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Research Article

Improving Indices in Evaluation of Medical Research Centers in Iran

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Abstract

To implement Health System Reform Plan properly, it is required to evaluate and survey process of health research system, as well as implementation process and effectiveness of such system using accurate indices. Research evaluation means systematic measurement of policies, programs or plans to determine the success in achieving the objectives of the nationwide health system, ultimately, improvement the health level of society equitably. Assessment of the scientific research centers causes beneficiaries of each scientific institution to be informed of improvement level and quality of scientific activities, and enables them to receive feedback from the evaluation for dynamic planning and developing of scientific activities. This study aimed at ensuring that the best indices are chosen for evaluation of health research system. Methodology: This research was conducted using descriptive-analytic method. The statistical population comprised all heads of research centers, and prominent experts and scholars of Iran. Sampling was done using targeted method. For data collection, indices that were most important in terms of evaluation of health research system were selected, which formed the main parts of the expert's opinion questionnaire. In process of asking expert's opinion, a limited population of fully qualified experts was used. Some of the questionnaires were completed by respondents via e-mail and others in person. Finally, 16 questionnaires were completed and analyzed. According to the results, the most important indices as seen from the views of experts were those of innovation and creativity in the field of research and services, strategic planning, including identification of the vision and mission of research centers (including mission, values, long term goals, internal environment analysis, external environment analysis, choice of strategies, alignment of activities with the objectives, the one-year-long action plan), designing new training courses for the purpose of targeted research, scientific breakthroughs leading to provision of services in the field of healthcare, health policy making and management, training and education industry, attracting elites and financial resources.Conclusion: Results of this study indicated that the selected indices had the potential to be used to ensure the proper and accurate evaluation of research centers, and to ensure their development in accordance with the set objectives.It is suggested for future researches to determine the utility of such indices at the end of the medical research centers evaluation period, and to provide proper mechanisms for provision of data in this regard and for measurement of the said indices.

Keywords: indicators, evaluation of research, medical research centers, health reform plan, Iran

Introduction

Over the past decade, centers of excellence always has sought access to the latest scientific findings and expand the boundaries of knowledge, training researchers, creating a dynamic and productive environment, and establishment and promotion of effective international scientific communications.
The knowledge cycle includes the acquisition of knowledge, the production and dissemination of knowledge, and application of knowledge.

The basis of research includes macro research strategies and macro policies and missions, based on which on which research should be developed. The important thing is that the findings of the research process should be evaluated in three areas: impact, outcome and output. To perform this task, in 2009, the Education Department of Ministry of Health placed on its agenda the plan to evaluate centers of excellence of Iran. Achievement of competent and efficient research in the research system requires continuous monitoring and ensuring that actions are in line with the targets. Such requirement is met by the assessment and evaluation of research centers. Performing evaluation through comparison of the actual conditions with the intended results helps managers and policy makers in assessing progress with respect to the goals and objectives. Assessment is an integral part of every executive activity.

One of the most important steps in the evaluation process is to determine the appropriate indices to measure performance. Performance measurement indices are defined for the purpose of measuring the results and ensuring accountability. Such indices must be measurable, comprehensive, easily understandable, important at present and in future, acceptable, and capable of measurement and control.

Evaluation allows the centers of excellence allows to compare their efforts in different fields against the maximum effort possible in that field, so that if they didn't score enough, they could try to collect more scores to reach the maximum level.

In Iran, establishment and development of centers of excellence has received attention from higher education policy makers in the past decade, According to the regulation of the Ministry of Science, Research and Technology, the term "center of excellence" refers to a scientific group (educational or research) that performs scientific activities and has certain characteristics in the field of education, research and services [2].

Currently, there are 110 centers of excellence at universities of Tehran, Tabriz, Mashhad, Kerman, Shiraz, Isfahan, Gilan, Kermanshah and Hamadan [3]. There are 26 centers of excellence in the field of Medical Sciences under the Ministry of Health and Medical Education. Since 2000, upon development of regulation of the said ministry, effective steps were taken to establish and develop centers of excellence in medical sciences across Iran, and as the next step, to design a system, and provide evaluation instruments based on absolute indices, and approval thereof by Supreme Council of Centers of Excellence in 2013 for the purpose of optimized allocation of financial resources, and also, ranking of centers of excellence. Particularly important in the assessment process should be reminded that the process of the institution is important because in other academic institutions around the world also runs a similar process.

