Developing a Model of Tuition Fee Calculation for Universities of Medical Sciences

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Abstract

Background: The aim of our study was to introduce and evaluate a practicable model for tuition fee calculation of each medical field in universities of medical sciences in Iran.
Methods: Fifty experts in 11 panels were interviewed to identify variables that affect tuition fee calculation. This led to key points including total budgets, expenses of the universities, different fields' attractiveness, universities' attractiveness, and education quality. Tuition fees were calculated for different levels of education, such as post-diploma, Bachelor, Master, and Doctor of Philosophy (Ph.D) degrees, Medical specialty, and Fellowship. After tuition fee calculation, the model was tested during 2013-2015. Since then, a questionnaire including 20 questions was prepared. All Universities' financial and educational managers were asked to respond to the questions regarding the model's reliability and effectiveness.
Results: According to the results, fields' attractiveness, universities' attractiveness, zone distinction and education quality were selected as effective variables for tuition fee calculation. In this model, tuition fees per student were calculated for the year 2013, and, therefore, the inflation rate of the same year was used. Testing of the model showed that there is a 92% of satisfaction. This model is used by medical science universities in Iran.
Conclusion: Education quality, zone coefficient, fields' attractiveness, universities' attractiveness, inflation rate, and portion of each level of education were the most important variables affecting tuition fee calculation.
Keywords: TUITION FEES, FIELD'S ATTRACTIVENESS, UNIVERSITIES' ATTRACTIVENESS, ZONE DISTINCTION, EDUCATION QUALITY

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Introduction

Medical education in Iran's education system has been merged with the health care system and is under the control of Iran's ministry of health and medical education. This ministry was established in 1985 with the aim of social accountability and community orientation of medical education in parallel with development of healthcare network around the country. This network was dedicated to deliver appropriate healthcare services to everybody and increased Iran's health indexes excessively (1). Medical education in Iran was fully gratuitous. Students, who are interested in studying medical fields, must participate in Iran's national organization of educational testing and then start studying in one of the medical fields in the universities, depending

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on their gained grades (2). According to the regulations (3), all students who have benefited from gratuitous education must serve one year per year of their duration of education in the areas according to government's requirement. There are 65 public medical universities in Iran (governmental) which admit about 8000 students per year in the fields of medicine, dentistry, pharmacy, and different-related courses (based on 2015 Iran's national organization of educational testing). Currently, about 250000 students are studying in different medical fields (4). Due to the sufficient number of medical graduates, reduction in gratuitous education started since the early 2010. To gain this goal, some public universities started taking tuition fees. It is a beginning for proposed and gradual privatization in the medical education. Calculation of exact tuition fees must be done in different fields and different universities because of the great numbers of applicants in medical fields and establishment of a reliable and practicable method. Therefore, this study introduced a model for determining tuition fees for each field of medical education considering variables such as education degrees, the university and zone distinction which are inserted in Iran's national university entrance examination formal announcement. Tuition fee calculation is one of the crucial issues in the universities because it should not decrease volunteer's interest in university entrance. Bruckmeier and colleagues found that there is no evidence for a general negative effect of the recent introduction for tuition fees on enrolment in Germany (5). In another study, the Effect of tuition fees on university applications and attendance was evaluated. The results have shown that increases in tuition fees have a negative effect on applications to higher education (6). In one study, effects of tuition fees on course and success of medical studies were investigated. The results have shown that Tuition fees failed to affect discontinuation rates or study duration of medical students (7). Several studies have been carried out in some universities to calculate tuition fees and the factors affecting them. Some studies have shown that tuition fees at prestigious private universities are higher than those in less prestigious universities in the US, while the opposite is the case in Japan. The tuition fees at public universities are generally lower than those in private universities; therefore, top students tend to register at high prestige, low-cost public universities. This situation has created a dilemma for prestigious private universities because they are in competition with public universities to attract top students and cannot impose heavy fees. Therefore, even if the quality of education in these universities increases, their tuition fees should remain low to attract more students (8).

Harford and Marcus examined factors determining tuition fees (9), showing that the amount of tuition fees will rise by increased quality of students determined with SAT (Scholastic Aptitude Test) scores and the quality of education determined by increased proportion of the professors with Ph.D degree. In 1994, Yonezawa and co-workers mentioned that there are different patterns in the economy of Japan's private universities tuition fees, and tuition fees are significantly influenced by the quality of education (10). Urata and colleagues determined tuition fees of Japanese private universities in 1998, demonstrating that the tuition fees are lower in more attractive universities with better conditions (11). In another study, the costs of education, mean SAT scores, class size, and the highest degree level were the main factors affecting tuition fees (12). Dimkpah and colleagues evaluated the impact of college quality on tuition fees. Based on their results, the quality features (credit of university, the percentage of faculties with doctoral degree, the student to faculty ratio and the university rating of universities were the most important factors influencing the tuition fees (13). In 2008, Funabashi and co-workers determined the factors affecting private universities tuition fees including the difficulty in university entrance exams (positive effect), date back of a university

(negative effect), the number of students per professor (positive effect), university size (positive effect), and tuition of adjacent universities (positive effect) (14).

