ORIGINAL ARTICLE

Improved Classification of Medical Universities in Iran, a New Approach

<div dir="rtl">

تحسین أسلوب ترتیب جامعات العلوم الطبیه فی ایران، رؤیه جدیده

</div>

Masoumeh Nazari Chamak[1],
Khodadad Sheikhzadeh[2], Ali
Akbar Haghdoost[3,*]

[1]Student Research
Assembly, Kerman
University of Medical
Science, Kerman, IRAN
[2]HIV/STI Surveillance
Research Center, and WHO
Collaborating Centre for
HIV Surveillance, Institute
for Futures Studies in
Health, Kerman University
of Medical Sciences,
Kerman, IRAN
[3]Modeling in Health
Research Center, Institute
for Futures Studies in
Health, Kerman University
of Medical Sciences,
Kerman, IRAN

[*]Modeling in Health
Research Center, Institute
for Futures Studies in
Health,
Kerman University of
Medical Sciences
Kerman, IRAN

Tel: +98 9133439427
Email:
ahaghdoost@gmail.com
Received: October 3, 2015
Accepted: December 20,
2015

Background: In order to check the practicality of classification of Universities of Medical Sciences (UMSs) based on their infrastructures, and scientific contributions, this study explored the most appropriate indicators to measure the size and productivity of UMSs.

Methods: In the first phase, we approached a group of experts who had a deep experience in the management of UMSs and in the ministry of health to check their recommendations. In the second phase, we collected the information of all UMSs in Iran in indicators to measure their achievement in education, research, health care services and their infrastructures. Having used factorial and principal component analysis, the most appropriate combination of indicators was formed, and UMSs were grouped and mapped, accordingly.

Results: Experts strongly recommended such a classification using the information of UMSs in all aspects of activities. The findings of models also showed an acceptable goodness of fit for the classification of UMSs based on scientific indicators, with and without taking into account of the indicators in related to the health services and infrastructure.

Conclusions: Since, the size of UMSs in Iran is extensively diverse, ranges from very small and newly established to old and globally well known ones, a satisfactory classification based on acceptable criteria is highly recommended.

Keywords: Classification, Principal Component Analysis (PCA), Medical Sciences Universities

<div dir="rtl">

المقدمه: تم اجراء هذه الدراسه بهدف متابعه ترتیب جامعات العلوم الطبیه علی اساس البنیه التحتیه والفعالیات العلمیه و المعاییر المناسبه فی استثمار جامعات العلوم الطبیه.

الاسلوب: فی المرحله الاولی تم تجمیع آراء و تجارب مجموعه من المدراء و الخبراء فی مجال اداره الجامعات علی مستوی وزاره الصحه. فی المرحله الثانیه تم تجمیع معلومات علی اساس المعاییر المطلوبه من جمیع جامعات العلوم الطبیه فی ایران حتی نقیّم مستوی نجاحهم فی مجالات التعلیم و البحوث و الخدمات العلاجیه و الصحیه و البنیه التحتیه. و من ثم عبر تحلیل العوامل الاساسیه تم ترکیب المعاییر المناسبه و تم علی هذا الاساس ترتیب جامعات العلوم الطبیه و اخذ الخرائط لها.

النتائج: لقد وصی الخبراء مراعاه هذا الترتیب حسب جمیع جوانب الفعالیات و معطیات الجامعات. ایضا اشارت نتائج النماذج تفوق متناسب لترتیب الجامعات علی اساس المعاییر العلمیه مع و بدون اخذ بعین الإعتبار المعاییر المرتبطه بالخدمات الصحیه و البنیه التحتیه.

الإستنتاج: نوصی باجراء ترتیب علی اساس معاییر ادنی نظرا الی تنوع الجامعات من حیث الحداثه و العراقه فی ایران.

کلمات المفتاح: ترتیب، تحلیل المؤلفات الاصلیه، جامعات العلوم الطبیه.

</div>

<div dir="rtl">

بهبود تیپ بندی دانشگاههای علوم پزشکی در ایران، رویکردی جدید

ایران کی یونیورسٹیوں کی درجہ بندی میں بہتری، نئی روش

</div>

<div dir="rtl">

مقدمه: به منظور بررسی کاربردی دسته بندی دانشگاه های علوم پزشکی مطابق با زیرساختها و فعالیتهای علمی آنها، این تحقیق بهترین شاخص ها را برای اندازه گیری وبهره وری دانشگاههای علوم پزشکی مورد بررسی قرار می دهد.

روشها: در فاز اول به منظور بررسی توصیه های گروهی از کارشناسان خبره در حوزه مدیریت دانشگاههای علوم پزشکی و وزارت بهداشت با کارشناسان فوق ارتباط برقرار نمودیم. در فاز دوم ما همه اطلاعات و شاخص های دانشگاههای علوم پزشکی را به منظور بررسی دست آوردهایشان در آموزش، پژوهش وخدمات بهداشتی و درمانی و زیرساختها را در ایران جمع آوری نمودیم. با تجزیه و تحلیل عاملی پایه ، مناسب ترین ترکیب فاکتورها شکل گرفت و مطابق آنها دانشگاههای علوم پزشکی طبقه بندی و نقشه برداری شدند.

