Early warning index of accident risk	No hazard indicators	Level 0: slow: no behavior in the following 1-5 levels
	Speech performance indicators	Level 1: verbal help, calling, but no beating
	Behavioral performance indicators	Level 2: magnetization, confined to home, for property. Can passively say don't stop. Level 3: obvious beating, regardless of the situation, for property, can't accept the action face stop level 4: continuous beating, regardless of the situation, for property or people, can't accept the action face stop. Including self injury and suicide 5: any act of force or fire, explosion, etc. against people with arms, no matter at home or in public

Because mental diseases often go through the prodromal stage and the onset stage in the process of occurrence and development, the treatment of mental diseases is generally divided into acute stage treatment consolidation stage

treatment maintenance stage treatment and other stages. Therefore, the establishment of early warning indicators of community prevention and control of mental illness should be hierarchical.

Table 5. Target prediction and detection parameters

Early warning signal	Target event occurred	No target event occurred	Total
Warning positive signal	a	b	a+b
Warning negative signal	c	d	c+d
Total	a+c	b+d	a+b+c+d

On this basis, combined with literature research and expert argumentation, most of the symptom monitoring systems in the prevention and control of infectious diseases are established to detect disease outbreaks and epidemics in time, so is symptom monitoring in the community prevention and control of mental diseases. Therefore, when evaluating the effect of early warning model, we often pay attention to the ability of early warning model discovery and identification, and put forward the framework of early warning index system, as follows Figure 2. The second round of expert scoring is used to calculate the index weight. The first level indexes were mental health importance (0.267752), monitoring system per-

formance (0.246915), monitoring system function (0.245534) and monitoring system resource allocation (0.239799). The top five indexes in the second level indexes were technical support (0.019132), disease occurrence frequency (0.018177), disease severity (0.016906), data quality (0.016300) and policy support (0.015789), and the third level indexes were technical support (0.019132), disease occurrence frequency (0.018177), disease severity (0.016906), data quality (0.016303) and policy support (0.015789) The top five indexes were prevalence rate (0.000394), supervision and quality control (0.000361), data authenticity rate (0.000332), risk beha-

violation rate (0.000330) and staff training rate (0.000325). See table for scales and weights at all levels.

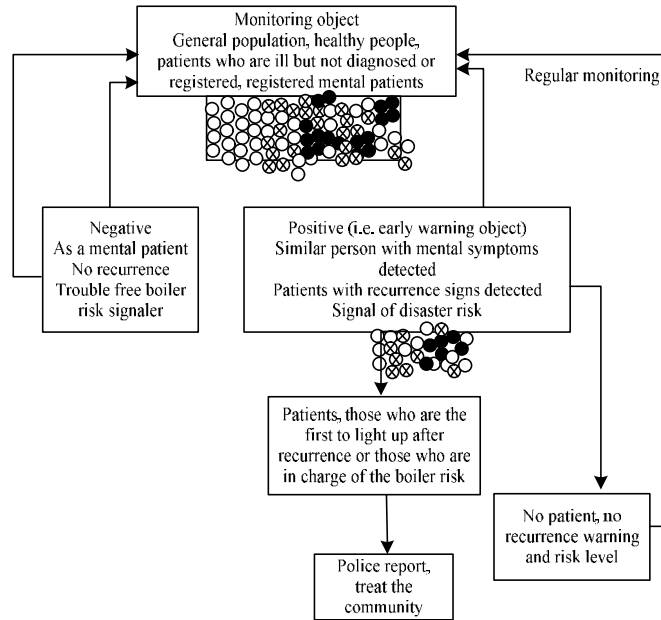


Figure 2. Evaluation and early warning diagram

Table 6. Scale of judgment matrix

Scale	Meaning
1	Indicates that the two indicators are of the same importance
3	The former is more important than the latter
5	The former is more important than the latter
7	The former is more important than the latter
9	The former is more important than the latter
2,4,6,8	Represents the intermediate value of the above adjacent judgments