Different analytical methods can be used for calculating tuition fees. Most studies have used regression analysis. Of these, some studies used hedonic price equation for tuition fees (9-10, 13, 15), while others have used the simultaneous equation model, indicating that tuition fees are considered as an endogenous quality variable of education. The estimation methods of these equations are two and three stage least square (12, 16, 17).

According to the above mentioned, we aimed to introduce and evaluate a practicable model for tuition fee calculation of each medical field in all universities of medical sciences in Iran. To the best of our knowledge, tuition fee calculation for Iran's universities has not been done before.

Materials and Methods

The aim of our study was to calculate the practicable tuition fees for all universities of medical sciences in Iran. To identify variables affecting tuition fee calculation, a deep and open-ended interview was performed that required more thought and more than a simple one-word answer. An open-ended question cannot be answered with a "yes" or "no" response, or with a static response. The response can be compared to information that is already known to the questioner. To do this, 50 experts in 11 panels were interviewed.

Our interview was an open-ended and flexible survey. All vice-deans of universities of medical sciences from all over the country were selected and divided in four groups of ten. Preset questions were posed in first group as an expert panel. Based on the interview transcripts, the questions were changed or completed and were then posed in the second group. This method was continued and performed on 4 panels of ten people. Finally, the answers were summarized. As mentioned, sampling was general and all the statistical community was selected and interview was conducted in person. The interviewers asked the questions and the responses were used in different panels. Questions were raised open-ended in order to obtain general understanding of the interviewees. After recognizing the effective variables and in order to analyze the results, they were ranked. Based on the experts' comments and literature review (9-10, 12-14), the key points listed below were found:

1. Total budgets that the government allocates to the universities cannot cover the budget needs (the basis for tuition fee calculation). Previous studies indicated that tuition fees also depend on state appropriation (12).
2. Expenses of universities in larger cities should be higher than those in smaller ones because of high general life expenditure indices. Koshal and co-workers found that median family income and regional factors are two of the most important factors in tuition fee calculation (12).
3. Attractiveness of different fields is not equal and is higher in medicine, dentistry, and pharmacy fields. Funabashi and colleagues have described that the number of students, as one of the indicating factors of fields' attractiveness, has positive effects on determination of tuition fees (14).
4. The universities and their places also have different attractiveness ratings. Based on the previous results, credit of the university, the percentage of facilities, and university dating have positive effects on the tuition fee calculation (13).
5. Education quality is not equal in different universities. Other studies have also shown that the amount of tuition fees will rise by increasing the quality of education determined by increasing the proportion of the professors with Ph.D degree (9-10).

According to the above results, fields' attractiveness, universities' attractiveness, zone distinction and education quality were selected as effective variables for tuition fee calculation. The variables were extracted

from the references, experts' viewpoints and specialized panels. Meanwhile, national organization of educational testing was also asked about the effective variables on the university ranking. Total costs per student in a year were calculated based on the financial reports of the universities in 2013 according to the following equation:

$$Cu = \frac{Cc + R}{N}$$

C_u=Total costs per student in a year
C_c=Total budgets the government allocates to the university
R=University income from providing educational and research services
N=Number of students

The difference between household consumption expenditure in different cities, which has been announced by Iran's central bank, was used (18) to calculate zone coefficient. For this purpose, household consumption expenditure coefficient in Tehran was considered 1 and other cities' coefficient was calculated in comparison with Tehran's coefficient. For calculation of fields' attractiveness coefficient, data were taken from the Iran's national organization of educational testing in the same year and a comparison between the number of admissions and applicants in each field was performed. For calculation of the universities' attractiveness coefficient, the number of admissions was compared with the number of students in each university. Universities' attractiveness was calculated based on the national organization of educational testing' model which was derived from this formula:

$$\text{University attractiveness: } \frac{\text{Number of students in each university}}{\text{Number of admissions}}$$

Education quality in universities was evaluated using questionnaires which were mailed or faxed to the experts of all universities in order to rate their universities. Quality rating of universities was determined by the Ministry of Health using different indexes such as numbers of professors, amounts of scientific and research activities, and students' scores in the comprehensive exams. Based on this, the highest university's rating was considered one and rests of the universities' rating were considered as a fraction of one. Finally, the tuition fees were calculated for different levels of education (post-Diploma, Bachelor, Master, Ph.D, Medical specialty and Fellowship). Share of costs of each level of education was gained by interviewing the financial managers of each university. Universities' administrative and financial deputies were asked to identify share of costs of each level of education. Final costs were extracted by averaging the managers' comments and viewpoints.