نتایج: کارشناسان چنین طبقه بندی را که از اطلاعات دانشگاههای علوم پزشکی در همه زمینه ها استفاده می نماید، را قویاً پیشنهاد می نمایند. همچنین یافته های مدل ها برتری قابل قبول متناسب برای طبقه بندی دانشگاه ها بر اساس شاخص های علمی، با یا بدون در نظر گیری شاخص های مرتبط با خدمات بهداشتی و زیرساختها را نشان دادند.

نتیجه گیری: از آنجایی که دانشگاه های علوم پزشکی در ایران از ابعاد خیلی کوچک و تازه تاسیس تا قدیمی و بزرگ جهانی تنوع دارند، یک طبقه بندی رضایت بخش بر اساس معیارهای قابل قبول بشدت توصیه می شود.

کلید واژه ها: طبقه بندی، تحلیل مولفههای اصلی، دانشگاههای علوم پزشکی

</div>

<div dir="rtl">

بیک گراونڈ: یہ تحقیق میڈیکل یونیورسٹیوں کی درجہ بندی کی عملی افادیت کا جائزہ لینے کےلئے کی گئی ہے۔ اس درجہ بندی کا معیار ان کا انفرا اسٹرکچر اور عالمی سرگرمیاں ہیں۔

روش: پہلے مرحلے میں تحقیق کے لئے میڈیکل یونیورسٹوں کے تجربہ کار اور سینئراساتذہ سے ہدایات حاصل کی گئیں جنھوں نے یونیورسٹیوں کے انتظامی اور علمی سطح پر کافی عرصہ گذارا ہے۔ دوسرے مرحلے میں ایران کی تام میڈیکل یونیورسٹیوں کے پیش نظر معیارات کی جمع آوری کی گئی تا کہ میڈیکل میدانوں میں ان کی کامیابی کا اندازہ لگایا جاسکے اس کےبعد علمی بنیادوں پر میڈیکل یونیورسٹیوں کی درجہ بندی کی گئی۔

نتیجے: ماہرین کا کہنا ہے کہ میڈیکل یونیورسٹیوں کے تمام سرگرمیوں کا جائزہ لینے کے لئے اس طرح کی درجہ بندی ہونا ضروری ہے۔

سفارش: چونکہ ایران میں موجود یونیورسٹیاں خاصی پرانی ہیں یا بالکل نئی ہیں اس وجہ سے قابل قبول معیاروں پر ایک درجہ بندی ضروری تہی۔

کلیدی الفاظ: میڈیکل یونیورسٹی، درجہ بندی، مناسب معیار ۔

</div>

INTRODUCTION

In the recent years, the progress of higher education has been significant in Iran, although in last three decades the country was under a long term sanction. However, in order to reach the national long term goals, much more progress and achievement particularly in science and technology is needed. For that reason, deeper and more comprehensive management plan is needed to utilize resources in the best way to maximize performance. For sure, such a plan must follow main rules of long term development plan of the country (1-4).

As part of this plan, it is important to show in what aspects universities might be stratified. In Iran Universities of Medical Sciences (UMSs), are under the supervision of the Health Ministry, and were classified into three levels till two years ago, type I were large and old universities, while type III were newly established small ones mainly train undergraduate students. Because of uncertainties in the validity of the criteria, this classification is less attractive nowadays, however it seems that a valid classification based on objective criteria will be accepted easily(5).

The pattern of classification used in Iran is not so common in the world; they usually rank universities instead of stratification. However, a trace of categorization and classification could be observed in the universities of USA and China. For instance, universities are classified into two categories in China: key excellent universities and normal universities. In the Carnegie classification in US, universities are divided into four groups: 1) national universities, 2) national colleges, 3) regional universities, and 4) regional colleges; then they are subdivided into north, south, west and Middle West according to their geographic location(6-14). Based on our literature review, and our experience of Iran, we could not find any specific criteria for stratification of universities. Because there is no certain criteria, UMSs always seek to promote to higher stratum in Iran; however, usually the negative response of system is not convincing mainly because there is no certain reason for decisions (5).

Having reviewed the conflicts in this regard, and in order to make a better stratification of UMSs in Iran, we believe that applied objective criteria are needed. Therefore, in this study, we explored the issue by collecting the concepts of experts and high managers in UMSs; and by analyzing the statistics of these universities to create the most reliable classification method.

METHODS

In a mixed study, we triangulated the data of UMSs (phase I), and the concepts of experts (phase II) to assess practicality of UMSs stratification in 2012-3. In following section, study phases were explained separately.