Table 7. Inspection and evaluation index weight

First level indicators	Mean	CV	Weight	Secondary index	Mean	CV	Weight	Three level indicators	Mean	CV	Weight
Importance of mental health	8.25	8.01	8.63	Frequency of disease	8.65	8.16	8.46	Sad disease rate	8.23	8.46	8.02
		8.12	8.24	Disease severity	8.84	8.25	8.29	suicide rate	8.95	8.62	8.49
Monitoring system function	8.46	8.06	8.69	Purpose of monitoring	8.26	8.60	8.06	Incidence of dangerous behaviors	8.46	8.94	8.16
		8.04	8.56	Purpose of measurement	8.13	8.54	8.46	Disability rate	8.46	8.73	8.63
		8.10	8.22	monitoring content	8.95	8.83	8.53	3 hospitalization rate	8.16	8.72	8.56
		8.13	8.35	Monitoring system group	8.64	8.62	8.46	Cases found	8.67	8.65	8.47
Monitoring system source configuration	7.03	7.65	7.95	monitoring data	7.95	7.06	7.95	Analysis of the influencing factors of dangerous behaviors	8.66	8.49	8.62
		7.79	7.64	Policy guarantee	7.84	7.89	7.52	Evaluation of prevention and control effect	7.95	7.46	7.29
		7.54	7.32	simplicity	7.66	7.46	7.29	Disease information	7.56	7.26	7.46
Monitoring system performance	6.89	7.12	7.22	flexibility	7.82	7.22	7.50	Medication information manager	7.48	7.59	7.63
		7.16	7.68	Acceptability	7.64	7.68	7.49	Records of dangerous behaviors	7.46	7.47	7.15

In the above table, sensitivity, also known as sensitivity, also known as true positive rate, refers to the proportion of objects that can be correctly detected, identified and sent out early warning signals in the actual target events. The higher the value, the stronger the early warning ability. Specificity refers to the proportion that the model can correctly judge the target event that has not occurred in a certain period of time within the scope of the monitoring object, and cannot send positive signals, that is, the proportion that can correctly send negative warning signals, which indicates the ability to correctly judge the non warning object. The purpose of early warning report based on symptom monitoring is to gain more time for community prevention and control of mental illness. Therefore, in evaluating the effect of early warning model, timeliness index is particularly important. The timeliness is expressed by the detection time of the target event. The detection time refers to the difference between the time when the model discovers the early-warning object and sends the positive signal and the time when the target event occurs. The smaller the value is, the better the timeliness of the early-warning detection is.

2.3. Standard of disease detection model index monitoring

Referring to the hierarchical structure analysis theory and the progressive expression idea of "sub module concept / dimension index" of the macro model of health system, the evaluation framework is decomposed layer by layer and level by level to form a multi-level evaluation structure system of "evaluation framework evaluation category evaluation project"; Then, in view of the initially formed multi-level evaluation structure system, we will seek the opinions and suggestions of practical experts with rich experience in disease prevention and control. Through multiple consultation and demonstration, we will gradually improve and supplement this from the perspective of practice, and finally complete the hierarchy and organization of the performance evaluation framework. The whole research process is in-depth layer by layer, and the construction of performance evaluation framework and its hierarchy and organization are completed. Finally, the goal of systematically expressing disease prevention and control performance is achieved from the macro level. The whole development idea and method can be represented by the figure below.

