A study on regional comprehensive performance evaluation indicator system of rational use of drugs

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Abstract. The current research presents the design of a 4-degree-3-level performance evaluation indicator system of rational use of drugs for health care institutions accord with the Balanced Score Card (BSC) method. Financial index, patient index, professional process index, and development and blazing new trials index are adopted in the light of scientific, guiding, operable and generalizable principles. The index weight is based on the analytic hierarchy process, and comprehensive performance evaluation indicators are calculated by a linear integrated weighting method. Its practical application in 21 state-run health care institutions in Ningbo, from 2008 to 2012, has arrived at the finding that the comprehensive performance evaluation indicator system offers a scientific, practical and effective performance management quantification and is thus worth popularizing.

1 Introduction

How to promote the level of medical staffs' rational use of drugs is the key link in the application of essential medicine system. Most of the previous researchers at home and abroad focus more on rational use of drugs or performance and quality evaluation on a certain level [1-4], while it is obviously insufficient in the respect of representation and completion with the abolishment of drug-dependent medical policies. In order to standardize the supervision mechanism of rational use of drugs for health care institutions, it is meaningful to research so as to construct an integrative performance evaluation indicator model which can generalize and reflect the numerous elements and influential factors of rational use of drugs under the background of new medical reform. The current research presents the design of a regional comprehensive performance evaluation indicator system of rational use of drugs accord with the Balanced Score Card (BSC) method.

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2 Subjects and methords

2.1 Subjects

21 state-run health care institutions in a certain city, China, have been chosen as subjects. Institutions' original data from 2008 to 2012 has been collected with a method of field investigation and used to calculate the actual value of evaluation indicators after proper statistical treatments. The average value of the actual data from 2008 to 2012 has been calculated to be the evaluation indicator for each health care institution.

2.2 Choice of evaluation indicators

Based on the Balanced Score Card (BSC) method, financial index, patient index, professional process index, and development and blazing new trials index have been adopted to the performance evaluation indicator system of rational use of drugs in the light of people-oriented, sustainable, policy-type, guiding, safe, operable and generalizable principles.

2.3 Calculation and standardization of evaluation indicators

(1) Calculate the index value of valuation indicator.

(2) Identify the properties of the indicators: the indicators were divided into three types: Positive Index (the higher was the better), Negative Index (the lower was the better), Neutral Index (target the value around or on a moderate level).

(3) Calculate the standardized value: relatively process the indicator values according to the linear interpolation method [5] so as to get the standardized value.

2.4 Define the indicator weight

The Analytic Hierarchy Process (AHP) [6] was adopted to define the weight of the screening indicators on each level.

2.5 Build a mathematical model of performance evaluation indicator system of rational use of drugs

The linear comprehensive weighted index method [6] was adopted to build a mathematical model of performance evaluation indicator system of rational use of drugs. The computation formulas are as follows:

$$A_i = \sum_{j=1}^{m} (W_j \times Z_{ij}) \quad \text{(j=1,2,…,m)} \tag{1}$$

$$Z(A_i) = \sum_{i=1}^{n} A_i \quad \text{(i=1,2,…,n)} \tag{2}$$

$$U(A_i) = \frac{Z(A_i)}{E(A_i)} \times 100\% \tag{3}$$

In the above formula, $Z(A_i)$ stands for the comprehensive index value of the performance evaluation indicator system of rational use of drugs for each health care institution. $E(A_i)$ stands for

the benchmark index of the performance evaluation indicator system for each health care institution. *U(Ai)* stands for the realization degree of the comprehensive index value of the performance evaluation indicator system for each health care institution. A_i refers to the comprehensive evaluation indicator value of different levels. *i* refers to the number of health care institutions to be evaluated. *j* refers to the indicators of performance evaluation on each level. Z_{ij} equals the target value (standardized value) from Ai to Z_j. W_j is the weight value of Z_j on different levels, thus, $\sum_{j=1}^{m} W_j = 1$.

The regional comprehensive performance evaluation on rational use of drugs in a certain department or health care institution can thus be made as well as ranked according to the value of *Z*. A higher *Z* means a better performance management on rational use of drugs.

2.6 Data processing

The research is statistically processed with the software SPSS 16.0 for Windows.