As for the degree of importance of the evaluation process, it should be noted that it is of the utmost importance in this process is important, because high institutions in the scientific world as well as other the same process are implemented in other scientific institutes around the world.

The benchmark of evaluation in European academic centers includes the following topics and sub-topics: [4].

The quality of the research; consistence of subjects of researches; value added created from inter-sector cooperation; the impact on related topic; achievement of applications for the transfer of such knowledge to operational sectors; employing famous research teams meeting international quality standards; creating research job opportunities, especially for young researchers; providing training courses on research concepts; International research employment opportunities, particularly for young researchers; gender equality, and structural equality, including organizational and managerial structural equality; use of local capacities; influencing the academic structures; and permanence. Another appraisal on research centers of an Asian country such as Korea focused on the index of leadership, and items of support for researches, provision of equipments, provision of scientific facilities for users, availability of research quality infrastructure, and leadership of researches were included as evaluation benchmark. [4] The evaluation conducted in Iran also suggest that in addition to considering the instruments and the methods used, it has been stressed that centers of excellence must send regular performance reports to a systematic structure gathering data relating to the indices adopted by the Supreme Council of Centers of Excellence [5]. The latter advantage empowered secretariat of the centers of excellence to build

capacity to provide performance statistics to domestic and foreign clients, and enabled documentation of such scientific institutions. However, to enhance the quality of evaluation instruments and methods, the educational Directorate of Ministry of health, treatment and medical education initiated design of medical centers of excellence evaluation model in 2007 through contracting. Having been designed, experimentally studied, and amended according to the opinion of the heads of medical centers of excellence, this instrument was adopted as the evaluation benchmark for all medical centers of excellence of Iran in 2009.

Mohammadi et al. (2009) focused on the evaluation of research centers on the basis of systematic approach, and input, process and output parameters, because output is product of input activities and process. [6]
Jamali (2011) stress the necessity to pre-research or post-research evaluation. This paper states that post-evaluation can concern output, outcome and impact, and/or the research process. There are various methods for evaluating the output, impact and outcome of a research, which can be categorized in three groups: quantitative, qualitative and quantitative-qualitative. [7]

The experiences from use of evaluation instruments and methods in the past few years reveal that some of the indices contained in the instruments require more clarification and transparency. For example, aspects of "governance" are not measured by such instruments. Therefore, in order to improve the quality of the evaluation instruments and methods, this paper explored the design of instruments and the content of research centers evaluation indices based on indices of "input and governance", "process", and, "educational, research, technological, and service outputs".

Methodology

This research was conducted using descriptive-analytic method. The statistical population comprised all heads of research centers, and prominent experts and scholars of Iran, who were experienced in the intended field, and were familiar with the concepts included in the questionnaire.

Sampling was carried out using targeted method, taking into account such factors as relevant executive work experience, record of having relevant papers published, and being a known figure in the intended filed on national level.

Data collection was carried out using a questionnaire containing 41 items, each of which related to importance of one of indices specified by the researchers. To develop the questionnaire, indices that were deemed by the researchers to be more important in study of evaluation indices for improvement of Iran's research centers were selected. To choose these indices, first documents related to available categorizations of health programs evaluation indices were reviewed. However, different categorization methods were found to be used in these documents, and therefore, the two following important categorizations were mostly used to select indices:

a) Evaluation indices of research centers of Ministry of Health
b) Systematic approach indices based on input, process and output factors

International experiences suggest that evaluation of the scientific institutions be conducted on the basis of a systematic approach, and input, process and output factors, because output is the product of input and process activities. This paper was carried out using the systematic approach, with the said three focuses, based on the performance indices of health research system, that is, governance and leadership, knowledge production and dissemination, mobilization of financial resources, creation of an encouraging environment, and using consultation services of experts [7]. Health research system indices include a set of indices to measure elements and activities of this system. Elements of activities of this system include: 1. The establishment of the research system including defining of the vision, mission and objectives of the research system, setting appropriate health research priorities, design and survey of research code of ethics, survey and evaluation of research system; 2 – providing and ensuring equitable allocation of financial resources; 3 – creation, maintenance and strengthening of the physical, human, legal and administrative capacities to guide, attract and support the researchers; 4 – production of credible and valid scientific results, such as making research results available to policy makers, executives, and the public, and the use of research results in the development of the drug, vaccines, and medical equipment to improve public health [8].