Phase I: Analysis of the UMSs indicators

In this phase, all main indicators of UMSs were collected from different sources. For this reason, the websites of universities and their formal reports were reviewed. In addition, available information was collected from the Ministry of Health and from their trustees. These indicators covered all aspects of UMSs activities including education, research and service delivery. (Table 1)

The collected data were analyzed using Principal Component Analysis (PCA) method in SPSS v.16. Since we had missing data for around 5% of indicators, we used the data of comparable universities, or we predicted missing values using simple regression technique.

Having used an orthogonal transformation (rotation methods), we created a score for every UMSs based on the dominant component which explained most of the variances. By using PCA, 13 models were designed, differing in input indicators (Table2). In this phase, based on the variables of scientific-educational, executive and overall domains, we examined two models for scientific- educational (sci1 and sci2), three for executive (ser1, ser2 and ser3) and eight models for the overall classification system (sciser1-8). We used the best model in each classification system, regarding the percentage of variance explained, for final analysis and classification.

In the next step, by using cluster analysis and clusters based on their scores, we grouped UMSs into three groups in a way to have minimum within and maximum between cluster variations. To perform this analysis, hierarchical cluster analysis (ward's method) was used(15).

Phase II: expert opinion

We approached to a group of experts in this field individually and sought their concepts about the usefulness of UMSs stratification. In addition, we asked what they think about the best criteria for classification. The selected experts were mainly the ex or current chancellors of UMSs, managerial team of the health ministry and distinguished researchers in this field in national level.

To collect their opinions, a questionnaire comprising four parts was designed. First section included ten questions

Table 1.Explored UMSs indicators classified into their capacities in education, research, infra-structure, and service delivery	
Indicators	Variable
Education	The number of schools, educational space, dormitory space, number of Faculty members (instructor, Assistant Professor, Associate Professor, Professor), students in different levels (undergraduate, graduate and post-graduate, clinical and non-clinical fields)
service delivery	The number of active hospitals, the number of active hospital beds, the number of urban and rural health centers, and the number of health posts,
Infra-structure	The number of personnel, The total budget, the size and population of catchment area
Research	The Number of active research centers, the number of scientific productions, the research budget

regarding the usefulness of stratification. The second part was about the limitations and weakness of the current scheme, the third part was about their suggestion for the best criteria for stratification and the fourth part included three open questions regarding the best strategies to improve effectiveness of stratification to speed up progress of UMSs.

RESULTS

Phase 1

Comparing the percentage of the variance explained by each model, the ser3 model, in the executive classification system, explained the 81.54% of the related variance which was the highest percentage among the models (table2). Although, the models of overall classification system used the highest number of the variables (in compare to the other systems), the highest percentage of variance explained by these models was 78.65% (sciser8), which were less than the best models, in terms of the variance explained, in the other classification systems (Table 2).

The results of universities' classification using PCA are as following:

Scientific-educational classification system: Based on this classification, about 20% of the UMSs of class III, moved up to class II; 16% of the UMSs of class II, move down to class III. In class I, there were no interclass movements, while the ranking within this class changed slightly about 86% of the UMSs from this class, kept their previous order.

Executive classification system: By using this classification system, about 5% of the UMSs of class II, moved up to class I; 33% of class III, moved up to class II; 12.5% of class I, moved down to class II; 21% of class II, moved down to class III, while about 74% of the UMSs, kept their previous position.

Overall classification system: Considering all available criteria, 20% of the UMSs of class III moved up to class II and about 16% of UMSs belong to class II, moved down to class III. It seems that compared to other systems using educational, research and executive variables is more realistic (table.3).

The results of PCA mapped by GIS as below:

Table 2. Models implemented in PCA

Classification system	model	Variables	Percentage of variance explained	Method of rotation
Scientific-educational	Sci1	The size of educational and dormitory space, Research budget, number of Faculties, number of students, number of academic members, and number of research centers.	%80.81	Quartimax
	Sci2	The above educational variables, considering the number of students in regard of their grade and professors in regard of their scientific grade	%79.53	
Executive	Ser1	Number of active hospitals, total budget, healthcare centers, Hospital active beds, the number of personnel, the population covered by the university health centers, number of heath houses and health posts.	%76.82	Oblimin
	Ser2	The above executive variables excluding health posts.	%78.82	
	Ser3	The above executive variables excluding health posts and health houses.	%81.54	
Overall	Sciser1	The size of educational and dormitory space, research budget, total university budget, consumable and property budget, Number of faculties, number of active hospitals, hospital beds, healthcare centers, The Number of research centers, the population covered by University, number of students in regard of their grade, number of professors in regard of their scientific grade, number of personnel, number of health houses and health posts.	%70.22	Quartimax
	Sciser2	The above variables excluding the health posts	%70.74	
	Sciser3	The above variables excluding the health posts and health houses.	%71.70	
	Sciser4	The above variables excluding consumable and property budget, considering the total number of professors and students (instead of their subcategories regarding to the grade)	%75.08	
	Sciser5	The above variables considering the total number of professors and students (instead of their subcategories regarding to the grade)	%75.08	
	Sciser6	The above variables considering the total number of professors and students (instead of their subcategories regarding to the grade) excluding the number of health houses.	%74.54	
	Sciser7	The above variables considering the total number of professors and students (instead of their subcategories regarding to the grade) excluding the number of health houses and health posts.	%76.18	
	Sciser8	The above variables considering the total number of professors and students (instead of their subcategories regarding to the grade) excluding the number of health houses, health posts, consumable and property budget	%78.65	