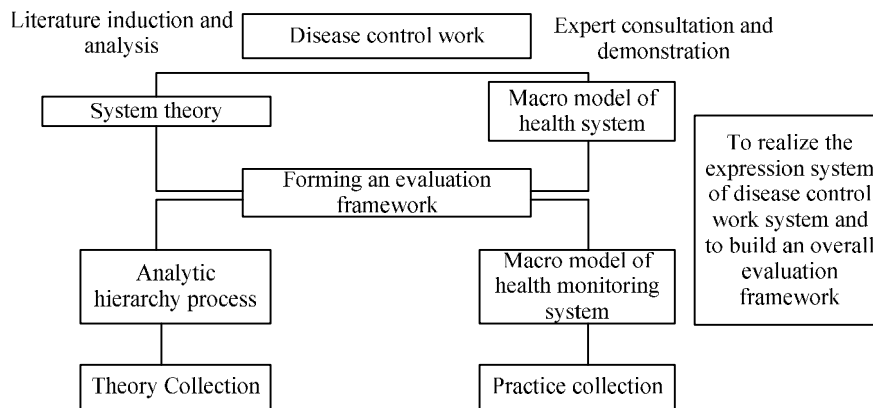


Figure 3. Hierarchical structure of disease detection model

On the basis of hierarchy and organization of evaluation framework, to establish a scientific index system of disease prevention and control performance, we need to focus on the following key technologies: whether the selected index is representative of the evaluation category and project, how to ensure that the selected index system is focused? How to determine the combination weight of performance evaluation index scientifically and reasonably; to solve the above problems, we need to build a scientific index system the following tasks should be focused on in establishing the index system of disease prevention and control performance:
 Comprehensive and systematic collection of indicators;
 Screening indicators;
 Defining indicators;
 Determine the index weight.

In order to achieve this screening process and ensure the representativeness of the selected indicators, based on the summary and analysis of the experience and problems in several rounds of screening process, this study defines eight principles to be followed in indicator screening, as follows:
 First, the indicators should be conducive to the government's supervision and evaluation of disease prevention and control;
 Second, indicators should be easily understood by the public and relevant departments;
 Third, the indicators should be scientific, balanced, oriented, comparable and operable;
 Fourth, indicators should have the widest representativeness for the evaluation categories or projects they

represent. The comprehensive evaluation of multiple indicators can maximize the work performance of the evaluation categories or projects they represent. The comprehensive evaluation of multiple indicators can truly reflect the content of disease prevention and control work; Fifth, the different indicators in the same evaluation category and the same evaluation project should have relative independence and mutual quality;

Sixth, we should pay attention to the current situation, take into account the development, and meet the needs of the development of disease prevention and control in China under the current situation of evaluation;

Seventh, regional performance evaluation of disease prevention and control should focus on social environment and work basis.

Eighth, the indicators should have a clear connotation and extension, and strive to be concise and accurate.

Based on the above steps, we can effectively achieve the research goal of constructing the mental disease monitoring and evaluation index system.

3. Analysis of Experimental Results

Establish database, input and organize through Excel 2003. SPSS13.0 is used for statistical analysis, mainly descriptive statistical analysis; in the use of analytic hierarchy process to determine the weight of the index system and fuzzy comprehensive evaluation method for comprehensive evaluation of performance scores, the algorithm of matrix operation is mainly used. According to the proportion of 5%, 476 cases were selected. A multi-stage and proportional sampling method was adopted to select the investigated cases.

In the first stage, according to the distribution of urban and rural areas, a district is randomly selected in a city of

a province, and B county and C City are randomly selected in a rural area.

In the second stage, according to the total number of serious mental illness cases in the reporting system in each county, the distribution proportion of the cases is determined. 138 cases are selected from district a, 236 from county B and 102 from city C.

In the third stage, 13 responsible reporting units and 11 responsible reporting units were selected in urban and rural areas respectively. The sampling proportion was determined according to the total number of cases reported in the system by each responsible reporting unit. The corresponding cases were randomly selected from the system, and their information was checked in the household, and the corresponding paper report card information was checked.