To prepare questionnaire, first the content domain of questionnaire was defined. Various methods are used

to determine the validity of the instrument [11]. These methods are apparent validity, content validity, concurrent validity, predictive validity, and construct validity. Each of these methods is used for a specific purpose. In designing the questionnaire, apparent validity and content validity methods are first used to ensure that a consistent the apparent content is prepared, and to determine content validity of the questionnaire. Since the objective of this study was to develop a specific questionnaire to evaluate evaluation indices of Iran's medical research centers, content validity method was used, because it is more valid than the apparent validity.

1-1 **Determining the class or dimensions of the content of the questionnaire**: at this stage, of the guidelines provided by Chadwick et al. (1982) were used to determine dimensions of content domain of the questionnaire [13] Evaluation indices were determined based on the results of these studies. In this section, the items covering such indices in evaluation of medical research centers were designed.

1-2 **Specialization of items and preparation of draft questionnaire**: at this stage, in meetings of 10 to 20 people held in research workplace (with emphasis on the above benchmarks), items were designed in a procedure in which researchers took note of items that they deemed to be capable of improving such benchmarks while the evaluation benchmarks were described and discussed. Then, such these items were categorized in different dimensions and layers given the literature, and experts' opinions. In this stage, it was tried to ensure that members of specialized group were from among heads of research centers, or heads of research departments of such centers, as well as experts and scholars in this field. A sample question from each class was provided as a guide, and the rest of questions were developed by the members of the group (based on practical experience of theirs or their colleagues). In this stage, a draft questionnaire was developed.

1-3 Development and promotion of the draft questionnaire:

Since the items were developed by a special group, it seemed necessary to use scientific guidelines in development of the questionnaire. Therefore, the guidelines provided by Leedy and Ormrod (2001) [10] were used to create a general and comprehensive questionnaire in order to increase the effectiveness of the responses. Finally, using such guidelines and making required modifications, a 41-item questionnaire was designed. This draft is summarized in Table 3.

In this model, the questionnaire was provided to the panel, and they were asked to provide their opinions regarding each item on the defined scale. The answers of members were coded as follows:

- E: Essential
- U: Useful but not essential
- N: Not essential
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Because judgment scale was differently perceived by different people, it was decided that judgment benchmark be scaled as "completely agree", "agree", "I have no idea", "disagree", and "completely disagree". It seemed that in consistence with guidelines provided by Leedy and Ormrod (2001), this scale facilitated completion of questionnaire because it additionally included the choice of "I have no idea", which extended the range of responses [14].

Also, in the instructions provided in the beginning of the questionnaire, members were asked to provide their corrective opinions regarding items to which they intended to answer by making "disagree" or "completely agree" choices. Respondents could also add aspects and items to questionnaire.

1-4 Identification of validation panel members: At this stage, members of panel group must be identified. Members of validation panel group must be from among specialists in the same field as that of content domain of questionnaire, so that accurate judgment becomes possible. Such members were selected according to predefined objectives in the following procedure: first, a limited number of people specialize in the same field of that of content domain of the study were selected as group leader, whose assistance were used in selecting other members of the panel group.
Although the method proposed by Lawshe considers the minimum number of members as 4, it was decided that more members be used in this study. This decision not only resulted in overcoming the upcoming limitations such as people's withdrawal from inclusion in the study, and their failure to return the completed questionnaire, but also increased the reliability of the results [12].

