Academic Journal of Medicine & Health Sciences
ISSN 2616-5791 Vol.2, Issue 1: 20-24, DOI: 10.25236/AJMHS.2021.020105

Research on resident Health level and Measurement and Control Model based on Index system and Entropy method

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Abstract: *In order to thoroughly implement the spirit of the National and Provincial Health and Health Conference, this action plan is formulated according to the outline of the healthy China 2030 Plan and combined with the reality of Shenzhen. In this paper, principal component analysis and mutation series evaluation are mainly used to solve the health problems of Shenzhen residents. First of all, this paper analyzes the factors that affect the health level of residents, determines the corresponding indicators and constructs a three-tier index system, including 21 indicators. As there may be a certain correlation between the indicators in the established index system, and the correlation between the indicators will produce repeated information for the evaluation of residents' health level, so the independent indicators are reduced by principal component analysis. Finally, the catastrophe series method is used to calculate the independent principal components. Then the indicators within the framework are analyzed and screened to determine the index system of population health assessment; finally, the social public health and environment and individual residents are evaluated by entropy method and fuzzy evaluation. Find out the main health problems of Shenzhen residents and analyze the potential influencing factors, and put forward suggestions for health promotion and health intervention.*

Keywords: *Principal component analysis, Catastrophe series, Analytic hierarchy process of evaluation, level of health*

1. Introduction

Urban health is mainly the health of urban residents, which mainly involves many aspects such as life, environment, health, medical treatment, sports and so on.Guided by the spirit of General Secretary Xi Jinping's series of important speeches and the new ideas, ideas and strategies of the CPC Central Committee in governing the country, we should adhere to the strategic position of giving priority to the development of people's health and adhere to the correct policy of health and health work. We will actively implement the health action plan in key areas around popularizing healthy living, optimizing health services, improving health security, building a healthy environment, and developing health industries. Strive to change the mode of health and health development, deepen the supply-side structural reform in the medical and health field, maintain and protect public health in all directions and in the whole cycle, build a healthy Shenzhen, create a new bureau for the reform and development of health and health undertakings, improve the health quality of citizens in an all-round way, and build a well-off society in an all-round way for high quality. We will speed up the construction of modern, international and innovative cities and advanced socialist administrative regions to provide a solid and healthy foundation.

2. Construction of principal component analysis model

Principal component analysis is a method of processing high latitude data. It projects the high latitude data into the low latitude space as little as possible through the projection method, so as to simplify the data structure [1].

According to the scheme required by question 1, the health level of Shenzhen residents is selected as the evaluation object [2-4]. In order to ensure the scientificity of principal component reduction and search the literature, the index data of 11-17 years are obtained. Taking environmental factors as an example, the actual operation is as follows [5] [6]:

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Step1: Find the original data through the official website (see Appendix) and standardize it with Z-score. First, the average value and variance of each factor are calculated, and then the results are obtained by using the standardized formula in step 1.

$$z_{1,j} = \frac{x_{ij} - x_1}{s_j} \tag{1}$$

Step2: Find the correlation coefficient matrix. The following results can be obtained through the calculation of data processing function in Excel:

$$R= \begin{matrix} 1.0000 & 0.2556 & 0.4920 & -0.3348 & 0.4984 \\ 0.2556 & 1.0000 & 0.9126 & -0.4071 & 0.3483 \\ 0.4920 & 0.9126 & 1.0000 & -0.2047 & 0.5167 \\ -0.3348 & -0.4071 & -0.2047 & 1.0000 & -0.2800 \\ 0.4984 & 0.3483 & 0.5167 & -0.2800 & 1.0000 \end{matrix} \tag{2}$$

Step3: From the calculated correlation matrix, the eigenvalues and eigenvectors are obtained by using the eig function in MATLAB.

$$X= \begin{matrix} 0.2051 & 0.6539 & 0.2858 & 0.5307 & 0.4088 \\ 0.6439 & 0.0138 & -0.2205 & -0.5337 & 0.5018 \\ -0.6983 & 0.1305 & 0.1895 & -0.4093 & 0.5403 \\ 0.2160 & 0.0872 & 0.8305 & -0.3869 & -0.3261 \\ 0.0955 & -0.7400 & 0.3796 & 0.3412 & 0.4275 \end{matrix} \tag{3}$$

Step4: The principal components are obtained from eigenvalues and eigenvectors.