At the same time, the responsibility reporting units and responsible reporters of all the major mental disorders in district a, county B and City C were investigated. Report accuracy refers to the consistency of patient information in the system with that in the actual investigation. The method is to compare the patient case information items verified in the household investigation with the case information items entered in the system one by one. If the two items do not conform to each other, the report is deemed to be accurate. If the two items do not conform to each other, the report is deemed to be inaccurate. Report accuracy rate (2) the number of accurate cases reported in the system / the number of cases extracted in the system x 100%.

Based on the above environment, the effect of the evaluation system under the traditional analytic hierarchy process, entropy method and fuzzy clustering method in the actual application process is compared and recorded, as follows:

Table 8. Comparison of monitoring effect of evaluation index system

Method name	Advantage	Shortcoming	Features
Delphi method	There is no need for sample data, and experts can make judgment only based on their understanding of index inner function and extension		It is based on the knowledge, experience and value judgment of the expert group. When there is no sample data, especially the qualitative index of human quantity, AHP is used
	Compared with the Delphi method, the scope of application is the same. Because the AHP method is more logical and detailed in the analysis of the relative importance of each index, and needs mathematical processing, its credibility is higher than the Delphi method, which is more scientific	There is a lack of horizontal comparison among various indicators, and sample data is needed, which is limited in application	
The method of Di value	Because it reflects the utility value of information entropy, the index weight given by it is more reliable than Delphi method and AHP method	Only the weight of classification index can be given. It is inconvenient to determine the weight of single index, which needs the support of complete data	Weight judgment based on the information characteristics of samples
Modular cluster analysis	It is applicable to the classification of the importance of fuzzy indicators, especially when there are multiple indicators at the same level and a large number of fuzzy indicators	The limitations of expert experience and knowledge have not been eliminated. If the experts are not selected properly, the credibil-	Based on the similarity of sample model shed data, the relative importance classification of indicators is made

	ity will be reduced	
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Further, the actual application effect of the application of the four evaluation index systems is compared and tested,

and the results of the comparison and test are recorded as follows:

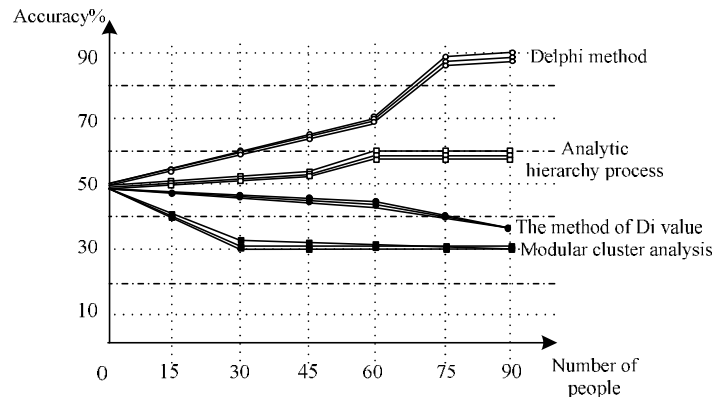


Figure 4. Comparison test results

It can be seen from the above test results that for the evaluation results of the other three index systems, the construction effect of the mental disease monitoring and evaluation index system based on Delphi method proposed in this paper has higher availability in the practical application process and fully meets the research requirements.

4. Conclusion

According to the operational logic, we should build a comprehensive framework to reflect the work performance, and make the evaluation framework organized and hierarchical, and evolve it into a representative and quantifiable evaluation index system; Then, from a single and quantifiable evaluation index system, the evaluation indexes of the upper layer represented by them are comprehensively expressed layer by layer, and the comprehensive analysis and evaluation of work performance are finally realized, so as to realize the realization degree, existing problems and cruxes of work objectives from different dimensions, and achieve the purpose of promoting work. To achieve the systematic expression of disease prevention and control performance, to build a comprehensive performance evaluation framework reflecting the work of disease prevention and control; to establish a disease prevention and control performance evaluation index system - index collection, index screening, index definition and demonstration, index weight determination; to comprehensively analyze the performance of disease prevention and control.

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