Nature of the study required that the specialists make at least one hour to complete the questionnaire. To overcome such problems as limited number of specialists in the study field, and multidimensional nature of content domain of the study, it was decided that the questionnaire be validated by at least 8 and at most 16 people. The minimum 8 was chosen on the grounds that it was two times as much as the minimum proposed by Lawshe, and therefore, allowed required consensus and validity coefficient of zero to be achieved with a higher level of confidence. And, the maximum of 16 was chosen on the grounds that it was two times as much as the minimum level, and ensured overcoming such problems as failure of respondents to return the completed questionnaire. 16 specialists in the field of development of medical research were identified. Among other inclusion benchmarks was respondent's willingness to make one hour to complete the questionnaire.

1-5 Administration and collection of validation questionnaires: some panel group members were communicated in person, by telephone or by e-mail. Of selected people, 16 agreed to participate in this study. Finally, 16 completed questionnaires were provided to researchers.

1-6 Data input: Judgments of group members were given as input to personal computer, Mathematical and statistical analysis of data was performed using Microsoft Excel Software.

1-7 Quantification of opinions of panel group members: Opinion of panel members who made E (essential) choice were quantified using the content validity ratio, hereinafter called CVR [12]. For this purpose, the following formula was used:

Equation 1: $CVR=ne-n/2/2$

In this equation, ne denotes number of panel members who considered that dimension or item to be essential; n/2 total number of group members divided by two; and CVR conversion of the linear and direct form of group members, who made "essential" choice.

The values assumed by CVR are as follows:

When less than half of the group members make "essential" choice, CVR is negative.
When half of the group members make "essential" choice, while another half of the group members make other choices, CVR is equal to zero.
When all of the group members make "essential" choice, CVR is equal to 1.
When not all group members have made "essential" choice, but the number of people that have made the "essential" choice is more than half, CVR ranges between zero and 0.99.

The designed indices were discussed in a meeting attended by experts including 6 head of medical research centers of medical universities, 6 heads of research departments of such centers, and 4 Directors General of Ministry of Health. Finally, it was agreed to prepare evaluation form based on the focuses, fields, and indices with the following characteristics; and, the evaluation benchmarks and scoring method were finalized.

Agreed focuses included:

1- **Focus of input**, which was categorized into three fields of governance, mobilization of resources and facilities, and manpower.

1-1 The field of governance deals with making strategic plans in each center. Strategic plans in this evaluation model were defined as a long-term five-year plan [9], which comprised elements of the vision, mission, objectives, one-year operational objectives, written survey plan, executive plan output indices, and written evaluation plan, which will be evaluated and revised annually.

1-2 Field of mobilization of financial resources was defined and scored according to indices provided by World Health Organization and based on attracting financial resources from governmental and non-governmental organizations. This index measured budget attracted or allocated out of governmental resources, public institutions, non-governmental resources, and other resources including charities, private organizations, NGOs, international organizational based in Iran or abroad, and scientific institutions abroad.

1-3 Field of attraction of manpower

This field represents attraction of people who are elite or exceptional talent as defined by Supreme Council of Cultural Revolution [9], and who have contributed to the center of excellence in theses or projects approved in the evaluated year. To calculate the score of index, each man-month corresponds to one score.

2 – Focus of Process

The evaluation of this focus aims at study of the fields of capacity building and knowledge production of the projects in progress.

2-1 Field of capacity building

In this field, potential of research centers are evaluated in terms of attracting cooperation of elites, attracting resources and facilities, network activities, empowering personnel, exchange and dissemination of knowledge, and cooperation with scientific organizations and international scientific relations. A set of standards including well-developed structure, availability of trained personnel to perform task, availability of information website, availability of specified processes to perform the plan in consistence with the index are considered for each index. The score of each index was defined by summing up the scores obtainable by the center for meeting each of the said standards.

2-2 Field of projects in progress

This field studies education and non-educational demand-driven projects, scientific and academic partnership with organizations abroad, revision of curricula, and design of new courses. In this field, indices related to educational activities scored higher.

3 – Focus of Output

In this focus, fields of knowledge dissemination, treated two separate fields, that is, educational and research knowledge dissemination, as well as field of knowledge application were considered for evaluating the extent to which results of researches and achievements of research centers lead to change of policies, management, and provision of health, medical, educational, and research services or improvement of health in community. Also, their effect on production in medical and pharmaceutical industries was considered. Elementary indices intended were revised by designer colleagues, and also, revised based on the opinions of some experts. Finally, 41 indices were selected (table 1).