Table3. Comparison of UMSs in Iran, using PCA among scientific -educational, Executive and overall classification systems, 2013

ID	University	Class¹	Executive score (model ser3)	Scientific-Educational score (model sci1)	Overall score (model sciser8)	ID	University	Class	Executive score (model ser3)	Scientific-Educational score (model sci1)	Overall score (model sciser8)
1	Tehran	1	2.31	4.32	4.36	22	Rafsanjan	2	-0.93	-0.54	-0.62
2	Shahid Beheshti	1	2.69	2/26	2.15	23	Lorestan	2	0.13	-0.38	-0.24
3	Esfahan	1	1.64	1.22	1.39	24	Semnan	2	-0.79	-0.41	-0.51
4	Shiraz	1	2.02	2.32	1.81	25	Bandar Abbas	2	-0.07	-0.35	-0.28
5	Mashhad	1	1.56	0/72	0.90	26	Ardabil	2	-0.29	-0.48	-0.44
6	Tabriz	1	1.60	0/76	1.03	27	Birjand	2	-0/62	-0.34	-0/44
7	Ahvaz	1	1.49	1.00	1.16	28	Shahrekord	3	-0.38	-0.38	-0.40
8	Kerman	1	0.11	0.58	0.45	29	Kurdistan	3	-0.04	-0.4	-0.3
9	Mazandaran	2	0.82	-0.0006	0.18	30	Bushehr	3	-0.45	-0.50	-0.48
10	Hamedan	2	0.19	0/040	0/08	31	Yasuj	3	-0/65	-0.43	-0.47
11	Babol	2	-0.73	-0.12	-0.27	32	Qom	3	-0.66	-0.67	-0.66
12	Kermanshah	2	0.30	0/09	0.19	33	Fasa	3	-0.99	-0.69	-0.76
13	Yazd	2	-0.20	-0/0006	0.06	34	Ilam	3	-0/65	-0.46	-0.51
14	Gillan	2	0.55	-0.10	0/06	35	Gonabad	3	-1.05	-0.65	-0.77
15	Urmia	2	0.74	-0.04	0.17	36	Zabol	3	-0.81	-0.49	-0.57
16	Golestan	2	0.04	-0.34	-0.26	37	shahrood	3	-0.93	-0.67	-0.72
17	Qazvin	2	-0.46	-0.29	-0.36	38	Jahrom	3	-0.99	-0.71	-0.77
18	Zahedan	2	0.11	0.04	0.03	39	Sabzevar	3	-0.86	-1.35	-0.47
19	Zanjan	2	-0.39	-0.21	-0/28	40	Bojnord	3	-0.62	-0.77	-0.74
20	Arak	2	-0.14	-0.40	-0.36	41	Jiroft	3	-0.84	-0.91	-0.89
21	Kashan	2	-0.77	-0.40	-0.48	42	Nishapur	3	-0.94	-0.91	-0.94

¹ Based on the classification system which was used up to two years ago

Figure 1. Ranking of Medical Universities in Iran based on previous classification method
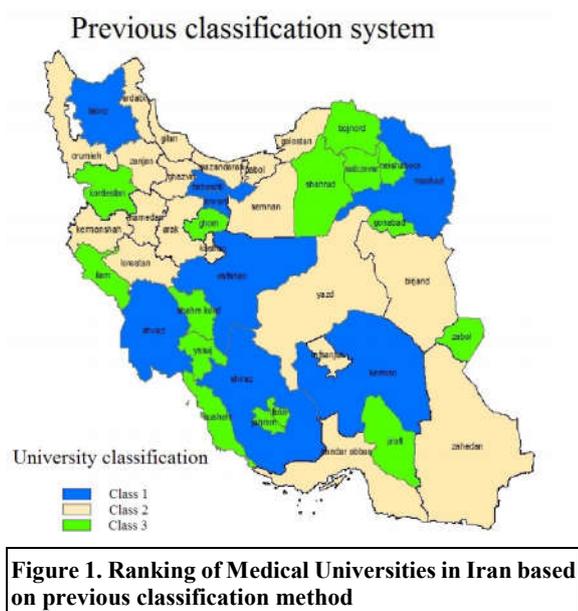
Cluster analysis was used in order to group the UMSs into three clusters, based on their scores (table 4).

According to the results of the cluster analysis using Ward's method:

In scientific- educational scenario (model sci1), about 7% of the UMSs are clustered in class 1, 12% in class 2 and the others in class 3.

