Research on the Evaluation of the Quality of Medical Research Project Funds Use

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Abstract. The illegal use of scientific research funds may lead to serious consequences such as "corruption crime", which not only causes the loss of national scientific research funds, but also ruins the personal future of scientific researchers. Establish the evaluation model of the use quality of scientific research funds, scientifically select evaluation indicators, and establish the weight of indicators, so as to quantify the use quality evaluation of project funds, and originally put forward the "corrective calculation". The evaluation indicator can effectively guide scientific research personnel to use scientific research funds rationally and prevent the negligent behavior of scientific research funds.

1. Introduction
Improper use of scientific research funds is likely to cause serious consequences. In 2017, China youth daily reported the "crime of scientific research funding"[1], which analyzed 34 judgments of scientific research funding crimes, all of which were classified as crimes of corruption. "China science news" [2] reported that the national natural science foundation of China (NSFC) has made public the papers with problems, among which 110 were medical papers (94%). Although some major scientific research projects passed the final acceptance, problems occurred in the subsequent special financial review, leading to serious consequences [3]. The reason is that the supervision of the use of scientific research project funds is not paid enough attention to, the project leader draws scientific research funds by making false invoices, and the hospital where the project is located intercepts the funds, so that the funds cannot be used for special purposes [4]. Based on the above considerations, this paper adopts the internationally mature evaluation technology and the original "correctability algorithm" to construct the evaluation model of the quality of medical research project funds and standardize the use of scientific research funds.

2. Materials and methods
2.1. Selection criteria of experts
Experts mainly come from medical system experts, who are required to work in relevant fields for more than 5 years and are familiar with the evaluation indicators. Eleven persons were invited to participate in the evaluation and selection of indicators. Because Delphi method requires expert evaluation to be anonymous, independent and feedback, it is more rigorous than traditional expert evaluation method.
2.2. Preliminary construction of indicators
Through literature analysis, analysis of laws and policies on medical research, consultation with relevant staff and project leaders, all indicators related to the use of medical research project funds and financial review were included, mainly including whether the use of funds in the beginning of the project was overspent, the benefits of the use of funds and the use of illegal. Three primary indicators, eight secondary indicators and 27 tertiary indicators were initially constructed. The indicators were set according to Likert five-level scoring method, which were set as 5, 4, 3, 2 and 1 points for quantification.

2.3. Research methods
Delphi method was adopted to construct, screen and simplify the evaluation indicator system [5], and the variation coefficient weight method was used to establish the indictor weight [6], and the expert authority coefficient was calculated. A large number of evaluation results were converted into percentage system or Bradford's law.

2.4. Statistical analysis
SPSS22.0 and EXCEL were used to conduct statistics on the questionnaire results, including questionnaire reliability, indicator variation coefficient, Kendall coefficient, Cronbach coefficient, etc.

3. Results

3.1. Reliability analysis of the questionnaire
The overall kronbach coefficients of the two questionnaires were 0.896 and 0.892 respectively, both greater than 0.6, indicating the high reliability of the questionnaire.

3.2. Expert reliability analysis
The Kendall's W (Kendall coefficient) coordination coefficient reflects the consistency of expert opinions. The Kendall's coefficient is 0.645 and 0.617 for two times. The P values of the two rounds of chi square test are less than 0.01, indicating that the expert has high credibility. The reliability of experts was 0.81, 0.85 and 0.86, all above 0.8, and the results were satisfactory.

3.3. Establishment of weights
The weight method of coefficient of variation was used for distribution. Coefficient of variation = standard deviation/mean difference; Weight of coefficient of variation = coefficient of variation of an indicator/sum of coefficient of variation of an indicator, and the results are shown in table 1 and 2.

Table 1. First-level indictor integral, variation coefficient and weight

| Indicators  | Integral (±SD) | Coefficient variation | Weight |
|------------|---------------|-----------------------|--------|
| A Expenses | 4.95±0.22     | 0.044                 | 0.34   |
| B Benefit  | 4.95±0.22     | 0.044                 | 0.34   |
| C Bad use  | 4.95±0.21     | 0.043                 | 0.33   |

Table 2. Second-level indictor integral, variation coefficient and weight

| Indicators            | Integral (±SD) | Coefficient variation | Weight |
|-----------------------|----------------|-----------------------|--------|
| A1 Income & expenditure | 4.81±0.40     | 0.083                 | 0.13   |
| A3 Cost overruns      | 4.76±0.43     | 0.092                 | 0.14   |
| B1 Economic benefits  | 4.76±0.44     | 0.091                 | 0.14   |
| B2 Social benefits    | 4.86±0.36     | 0.074                 | 0.11   |
| B3 Project completion | 4.57±0.51     | 0.111                 | 0.17   |
| C1 Personal behavior  | 4.76±0.43     | 0.092                 | 0.14   |
| C2 hospital behavior  | 4.67±0.48     | 0.103                 | 0.16   |
3.4. Correctable algorithm
The correctability algorithm is mainly used for the above evaluation calculation. Based on the degree of whether the fund loss can be recovered and corrected, the five-grade scoring method is adopted: completely correctable, correctable, ordinary, uncorrectable and difficult to correct, and 5, 4, 3, 2 and 1 points are given respectively. Set Q as the use quality score of project funds and n as the correctability score of the project, then the final total score W can be calculated as follows:

\[ W = Q \times (1 + n/5) \]

3.5. Application practice
Evaluate the use of funds for a project. Starting from three levels of indicators, the score is five-level, that is, 5-1, the more important, the better, the higher the score. Still rely on expert points. It is proposed that 01, 02... And other 20 scientific research projects to assess the use of funds.