Table 1 – Selected indices for asking experts' opinions

1.	Set the research center's vision
2.	Set the mission of center
3.	Set the chart of center
4.	Determine what rationale, doctrine and policies of the center are.
5.	Set status map of center, including weaknesses, challenges and opportunities
6.	Set executive instructions for research center
7.	The ability to attract funds and support
8.	Determine the legal management of the center
9.	Appoint specialized training management for center
10.	Ability to attract elite to research center
11.	Ability to attract resources
12.	Ability of center to establish International relationships
13.	Cooperation with international organizations
14.	Network activity in the center
15.	Ability to empower staff
16.	Availability of demand-driven non-educational projects
17.	Availability of demand-driven educational projects
18.	The ability to consult organizations abroad
19.	Design the new training courses as required with emphasis on interim courses
20.	Revise curricula

20. Ranked first by the efforts of exceptional talents educated in the center in countrywide exams
21. The number of PhD graduates and specialists and super-specialists
22. Overseas students who attended formal training courses or graduated from such courses of the center
23. Provide study opportunities in Iran for faculty members
24. Hold formal training courses
25. Number of specialty and super-specialty theses directed by the center
26. Have scientific research journal center
27. Number of first type papers published by center
28. Number of second type papers published by center
29. Number of third type papers published by center
30. Publish non-indexed papers
31. Present papers abroad
32. Write books
33. Produce educational media, diagnostic and medical guides and scientific software
34. Citation of papers published in the name of the center
35. Citation of articles published by the center in reference book of Educational Department of Ministry of Health
36. References to articles in the pole test reference textbooks in the field of Education, Ministry of Health
37. Hold national and international seminars
38. Have scientific achievement that have led to the provision of services in the fields of healthcare, health policy and management, industry, community, education and research
39. Innovative and creative in the fields of education, research and service
40. Won scientific medals for scientific activity from scientific festivals
41. Have consultation department.

When all members of panel disagree with essentiality of an item, it is concluded that such item is completely non-essential.

1- When all the members of the Panel agree completely with an item being essential, there two possibilities: either all of them are wrong or all of them are right. Since they are making opinion as expert comments, it must be concluded that it is not that they all are wrong, and therefore, such item can be considered as being significantly essential.

- Every item that is deemed by over half of the members of panel as being essential has some degree of content validity.
- The higher the number of panel members who vote yeah to essentiality of an item (over 50%), the higher the validity of that item would be.

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It seems that it is sometimes necessary to give different weights to CVRs calculated for different items. [12]

1-9- Determining mean values of judgments made by panel members

According to suggestion by Lawshe, to calculate mean values of judgments made with regard to each element of the instrument, the following conversions were made in validation questionnaire.

- 2 was substituted for E that denoted essentiality.
- 1 was substituted for N that showed that some element was required but not essential.
- 0 was substituted for U that denoted inessentiality.

1-10- Determining the benchmarks for inclusion or exclusion of the items:

The following benchmarks were used for inclusion or exclusion of the items as items of the medical research centers evaluation indices questionnaire.

An item was unconditionally included if its CVR was equal to or greater than 0.75. This figure was set considering the number of panel members (16), and obtained from table 2.

Table 2

Item	CVR	Numerical mean of judgments	Included or Excluded
1 - Has the vision of research center been specified?	1	2	Included
2 - Has the mission of research center been specified?	1	2	Included
3- Has the organizational chart of research center been specified?	1	2	Included
4- Have the doctrine and policy of research center been specified?	0/88	1.8	Included
5- Has the status map of research center, which includes weaknesses, challenges and opportunities been specified?	1	2	Included
6- Have the executive instructions for research center been specified?	0/88	1.8	Included
7- Has the center had attracted funds and support?	0/75	1.7	Included
8- Has the legal management of the center been appointed?	1	2	Included
9- Has the educational management of the center been appointed?	1	2	Included
10 – Has the research center had the ability to attract elite to research center?	0/88	1.8	Included
11- Does the research center have the ability to attract funds and resources?	0/88	1.8	Included
12- Has the research center had the ability to establish relation with international communities?	0/62	1.6	Included
13- Has the research center been accepted by international organizations?	0/62	1.6	Included
14- Is there network activities in the research center?	0/5	1.5	Included
15- Has the research center had the ability to empower its staff?	0/75	1.7	Included
16- Does the research center perform demand-driven non-educational projects?	0/75	1.7	Included
17- Does the research center perform demand-driven educational projects?	1	2	Included
18- Does the center have the ability to consult organizations abroad?	0/5	1.5	Included
19- Has the center designed the new training courses as required with emphasis on interim courses?	0/5	1.5	Included