For example, environmental factors X1

$$\begin{cases} F11 = 0.41X11 + 0.50X12 + 0.54X13 - 0.33X14 + 0.43X15 \\ F12 = 0.53X11 - 0.53X12 - 0.41X13 - 0.39X14 + 0.35X15 \end{cases} \tag{4}$$

In the same way, we can get the relevant factors of medical treatment, life and style.

3. Catastrophe progression evaluation

There are three common catastrophe system models [7], as shown in the table below:

Table 1: Type list

Types	Number of indicators	System model
Cusp type.	2	$f(x) = x^4 + ax^2 + bx$
Dovetail type.	3	$f(x) = 1/5x\hat{}5 + 1/3ax\hat{}3 + 1/2bx^2 2 + cx$
Butterfly type	4	$f(x) = 1/6x\hat{}6 + 1/4ax^3 4 + 1/3bx^2 3 + 1/2cx^- 2 + dx$

Select the corresponding model according to the number of indicators, and use the formula to normalize the indicators.

$$k_i = \frac{k_i}{\max(k_1 \ldots\ldots k_m)} \tag{5}$$

Use the normalization formula of each model in the above table to calculate the mass state value corresponding to the control variable. They are recorded as M_1.. M_K. Calculate the mass state value of the state variable according to the mass state value of each control variable. If each control variable is complementary, then.

$$f = (m1 + \cdots mk) / k \tag{6}$$

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If not, then:

$$f = \min(m1 \cdots mk) \tag{7}$$

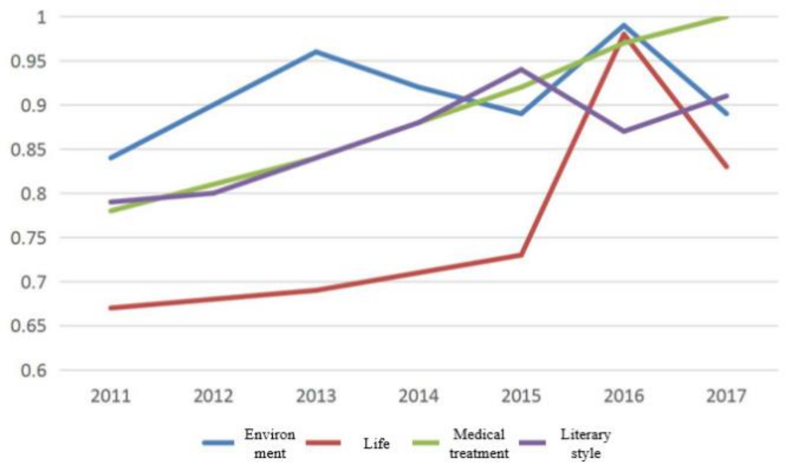

Figure 1: Influence result diagram

4. Construction of Entropy weight Evaluation Model

4.1 Selection of evaluation set

This paper adopts the international general standards, determines the evaluation criteria for each index, and establishes the evaluation set.

Establish universe $U = \{u_1, u_2, \ldots, u_n\}$, and establishment of evaluation level domain $V = \{V_1, V_2, \ldots, V_n\}$. Then find out the fuzzy relationship matrix between factor domain and evaluation domain.

$$R = \begin{pmatrix} r_{11} & \cdots & r_{1n} \\ \vdots & \ddots & \vdots \\ r_{m1} & \cdots & r_{mn} \end{pmatrix}, 0 \le r_{ij} \le 1 \tag{8}$$

4.2 Comprehensive evaluation results

Due to the different emphasis on each factor in U, it is necessary to give different weights to each factor, assign the above calculated weight to each factor, and represent it as a fuzzy subset on U, that is $A = \{\alpha_1, \alpha_2, \ldots, \alpha_n\}$ .And $\sum_{i=1}^{n} \alpha, \quad \alpha_i \ge 0$, After calculating R and a, the comprehensive evaluation is b=a.