**Step 1:** Calculate the three-level indicator score

| Indicators | B11 | B12 | B13 | B21 | B22 | B24 | B34 | C11 | C12 | C13 | C21 | C22 | C23 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Weight     | 0.05| 0.09| 0.08| 0.07| 0.08| 0.07| 0.07| 0.06| 0.10| 0.08| 0.08| 0.08| 0.07|
| Score      | 4   | 5   | 4   | 4   | 3   | 3   | 4   | 4   | 3   | 4   | 3   | 4   | 4   |
| Score      | 0.2 | 0.45| 0.32| 0.28| 0.24| 0.21| 0.28| 0.18| 0.4  | 0.32| 0.32| 0.24| 0.28|

**Step 2:** Calculate the score of secondary indicator

| Indicators | A1 | A3 | B1 | B2 | B3 | C1 | C2 |
|------------|----|----|----|----|----|----|----|
| The weight | 0.13| 0.14| 0.14| 0.11| 0.17| 0.14| 0.16|
| Three level indicator score | 1.21* | 1.1* | 0.65 | 0.81 | 0.28 | 0.9 | 0.84 |
| Score      | 0.159| 0.154| 0.091| 0.089| 0.048| 0.126| 0.134|

* is the actual percentage.

**Step 3:** Calculate first-level indicators

| Indicators | A   | B   | C   |
|------------|-----|-----|-----|
| The weight | 0.34| 0.34| 0.33|
| Score of secondary indicators | 0.313| 0.228| 0.26|
| Score      | 0.106| 0.0775| 0.0858|
| total score: A+B+C | 0.269|

And so on, you can get points for other items.

Percentage system conversion method: convert the highest score into 100 points and multiply the conversion ratio by other points respectively to get the percentage points of all items. In this example, 0.72 is the highest score. If 0.6786 is converted into 100 points, it needs to be multiplied by 138.89. Then the scores of other projects can be multiplied by 138.89 respectively to get. Bradford’s law classification: its distribution: 1: a: a^2. When alpha is 2, 1/(1+2+4)=14.3%, the top 14.3% is considered excellent. Similarly, the projects between 1/7 and 2/7 can be listed as good, and the projects between 2/7 and 4/7 can be regarded as qualified. The proportion is multiplied by the total number of projects and rounded to obtain: the projects ranked in the top 3 are excellent, the projects ranked in the top 4 to 6 are good, and the projects ranked in the top 7 to 11 are qualified. See table3.
Table 3. The final points and ranking of 20 projects are as follows:

| Project number | Score | Correctable rating | Total score | Percentage conversion score | Final ranking |
|----------------|-------|--------------------|-------------|------------------------------|---------------|
| 01             | 0.269 | 4                  | 0.4842      | 67.                          | 6             |
| 02             | 0.198 | 3                  | 0.3168      | 44.                          | 17            |
| 03             | 0.324 | 2                  | 0.4536      | 63                           | 12            |
| 04             | 0.224 | 5                  | 0.448       | 62.2                         | 14            |
| 05             | 0.301 | 3                  | 0.4816      | 66.8                         | 7             |
| 06             | 0.284 | 3                  | 0.4544      | 63.1                         | 11            |
| 07             | 0.330 | 4                  | 0.594       | 82.5                         | 5             |
| 08             | 0.250 | 4                  | 0.45         | 62.5                         | 13            |
| 09             | 0.172 | 4                  | 0.3096      | 43                           | 18            |
| 10             | 0.262 | 4                  | 0.4716      | 65.3                         | 9             |
| 11             | 0.145 | 5                  | 0.29        | 40.2                         | 20            |
| 12             | 0.236 | 5                  | 0.472       | 65.5                         | 8             |
| 13             | 0.380 | 3                  | 0.608       | 84.4                         | 3             |
| 14             | 0.168 | 4                  | 0.3024      | 42                           | 19            |
| 15             | 0.255 | 4                  | 0.459       | 63.7                         | 10            |
| 16             | 0.214 | 4                  | 0.3852      | 53.5                         | 16            |
| 17             | 0.377 | 4                  | 0.6786      | 94.2                         | 2             |
| 18             | 0.220 | 5                  | 0.44        | 61.1                         | 15            |
| 19             | 0.372 | 3                  | 0.5952      | 82.6                         | 4             |
| 20             | 0.400 | 4                  | 0.72        | 100                          | 1             |

4. Discussion
In recent years, the government and academic circles have paid more and more attention to the academic misconduct and phenomenon in the field of scientific research, and once discovered, they will be punished accordingly [7]. However, if the use of scientific research funds are considered as a "violation", it is not conducive to encouraging researchers to actively undertake research tasks. The negligence of scientific research funds may be caused by insufficient supervision, management and guidance, and sometimes the losses can be made up. Because outlay budget cannot forecast, market condition, price rises and falls, it is difficult to control artificially. Project funds overspend, there is a certain risk. In addition to reflecting the people-oriented management purpose, correctable algorithm also suggests whether researchers can bear negative consequences, so as to strengthen self-restraint.

In a word, set up a scientific research project funds use evaluation indicator system, can use quality of scientific and reasonable evaluation of scientific research funds, guide the rational use of scientific research project director of scientific research funds, the hospital also gives a project to do financial regulatory responsibilities, to prevent excessive misuse of research funds play a positive role in scientific research personnel.

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