20- Has the center had revised curricula?	0/5	1.5	Included
21- Has the center had exceptional talents educated in the center who have obtained high ranks in countrywide exams?	0/5	1.5	Included
22- Does the center have PhD graduates and specialists and super-specialists?	0/62	1.6	Included
23- Has the center Overseas students who attended formal training courses or graduated from such courses of the center?	0/37	1.3	Excluded
24- Does the center provide study opportunities in Iran for faculty members?	0/62	1.6	Included
25- Does the center Hold formal training courses?	0/62	1.6	Included
26- How many specialty and super-specialty theses have been directed by the center?	0/62	1.6	Included
27- Does the center Have scientific research journal center?	1	2	Included
28- How many first type papers have been published by center?	1	2	Included
29- How many second type papers have been published by center?	1	2	Included
30- How many third type papers have been published by center?	0/88	1.8	Included
31- Has the center had non-indexed papers published?	0/88	1.8	Included
32- Does the center have papers publish abroad?	0/88	1.8	Included
33- Does the center have book publication department?	0/88	1.8	Included
34- Does the center Produce educational media, diagnostic and medical guides and scientific software?	0/75	1.7	Included
35- Have paper published by the center been cited in journals?	0/88	1.8	Included
36- Have the articles published by the center been cited in reference book of Educational Department of Ministry of Health	0/62	1.6	Included
37- Does the center holds national and international seminars?	0/62	1.6	Included
38- Does the center have scientific achievement that have led to the provision of services in the fields of healthcare, health policy and management, industry, community, education and research?	0/88	1.8	Included
39- Does the center have a department of Innovation and creativity in the fields of education, research and service?	1	2	Included
40- Has the center won scientific medals?	0/5	1	Included
41- Has the center have consultation department?	0/88	1.8	Included

- An item was included if its CVR ranged 0-0.48, and numerical mean of judgments was equal to or greater than 1.5. Such CVR values indicate that more than half of panel members made "completely agree" or "agree" choices. The mean value equal to or greater than 1.5 indicates that the mean judgment is closer to “completely agree” and “agree” choices. On the other hand, the mean value equal to or greater than 1.5 suggests that the mean judgment is equal to or greater than 75% of the maximum mean (2), which is greater than the minimum acceptable value (60%) specified for validity. [13]
- An item was excluded if its CVR was smaller than zero, and numerical mean of judgments was smaller than 1.5.
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CVR values smaller than zero meant that less than half of subjects made "completely agree" or "agree" choices (essential item in Lawshe’s scale), and that numerical mean of judgment was closer to choice of “I have no idea” (Lawshe’s unessential scale).

CVR value, numerical mean of judgments and results showing whether an item was included or excluded in cognitive failures questionnaire are summarized in Table 3.

1-11- The content validity index and introduction of the finalized questionnaire: content validity index, hereinafter briefly be shown as CVI, is the mean value (CVR Σ) of items remaining in the validated model, the test, or the instrument. CVI represents a comprehensiveness of judgment related to the validity of the finalized model, the test, or the instrument. As final content validity increases, CVI approaches 0.99; the opposite of this also holds.

Equation (2):

$$CVI=\sum 1/n \ \ CVR/Retained\ numbers$$

In this equation, CVI denotes content validity index, and retained number denotes the number of remaining items.