In executive scenario (model ser3) about 17% of the UMSs are clustered in class1, 43% in class 2 and the others in class 3. In overall scenario (model sciser8), just one Medical University (Tehran) was in class 1.

Phase 2: the results of Expert opinion

Questionnaires were sent to 100 experts and 29 of them were completed. The results were analyzed and the findings were categorized into three groups (table.1). The participants described some useful criteria for classification and almost all of them believed that classification method should be changed to enhance performance of universities. They mentioned the gaps in the current classification method and suggested strategies to improve it. The most important

reasons for classification of universities as mentioned by our participants are, comparing universities based on their infrastructures (15.56± 0.478), promoting motivation (15.4±0.989), determining the goals and their missions (15±0.799) and improving the quality of services (15±0.928). The scores are on the scale of 0-20.
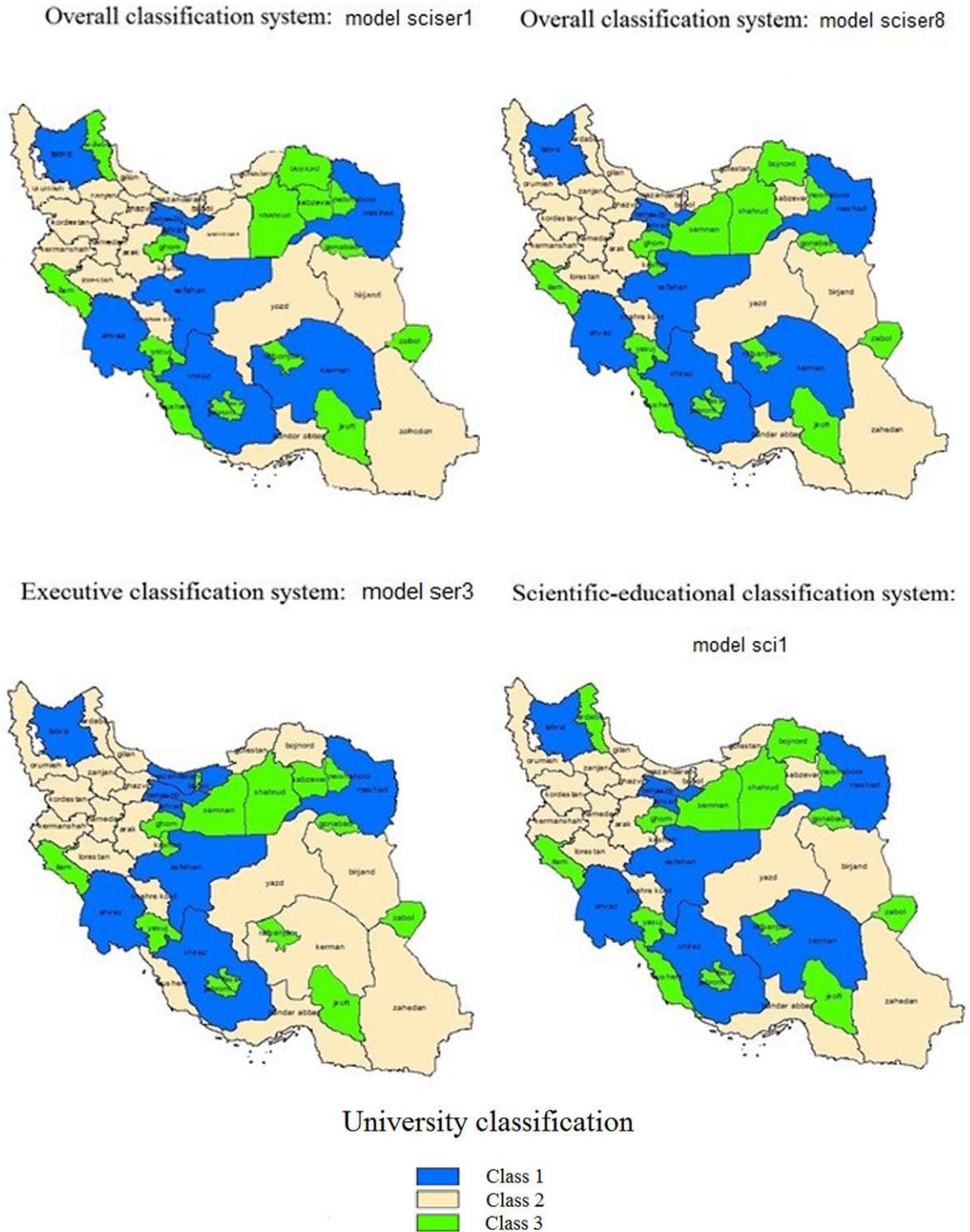
Overall classification system: model sciser1

Overall classification system: model sciser8

Executive classification system: model ser3

Scientific-educational classification system:

model sci1

University classification

Class 1
Class 2
Class 3

Figure 2. Classification of Medical Universities in Iran, considering scientific-educational, executive and overall classification systems, 2013

Table 4. Comparison of UMSs in Iran, using cluster analysis among scientific - educational, Executive and overall classification systems, 2013