3 Results

3.1 Evaluation indicator system

The research group has put forward 103 preselected group indexes, after being screened, 36 of which have been ascertained as indexes on the infrastructure layer. Financial index, patient index, professional process index, and development and blazing new trials index have been adopted as the four dimensions, meanwhile, 4 first level index, 12 second level index and 36 third level index have been adopted as the three levels of the performance evaluation indicator system of rational use of drugs in health care institutions (Table 1). There are 8 financial indexes, 12 patient indexes, 11 professional process indexes, and 5 development and blazing new trials indexes respectively. 17 positive indexes, 4 neutral indexes and 15 negative indexes have been set up according to the index attribute as well.

3.2 Results of index weighting calculation (Table 1).

Table 1. Comprehensive performance evaluation indicator system of rational use of drugs and its weight based on BSC

No.	First Level Index (weight, %)	Second Level Index (weight, %)	Third Level Index (weight, %)	Unit	Index Attribute	Synthetic Weight
1	Financial module (20)	1.Earning power(35)	Ratio of regular fiscal aid revenue to operating revenue (60)	%	positive	0.0420
2			Operating income and expenditure balance ratios (40)	%	neutral	0.0280
3		2.Spending power(35)	Outpatient's average medicine cost per doctor visit (25)	RMB	negative	0.0175
4			Average daily medicine cost of hospitalization (20)	RMB	negative	0.0140
5			Average medicine cost of each discharged patient (25)	RBM	negative	0.0175

6			Average ratio of pharmaceutical affairs cost price to each hundred-yuan drug sales revenue (30)	RMB	negative	0.0210
7		3.Support capability(30)	Coverage of health care institutions' management system of rational use of drugs (60)	%	positive	0.0360
8			Rate of qualified prescriptions (40)	%	positive	0.0240
9	Patient module (35)	1.Medicine attributes (35)	Average medicine variety on each prescription (25)	type	neutral	0.0306
10			Average variety of essential drugs in each prescription (25)	type	Positive	0.0306
11			Average variety of antibiotics in each prescription (25)	type	negative	0.0306
12			Percentage of antibiotic prophylaxis applied on operated patients (15)	%	negative	0.0184
13			Percentage of antibiotics applied on inpatients (10)	%	negative	0.0123
14		2.Image and prestige (25)	Patients' awareness rate of rational use of medicine (35)	%	Positive	0.0306
15			Utilization of generic names of drugs (25)	%	Positive	0.0219
16			Utilization of essential drugs or formularies (40)	%	Positive	0.0350
17		3.Patients' needs	Average cost of each prescription (35)	RMB	negative	0.0490
18			Percentage of essential drugs in each prescription (25)	%	positive	0.0350
19			Cost of antibiotics in each prescription (30)	%	negative	0.0420
20			Average expenses on antibiotics from patients who have accepted antibiotic treatment (10)	RMB	negative	0.0140
21	Project process module (35)	1.Quality of medicine use (45)	Utilization of antibiotics (20)	%	negative	0.0315
22			Utilization of injections (15)	%	negative	0.0236
23			Utilization of steroids (10)	%	negative	0.0158
24			Proportion of prescriptions with over two kinds of antibiotics (30)	%	Negative	0.0473
25			Reports rate on adverse drug reactions (25)	%	Positive	0.0394
26		2.Efficiency	Average consultation time (40)	Min.	Positive	0.0420

27		of medicine use (30)	Average time of compounding (40)	Sec.	Positive	0.0420
28			Average days of antibiotic prophylaxis for operating patients	Day	Negative	0.0210
29		3.Medicine follow-up (25)	Percentage of medicine labeling integrity (30)	%	Positive	0.0263
30			Percentage of antibiotic treated patients being sent to pathogenic examinations and drug sensitive tests (10)	%	Positive	0.0088
31			Patients' degree of satisfaction in rational use of drugs (60)	%	Positive	0.0525
32	development and creative module (10)	1.Diathesis and capabilities (40)	Percentage of health technicians with middle and senior titles (60)	%	Neutral	0.0240
33			Thesis published by health technicians per capita (40)	article	Positive	0.0160
34		2.Information capacity (35)	Information process degree of rational use of drugs (100)	%	Positive	0.0350
35		3.Ability to inspire (25)	Coverage of on-the-job vocational training on rational use of drugs (70)	%	Positive	0.0175
36			Annual earnings per capita of the staff members on the payroll (30)	RMB	neutral	0.0075

