Frontiers in Medical Science Research

ISSN 2618-1584 Vol. 1, Issue 1: 92-95, DOI: 10.25236/FMSR.20190111

Evaluation of Diabetes Treatment Based on Principal Component Analysis

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ABSTRACT. *Diabetes severely jeopardizes the health of patients. In order to improve the safety of patients, this paper screens out 11 indicators related to the medical effects of diabetes according to the conceptual framework of the evaluation system of II type diabetes medical effects, and then conducts Pearson on these indicators. Correlation analysis, combining or deleting three related indicators, and finally carrying out principal component analysis on the remaining eight indicators, ranking the three main components extracted as first-level indicators, and the remaining indicators are listed as secondary indicators, establishing A set of indicators for evaluating the effectiveness of diabetes medical treatment.*

KEYWORDS: *diabetes, pearson correlation analysis, evaluation index, principal component*

1. Introduction

Diabetes is one of the most common chronic non-communicable diseases. It is a clinical syndrome caused by the interaction of genetic factors and environmental factors. It is caused by insulin deficiency or insulin dysfunction secreted by the pancreas in the human body [1]. The prevalence of diabetes in China 20 years ago was 0.67%, and the number of patients now has reached 114 million [2]. Controlling blood glucose levels in inpatients plays an important role in reducing morbidity and mortality [3]. In order to improve the safety of patients, it is necessary to analyze and evaluate the diabetes treatment mode of patients admitted to existing hospitals. Therefore, it is very important to establish a set of diabetes medical evaluation index system.

2. Establishment of an evaluation index system for diabetes medical effects

The established diabetes medical effect evaluation index system is shown in Table 1.

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Table 1 Diabetes medical effect evaluation index system

	Primary indicator		Secondary indicators
Medical effect	Disease analysis index		AlCresult
	Economic Indicators	Outpatient medical expenses	number_outpatient
			num_lab_procedures
			number_inpatient
			number_emergency
		Hospitalization expenses	time_in_hospital
			readmitted
			number_diagnoses

3. Model solution

Step1:

According to the conceptual framework of medical ii type diabetes medical effect evaluation index system, the evaluation indicators related to the medical effect of diabetes are selected:

Step2:

The 11 indicators screened out may have a correlation between the two.In the statistical analysis, the variables and variables are independent of each other, so the correlation coefficient between the variables is calculated by Pearson correlation analysis, and the relevant variables are combined or deleted according to the correlation coefficient.

The calculated Pearson correlation analysis results are shown in Figure 1:

	time_in_hospital	num_lab_procedures	num_procedures	num_medications	number_outpatient	number_emergency	number_inpatient	number_diagnoses	readmitted	max_glu_serum	A1Cresult
time_in_hospital	1	0.318**	0.207**	0.467**	-.011**	-.011**	0.064**	.217**	.028**	.177**	-.036**
num_lab_procedures	0.318**	1	.073**	.272**	-.017**	-.009*	.029**	.152**	.028**	.200**	0.002
[illegible]	.207**	.073**	1	.412**	-.024**	-.039**	-.064**	.089**	-.048**	-0.006	0.000
[illegible]	.467**	.272**	.412**	1	.039**	0.004	.053**	.268**	.015**	.149**	-.050**
number_outpatient	-.011**	-.017**	-.024**	.039**	1	.081**	.103**	.091**	.075**	-.049**	0.003
number_emergency	-.011**	-.009*	-.039**	0.004	.081**	1	.270**	.052**	.080**	.059**	-0.005
number_inpatient	.064**	.029**	-.064**	.053**	.103**	.270**	1	.101**	.153**	.057**	0.015
number_diagnoses	.217**	.152**	.089**	.268**	.091**	.052**	.101**	1	.095**	0.030	-.138**
readmitted	.028**	.028**	-.048**	.015**	.075**	.080**	.153**	.095**	1	.032*	0.004
[illegible]	.177**	.200**	-0.006	.149**	-.049**	.059**	.057**	0.030	.032*	1	.532**
A1Cresult	-.036**	0.002	0.000	-.050**	0.003	-0.005	0.015	-.138**	0.004	.532**	1

**在 0.01 级别（双尾），相关性显著。

*在 0.05 级别（双尾），相关性显著。

Figure. 1 Pearson correlation analysis results

From the results in Figure 1, we can see that there is a correlation between num_procedures and num_medications, there is a correlation between

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num_medications and time_in_hospital, and there is a correlation between max_glu_serum and AlC-resence, so we can further filter out eight indicators: time_in_hospital, num_lab_procedures, number_outpatient, number_emergency, number_inpatient, number_diagnoses, readmitted, AlCresult.