ID	University	Class[1]	Executive score (model ser3)	Scientific-Educational score (model scil)	Overall score (model sciser8)	ID	University	Class	Executive score (model ser3)	Scientific-Educational score (model scil)	Overall score (model sciser8)
1	Tehran	1	1	1	1	22	Rafsanjan	2	3	3	3
2	Shahid Beheshti	1	1	1	2	23	Lorestan	2	2	3	3
3	Esfahan	1	1	1	2	24	Semnan	2	3	3	3
4	Shiraz	1	1	2	2	25	Bandar Abbas	2	2	3	3
5	Mashhad	1	1	2	2	26	Ardabil	2	2	3	3
6	Tabriz	1	1	2	2	27	Birjand	2	3	3	3
7	Ahvaz	1	1	2	2	28	Shahrekord	3	2	3	3
8	Kerman	1	2	2	3	29	Kurdistan	3	2	3	3
9	Mazandaran	2	2	3	3	30	Bushehr	3	2	3	3
10	Hamedan	2	2	3	3	31	Yasuj	3	3	3	3
11	Babol	2	3	3	3	32	Qom	3	3	3	3
12	Kermanshah	2	2	3	3	33	Fasa	3	3	3	3
13	Yazd	2	2	3	3	34	Ilam	3	3	3	3
14	Gillan	2	2	3	3	35	Gonabad	3	3	3	3
15	Urmia	2	2	3	3	36	Zabol	3	3	3	3
16	Golestan	2	2	3	3	37	shahrood	3	3	3	3
17	Qazvin	2	2	3	3	38	Jahrom	3	3	3	3
18	Zahedan	2	2	3	3	39	Sabzevar	3	3	3	3
19	Zanjan	2	2	3	3	40	Bojnord	3	3	3	3
20	Arak	2	2	3	3	41	Jiroft	3	3	3	3
21	Kashan	2	3	3	3	42	Nishapur	3	3	3	3

[2] Based on the classification system which was used up to two years ago

There were other reasons such as empowering the university management system through developing new positions (14.47±0.877), allotment of the budget and resources (14.48±1.06), organization chart in accordance with university needs (14.36±0.844), promoting motivation and creating a competitive atmosphere (14±1.23) that could be important for classification of the universities as well. Some of the participants believed that ranking the universities based on clear and non-distorted criteria which are affected only by their activities would be better than classification.

Unclear criteria (18.44±0.497), incomprehensive criteria (17.23 ±0.868), lack of mechanisms to change the status of universities in the classification (17±0.928) and empirical criteria (16.84±0.833) were mentioned as the most important pitfall of current classification method. They also indicated the inappropriateness of the criteria with the native traits and scientific needs of the universities (16.28±0.663), un-generalized criteria (15.84±0.854) and lack of motivation to improve function of universities (14.84±1.04) were mentioned as the other deficits in the present classification

method. Some of the experts believed that lack of clarity and appropriateness of the criteria has made the background for false promotions.

In the third part of the questionnaire, participants mentioned the following parameters as the most important factors in classification: quality of education (18.67±2.51), quality of research (17.19±3.6), amount of healthcare services (15.69±3.98), amount of therapy services (15.04±3.73) and the quantity of education including the number of major fields present at the university and levels of education (13.44±3.83).

Evaluation of the UMSs comprehensive plan and its accordance with the national comprehensive plan was suggested by the experts as a necessary tool for determining the most appropriate indices. Considering the cost-efficacy and reward system and using the successful programs performed in the renowned universities were other strategies suggested by them. Since the UMSs in Iran have been established to improve the health level of the society, it is better that the classification be based on the health indices

and other relating factors. A part of participants believed that university typing is performed just by a few numbers of experts and there is no announcement for that, therefore they consider this issue as a main obstacle for the promotion of the universities. Interference of the Ministry of Health decisions by some universities is one of the problems mentioned by the experts. They suggested that the UMSs improvement should be placed on the agenda in order to avoid inactivity.

DISCUSSION

Results of this study indicated that classification process currently implemented in Iran needs an essential revision in order to achieve a clear, objective and scientific criterion to promote universities. The most important factors for classification, revealed by component analysis in the overall ranking system, were number of hospitals, size of educational and dormitory spaces, number of departments, total budget, total number of students, total number of academic members, population which is covered by each university, active hospital beds, research centers, health personnel and healthcare centers. Cluster analysis did not help to classify, therefore classification should be based on the obtained scores from component analysis and also qualitative synthesis of the other factors such as regional monitoring, comprehensive scientific map and comprehensive map of health promotion.

It seems that after Islamic revolution in Iran, very limited criteria have been used for classification system of medical universities. This kind of system which is used in Iran is not common among other countries. In other countries, ranking system is mainly used for comparing the universities instead of classification. In our literature review, there were some similar systems that use classification to categorize the educational services, in order to develop models that fit to the geographical location and educational systems (5-14, 16-19).