3.3 Actual application of the comprehensive performance indicator system of rational use of drugs in health care institutions from 2008 to 2012 in a Chinese city

The average composite performance index of rational use of drugs among 21 health care institutions from 2008 to 2012 in a Chinese city was 61.15. The average index of the U Institution was the highest 72.11 in 2012, while in the year 2009, that of the K Institution was merely 44.26 as the lowest. Judging from the average index from 2008 to 2012, the T Institution, scoring 66.84, achieved the highest composite performance index of rational use of drugs, while the B Institution only accounted for 50.23. The top three were the T Institution, the Q Institution and the E Institution in proper sequence with scores 66.84, 66.48 and 65.38 respectively. The last three were the B Institution, the K Institution and L Institution with scores 50.23, 52.15 and 55.93 in file (Table 2).

Table 2. Results of the performance evaluation of rational use of drugs in health care institutions from 2008 to 2012 in a Chinese city

INSTs	Financial module indicator		Patient module indicator		Project process module indicator		Develop and creative module indicator		Comprehensive performance evaluation	
	Performance index	ranks	Performance index	ranks	Performance index	ranks	Performance index	ranks	Total Performance index	ranks
A	11.73	17	16.92	19	21.70	6	6.75	9	63.49	6
B	9.24	21	14.81	21	21.17	7	9.32	1	63.29	7
C	11.96	16	16.89	20	22.47	4	7.05	8	65.19	4
D	11.57	18	19.09	18	23.31	2	6.70	10	66.48	2
E	14.14	4	24.79	1	18.76	17	8.02	4	58.37	17
F	12.77	10	24.43	5	19.10	15	4.04	19	59.53	15
G	13.39	9	23.51	7	18.59	18	2.62	21	56.36	18
H	13.39	8	20.66	15	17.40	20	4.10	18	52.15	20
I	14.20	2	23.26	10	18.07	19	4.49	16	55.93	19
J	12.22	15	23.34	9	19.94	11	5.82	13	60.83	11

K	12.43	13	22.22	13	13.40	21	5.01	14	50.23	21
L	11.11	19	20.64	16	19.68	12	7.11	7	60.72	12
M	14.17	3	23.03	11	20.94	9	3.33	20	62.29	9
N	12.51	12	22.42	12	22.72	3	7.69	5	65.38	3
O	12.57	11	19.94	17	21.10	8	6.59	11	62.88	8
P	14.07	5	24.77	3	20.11	10	4.37	17	62.02	10
Q	13.85	7	23.92	6	22.01	5	8.27	3	63.80	5
R	14.25	1	23.45	8	19.05	16	7.33	6	58.65	16
S	13.88	6	21.99	14	19.14	14	8.38	2	59.84	14
T	12.39	14	24.78	2	23.48	1	6.20	12	66.84	1
U	9.96	20	24.54	4	19.23	13	4.85	15	60.36	13

4 Discussion

In China, National Essential Drug System (NEDS) is an important and difficult part of the new health care reform. To set up and manage an effective NEDS, a scientific and effective performance evaluation system of rational use of drugs is much needed. The research integrates experts' suggestions with the current practice of rational use of drugs in health care institutions, so as to set up a representative, guiding, practical, independent and sensitive indicator system. What's more, its practical application in 21 state-run health care institutions from 2008 to 2012 in a Chinese city, has arrived at findings accord with the operational state, which has further revealed the correctness, effects, reliability and scientific nature of the evaluation findings. Thus, being repeatable and feasible, the performance indicator system has been proven a practical and effective performance management quantization tool which is worth of populating.

However, under the background of new national health care reform, it is a huge systematic project to set up a performance evaluation system of rational use of drugs for health care institutions. The various levels of health care institutions and their unique developmental characteristics have directly led to the complexity and difficulty in setting up a performance evaluation system of rational use of drugs. Despite the fact that the current research have managed to choose fewer but better indicators in an objective and overall way, we believe there are significant improvements still to be made. Abundant, repeated investigations and applications wait to be planned and then carried out step by step. Aimed at an ambition of digitalization of performance evaluation indicator system of rational use of drugs, the construction of residents' electronic health files (HER) should be progressively refined, so as to make the evaluation system a valid method in measuring the management effects of health care institutions' performance evaluation of rational use of drugs.

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