Table 2: Grade and classification of social public health and environment and individual resident assessment system

Grade	A	B	C	D	E
Score	>80	70-80	60-70	40-60	<40
Classification	High quality	Good.	Medium.	Primary.	Unqualified

Grade and classification of social public health and environment and individual resident assessment system

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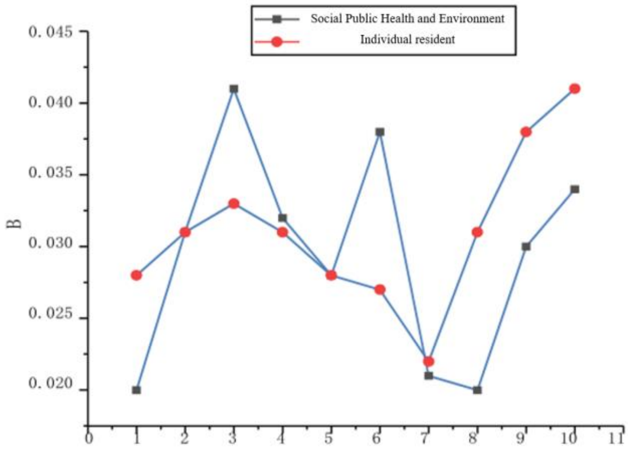

Figure 2: Grade and classification of social public health and environment and individual resident assessment system

5. RBF neural network model

Mapminmax function is used to normalize the data instead of the original radial basis function. The normalization method is [- 1,1] normalized mapping (see the appendix for the specific usage of the normalization function). Expressed by equation:

$$y=\left(ymax-y\min\right)^{*}\left(x-x\min\right)/\left(xmax-x\min\right)+y\min \tag{9}$$

Add a neuron to get the corresponding output, and then redesign the linear layer of the network to gradually reduce the error and reverse the repetition

The RBF neural network structure is constructed by newrb function. There are no neurons initially. Starting from the sample with the maximum error in the input data, each additional neuron will obtain the corresponding output, and then redesign the network linear layer to gradually reduce the error, repeatedly find the maximum error sample, add one neuron, and cycle this step until the maximum number of neurons is limited. The network is divided into two layers: input layer and output layer. The calculation process can be regarded as the hidden layer of input layer and output layer of BP neural network. The input layer only plays the role of transmitting information. The number of neurons of the established radial basis function neural network is equal to the number of inputs.

Set the radial basis function objective error as 1e-6 and the radial basis function expansion speed value as the number of neurons. Generally, the larger the radial basis function expansion speed spread, the smoother the function fitting. But too large spread needs a lot of neurons to adapt to the rapid change of function. If the spread setting is too small, it means that many neurons are required to adapt to the slow change of the function, so the spread can be set as the maximum dimension of training data.

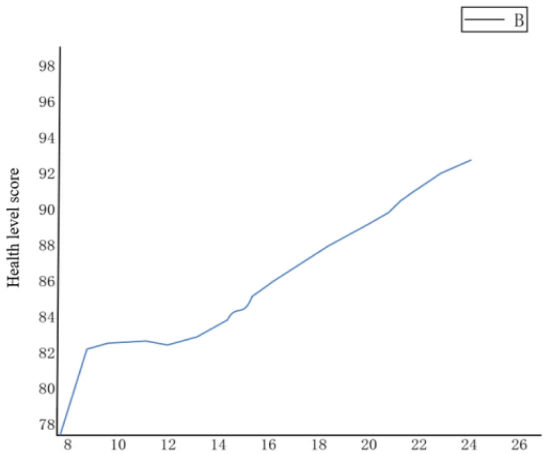

Figure 3: Health score result

ISSN 2616-5791 Vol.2, Issue 1: 20-24, DOI: 10.25236/AJMHS.2021.020105

The objective function is: $\min(\max)\sum_{i=1}^{5} z_{i2} = \sum_{i=1}^{5} b_{i2} + k_{i2} \cdot n_i$

Then the evaluation level of the evaluation index is determined, the output value is selected as the input index and the profit is selected as the output index, and the evaluation results are analyzed for DEA analysis.

6. Conclusion

In this paper, aiming at the health problems of Shenzhen residents, in order to deeply implement the spirit of the national and provincial health and health conference, principal component analysis, catastrophe series evaluation, analytic hierarchy process, RBF neural network prediction and data envelopment analysis are used to solve the health problems of Shenzhen residents. First of all, the factors affecting the health level of residents are analyzed, and then the mutually independent indicators are reduced by principal component analysis. Finally, the catastrophe series method is used to calculate the independent principal components. Then establish entropy method and fuzzy evaluation to evaluate social public health and environment and individual residents, find out the main health problems of Shenzhen residents and analyze the potential influencing factors, and put forward suggestions for health promotion and health intervention. Finally, the RBF neural network is used to monitor the abnormal data and push the solution in time. Because the model does not take into account the economic benefits of the evaluation model. It even makes it difficult for the model to meet the actual needs. Finally, this paper then establishes the packet analysis model to improve the applicability of the model.

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