Based on the opinion of experts, current classification is not useful and cannot motivate medical universities to improve due to the lack of clarity, disintegrated and non-scientific criteria, inappropriateness to the geographical situation and scientific needs of the country, lack of clear mechanism of classification and in-generalization of the criteria.

Moreover, budget allocation is identical for all the medical universities, so each university's budget is increased each year without considering the progress of universities indices and function. The lack of clear criteria for improvement of the universities and lack of knowledge regarding the previous implemented criteria, results in no motivation among medical universities for improvement(20).

The experts believed that ranking is as necessary as classification. In their viewpoints, improving the status of classification of medical universities should be done by changing the classification criteria in a logical interval, determining clear and scientific criteria appropriate to the cultural situation, considering the geographical location, undeveloped area, rate of increasing the health indices, population distribution, index for capital and equipment, relationship to industry, and inter-universities and international communications.

According to the results of this study, we need more criteria for classification, in addition to the research and education criteria, because medical universities were integrated to the health service department according to the community needs and now providing health services in addition to the research and education for this reason, it is unsuitable to classify universities just based one domain (e.g. education or health services) or have several classification systems according to the several domains. So the classification system should consist of health services criteria in addition to the research and education ones. Therefore, it is better to simplify the method of classification using a comprehensive and consistent system. By using the classification criteria

Key points	Proposed strategy
Table 5. The most important views of participants in the survey	
Appropriate indicators for classification	geographical location, deprivation of the region, progress status of academic staff, qualitative criteria, duration of work with internet for academic staff, university output(doctors, specialists, etc), industrial links, inter-university communications, international communications, appropriateness of the number of academic staff with research and innovations, extent and quality of services and their improvement rate, contribution of university to achievement of the comprehensive national plan, people satisfaction, implementation of the national campaigns and community empowerment.
Changes in the criteria and the necessity of Universities improvement	revision of the criteria quantitatively and qualitatively and changing the criteria over **some** years, classification at first based on quality and then quantity and performance, classification as a criterion for allocating funds, the necessity of a dynamic classification, theory of safe competition, codification of criteria based on needs and scientific development plans.
Appropriate methods for improving classification system	Fairly conditions for allocation of resources, evaluation of the UMSs role and its accordance with the national comprehensive plan, encourage and reward systems, use of successful and efficient patterns in prestigious universities, intervention of the board of the university trustees in classification, determination of criteria for classification by the association of medical education and medical education to eliminate bias, incentive mechanism for experts and academic staff employment in underserved areas, classification in different levels of faculties and departments, focusing on efficiency and customer respect, revision and weighting of criteria, paying attention to the health components and their related factors.

implemented in other countries, the role of universities in providing health services would be ignored (16, 18, 20-26). Classification criteria should be flexible, logical, clear, and comprehensive and change in a defined interval in order to improve the strategic planning of the universities. Factors should be variable since the needs of the society are alternating. Classification system should be dynamic and flexible and the criteria should be revised both qualitatively and quantitatively in a logical timely manner.

In the presence of the current university ranking, classification should be useful if it is in line with the university clustering in the country. It means that classification could be a kind of university clustering (university zone) regarding their geographical location. In the national comprehensive map for the scientific progress, implementation of university clustering has been mentioned by using local capacities, national clarification of tasks and duties and geographical considerations.

Regarding the geographical clustering of the universities, the situation of the capital of Iran, Tehran, should be considered as an exception, which three class one universities are located in. They cannot be merged; therefore, we suggest that each of them together with some of small universities in the area (such as Behzisti, Artesh, Baqyatollah, Qom, Shahrood and Alborz) is considered as a local cluster.

Determination of criteria and gold standards for classification by using logical and scientific principles, result in suitable resource allocation across the country areas and would prevent the medical universities from the related future problems.

During the process of classification, different scenarios should be considered and used. Decision for selection of the best model for classification should be made by the experts. For this reason, in this research, different scenarios are provided for experts' usage. It seems that component analysis models can produce reliable and realistic scores.

Our final suggestion is the conceptualization of a comprehensive model for the university classification which comprises educational, research and administrative criteria considering regional and cultural differences and is based on the local thoughts and needs, using successful experience and models and finally considers the 20-year development document. It should also use the capabilities of experts and solve the problems using available resources. As the final suggestion, the model should meet the needs of universities while considering the country's logistics.

In the case of the universities' integration, the need for classification is more prominent. The fact of integration should be considered, otherwise, in the presence of a good ranking system, there is no need for university classification. University classification should be considered as a separate process from ranking. There should be an objective method so that the universities know how to improve their current situation and how they are organized in different classes. Indeed, scores should not be the only criteria for classification and geographical location of the universities should be considered as well. There should be a class one; some class two and some class three universities in each region of the country. The mission of these clusters of universities (zones) and the method of relationship between them should be clearly defined.