Results

Of the 16 people who completed the questionnaire, 6 were heads of research centers, 6 were head of research department of university, and 4 were the ministry's director general (4 female and 12 male). Table 3 shows mean score of different indices from view of experts. According to the results of this study, the most important indices from view of experts were innovation and creativity in the field of research and service, strategic planning, including identification of the vision and mission of research centers (including mission, values, long term goals, analysis of the internal environment, study of the external environment, selection of strategies, external environment analysis, choice of strategies, alignment of activities with the objectives, the one-year-long action plan), designing new training courses for the purpose of targeted research, scientific breakthroughs leading to provision of services in the field of healthcare, health policy making and management, training and education industry, attracting elites and financial resources, with CVR being equal to 1.

In output indices group, in the field of application of knowledge, index of innovation and creativity in research was the most important index (numerical mean = 2); in group of input indices, in the field of governance, the index of strategic planning for research centers was the most important index (numerical mean = 2); in input indices group, in the field of projects in progress, index of designing new training courses in line with objectives of research was the most important index (numerical mean = 2); in output indices group, in the field of application of knowledge, index of scientific breakthroughs leading to provision of services in the fields of healthcare, policy making, health management, industry, education and research was the most important index (numerical mean = 2); and in input indices group, in the field of application of knowledge, index of scientific breakthroughs leading to provision of services in the fields of building capacity for attraction of elites by research centers was the most important index (numerical mean = 2).

Discussion

Overall, based on the findings of this study, indices of innovation and creativity in the field of research and service, strategic planning, including identification of the vision and mission of research centers (including mission, values, long term goals, analysis of the internal environment, study of the external environment, selection of strategies, external

environment analysis, choice of strategies, alignment of activities with the objectives, the one-year-long action plan), designing new training courses for the purpose of targeted research, scientific breakthroughs leading to provision of services in the fields of healthcare, health policy making and management, training and education industry, attracting elites and financial resources were the main indices involved in evaluation of research centers.

Creativity and innovation in research is an index that has received less attention, and is one of the reasons for this could be the lack of proper capacity for accreditation of such products by the Ministry of health. Based on the findings of this study, it would appear that such creativity and innovation in research can be one of the main indices to be used in survey and evaluation of the research centers.

The necessity to pay attention to market patterns, to accept the new role of experience and experiment as a cognitive activity, and to revise the relationship between science and technology, increased importance of the public space, increasing popularity of democratic practices, and opportunity for a closer international cooperation are among the reasons why formation of centers of excellence is necessary.

Providence requires that economic and social needs of the future generations be considered. Therefore, it is necessary for universities to encourage their affiliated research centers to meet the economic, social, industrial and service needs. According to such approach, application of knowledge can be considered as the most important function of research centers of medical universities.

Since indices of this evaluation cover all aspects of management including recruiting and training human resources, finance, procurement of equipment, empowerment and knowledge production processes, and finally, output in terms of education, research, service and industry, it can be considered to be a comprehensive evaluation. This method allows the centers of excellence allows to compare their efforts in different fields against the maximum effort possible in that field, so that if they didn't score enough, they could try to collect more scores to reach the maximum level.

However, in many areas of the output, no limit has been specified for scores to be obtained in the main activities, and so, it is not possible to identify the differences between research centers in terms of such activities. Yet, the scoring trends of one research center in different years can be compared, and the results of such comparison can be used to measure growth of that research center. Another important point to note is that it may be required in revision of indices to consider more weight for some indices based on specific mission of each center, or to exclude some indices because they are not relevant to some centers. Thus, it is recommended to categorize the centers in terms of their mission, and to develop specific indices for each of them.

Conclusion

It can be concluded from what was said that given health system reform plan should direct all health system activities until 2025, one of the concerns of health system policy makers is to ensure that all such activities are in line with the set targets, which requires measurement of appropriate indices. The results of this study showed that experts in the field of research believed that the selected indices had the potential to be used for the said purpose. It is suggested for future researches to determine the utility of such indices at the end of the medical research centers evaluation period, and to provide proper mechanisms for provision of data in this regard and for measurement of the said indices in the interval between two evaluations. It is very important that such indices are accepted as indices selected by consensus of experts in Iran, and to create a solid infrastructure for survey of such indices.

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