Step 3: Perform principal component analysis on the selected indicators.The selected indicators are cost-type indicators, so the data is directly standardized.For the normalized data, the correlation coefficient matrix is calculated, and then the 11 eigenvalues of the correlation matrix are calculated.

Among the 11 eigenvalues obtained, 20.381%, 17.175%, 13.071% were selected, and the cumulative variance contribution rate was 50.627%<80%, so these three principal components only roughly divided the 8 indicators into hospitalization expenses. Outpatient medical expenses, disease analysis indicators are the three parts.Although the cumulative variance contribution rate is not high, the entire component analysis is based on the known conceptual framework of the ii-type diabetes medical effect evaluation index system, and is based on a large sample (100,000 sets of data), so the new The evaluation index system will not change much in the big direction.If there is no conceptual framework for the ii type diabetes medical effect evaluation index system, it is necessary to extract at least five principal components (extraction rate >73%) to make a detailed division of these eight indicators.

The distribution of these eight indicators on these three principal components is shown in Figure 2.

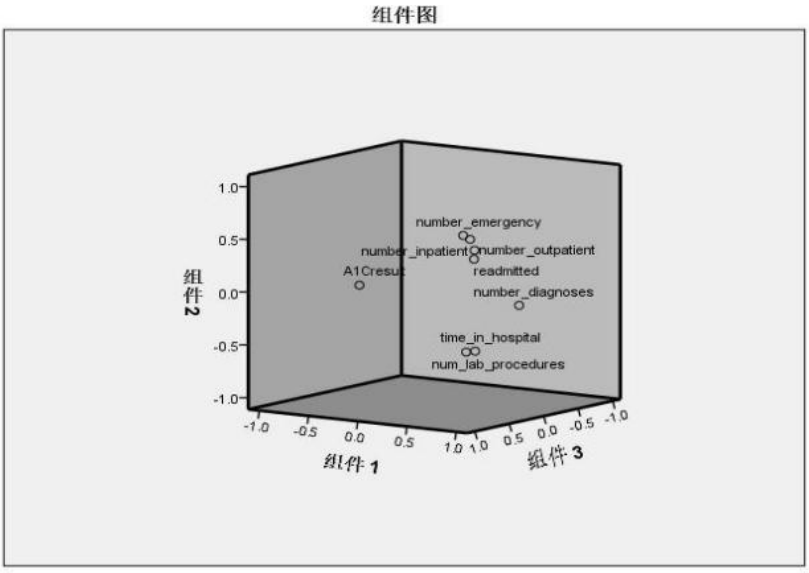

Figure. 2 indicator distribution map

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Table 2 Conceptual Framework for the Evaluation System of Medical Effects of Type II Diabetes

	Primary indicator	Secondary indicators	Three-level indicator
Medical effect	Physiological effects of disease	Disease analysis index	Fasting blood sugar
			2 hours postprandial blood sugar
			Glycated hemoglobin
			Fasting blood c-peptide
			Fundus symptoms
		Physiological function index	Somatosensory
			Physical activity
			Related internal organ sensation
	Non-disease effect	Non-economic indicators	Interpersonal communication
			Emotional activity
			Professional activity
			Family activity
		Economic Indicators	Outpatient expenses
			Hospital costs
			other fee

4. Conclusion

In this paper, the principal component matrix (in Table 2) is used to obtain the principal component score coefficient, and then the principal component score coefficient is used to obtain the score of the patient under each index. Finally, the composite score of the patient's diabetes medical effect is obtained according to the variance contribution rate (weight).The final medical effect is evaluated based on the comprehensive score, because the 8 indicators are cost-based indicators, so the lower the comprehensive score, the better the medical effect.

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