Classification, unlike ranking, should have high stability, and should not be changed quickly (e.g. during a one or two-year interval). After determination of the core universities (class one university in each cluster), classification would be stable and its changes would diminish. This goal could be achieved through the improvement in the management system appropriate with the current situation. Finally, university clusters, could meet the fundamental and scientific needs through their high capabilities and comprehensive programming.

ACKNOWLEDGMENTS

Conflict of interest: The authors declare no conflict of interest.

REFERENCES

1. Haghdoost A-A, Ghazi M, Rafiee Z, Afshari M. The trend of governmental support from post-graduated Iranian students in medical fields to study abroad. Iranian journal of public health 2013; 42(Suppl 1): 141.
2. Larijani B, Majdzadeh R, Delavari AR, Rajabi F, Khatibzadeh S, Esmailzadeh H, et al. Iran's Health Innovation and Science Development Plan by 2025. Iranian journal of public health 2009; 38(Suppl 1): 13-6.
3. Technology MoSRa, Education MoHaM. Documental comprehensive map of the country. Tehran: The Supreme Council of Cultural Revolution, Vice President for Science and Technology, Ministry of Science Research and Technology, Ministry of Health and Medical Education, Ministry of Education, Parliament; 2011. [In Persian].
4. Technology MoSRa, Education MoHaM, University IA. Regulations on Management of Universities and Institutions of Higher Education, Research and Technology. 2011: 1-29.
5. Nazari Chamak M, Haghdoost AA, Islaminejad T. The position of university classification in Iran and International Arena; A systematic review. Future of medical education journal; 2(3): 11-8.
6. Driscoll A. Carnegie's new community engagement classification: Affirming higher education's role in community. New Directions for Higher Education 2009; 147: 5-12.
7. Fang W. The development of transnational higher education in China: A comparative study of research universities and teaching universities. J Stud Int Educ; 16(1): 5-23.
8. Huang M-H. Opening the black box of QS World University Rankings. Research Evaluation.rvr003.
9. McCormick AC, Zhao C-M. Rethinking and reframing the Carnegie classification. Change: The magazine of higher learning 2005; 37(5): 51-7.
10. Mohrman K, Wang Y. China drive for world-class universities. Higher Education, Policy, and the Global Competition

Phenomenon: 161-76.

11. Shin JC. The world-class university: Concept and policy initiatives. Institutionalization of world-class university in global competition. USA: Springer: 17-32.

12. Shulman LS. The Carnegie classification of institutions of higher education. Menlo Park: Carnegie Publication. 2001.

13. Yang R, Welch A. A world-class university in China? The case of Tsinghua. Higher Educ; 63(5): 645-66.

14. Zhang H, Patton D, Kenney M. Building global-class universities: Assessing the impact of the 985 Project. Research Policy.42(3):765-75.

15. Chehrei A, Haghdoost AA, Fereshtehnejad S, Bayat A. Statistical analysis of medical research using the software SPSS. Tehran: Pajhwok Elm Arya; 2011.

16. Aminpour F, Kabiri P, Otroj Z, Keshtkar AA. Webometric analysis of Iranian universities of medical sciences. Scientometrics. 2009;80(1):253-64.

17. Deem R, Mok KH, Lucas L. Transforming higher education in whose image? Exploring the concept of the â€˛world-classâ€™ university in Europe and Asia. Higher education policy. 2008;21(1):83-97.

18. Wu W. Cultivating research universities and industrial linkages in China: The case of Shanghai. World Dev2007; 35(6): 1075-93.

19. Deem R, Mok KH, Lucas L. Transforming higher education in whose image? Exploring the concept of the /˛world-class/' university in Europe and Asia. High Educ Policy 21(1): 83-97.

20. Keyzouri AH. Introducing some quality indices of Iranian university system to be used in the university budgeting. Quarterly journal of research and planning in higher education. 2007; 13(3): 57-84. [In Persian].

21. Malek-Afzali H, Setare-Forouzan A, Momtazmanesh N, Dejman M, Fakhr-yaseri A. Excellence assessment model for Iranian medical centers. Teb va Tazkiyeh 2012; 19(3): 9-20. [In Persian].

22. Nassiri-Koopaei N, Majdzadeh R, Kebriaeezadeh A, Rashidian A, Yazdi MT, Nedjat S, et al. Commercialization of biopharmaceutical knowledge in Iran; challenges and solutions. DARU J Pharm Sci 22: 29.

23. Etemadi-Fard A. Webometrics ranking of world universities in Iran indicators in 2007. Rahyaft 2008; 40: 76-81. [In Persian].

24. Bakhtiyari-nejad F, Heidari AH. The principles and structure of scientific centers of excellence. Rahyaft 2008; 41: 58-66. [In Persian].

25. Abbasi-Moghadam M, Razavi S, Nouraei M. Attitudes of academic experts the results the integration of medical education and healthcare in 2003. Journal of Tehran University of Medical Sciences 2005; 62(1): 80-8.

26. Lame A. The concept of integration. Teb va Tazkiyeh 2006; 16: 22-30. [In Persian].