After tuition fee calculation, the model was tested during years 2013 to 2015.

The model was presented to the Central Board of Trustees of Iran's Ministry of Health and was approved for implementation in the country. For two consecutive years, we asked the universities about the quality of the model. The results showed that their satisfaction about the model's comprehensiveness was more than 90%. Based on this, this model is being implemented in the country. A questionnaire containing 20 questions was prepared. Content validity of the questionnaire was examined based on expert comments and opinions. They were asked to evaluate the relevance, completeness, and clarity of each question. They also scored questions based on the degree of importance for each question.

After evaluating the relevance, comprehensiveness, clarity and scoring of each question, the Cronbach's Alpha Coefficient for each question was determined to test the reliability of the questionnaire. It was calculated as follows using SPSS software:

$$\alpha = \frac{K}{K-1}\left(1 - \frac{\sum_{i=1}^{K} \sigma_{Y_i}^2}{\sigma_X^2}\right)$$

Where K is the components, σ_X^2 is the variance of the observed total test scores and $\sigma_{Y_i}^2$ is the variance of component i for the current sample of persons. Cronbach's Alpha Coefficient was found to be more than 0.75. Correlation of each

question with other questions was higher than the medium level and there was no negative correlation (an inverse relationship) between questions. Finally, all Universities' financial and educational managers were asked to respond the questions regarding model's reliability and effectiveness.

Results

Table 1 presents the differences in household consumption expenditures in different zones, also called zone coefficient.

As shown, the zone coefficient of each city is the result of division of Tehran household consumption expenditures to the city consumption expenditure.

$$\text{Zone coefficient} = \frac{\text{Tehran consumption expenditure}}{\text{City consumption expenditure}}$$

Attractiveness coefficients for some of the medical fields and universities are shown in tables 2 and 3.

Table 4 shows the education quality coefficient in different universities, resulting from expertise questionnaires in medical universities.

Table 2. Fields' attractiveness coefficient

Name of the field	Attractiveness coefficient
Dentistry	1
Medicine	0.99
Pharmacy	0.98
Nursing	0.6
Midwifery	0.62
Laboratory Sciences	0.7
Public Health	0.58
Environmental Health	0.65
Nutrition	0.85
Genetics	0.88

The portion for each level of education was gained from the total costs of education in universities by interviewing financial managers of the universities. They were 0.4, 0.65, 0.9, 1.05, 1.42 and 1.55 for post-Diploma, Bachelor, Master, Ph.D, Medical specialty and Fellowship, respectively.

Finally, tuition fees were calculated as below due to the defined concepts:

$$Ti = \left[\frac{Cu_x \, Qi}{Ri}\right]_x Ai_x \, Gi_x \, Ii_x \, Di$$

T_i=Tuition fees for each student in each level

Table 1. Zone Coefficient in different cities

City name	Zone Coefficient	City name	Zone Coefficient
Tehran	1	Khorramabad	1.21
Kashan	1.15	Ilam	1.25
Qom	1.14	Ahvaz	1.21
Qazvin	1.14	Rasht	1.14
Arak	1.14	Kerman	1.16
Hamadan	1.15	Rafsanjan	1.16
Shiraz	1.12	Kermanshah	1.19
Bushehr	1.22	Sari	1.14
Yasuj	1.24	Babol	1.14
Fasa	1.2	Gorgan	1.14
Jahrom	1.2	Urmiye	1.18
Mashhad	1.12	Shahr-e kord	1.2
Birjand	1.19	Bandar abbas	1.22
Gonabad	1.2	Zahedan	1.26
Sabzevar	1.15	Zabol	1.28
Bojnord	1.2	Yazd	1.14
Tabriz	1.17	Zanjan	1.17
Karaj	1	Semnan	1.15
Isfahan	1.12	Ardabil	1.21
Sanandaj	1.22	Shahrood	1.15

Table 3. Universities' attractiveness coefficient

University name	Attractiveness coefficient	University name	Attractiveness coefficient
Tehran University of Medical Sciences	1	Lorestan University of Medical Sciences	0.68
Shahid Beheshti University of Medical Sciences	1	Medical University of Ilam	0.63
Iran University of Medical Sciences	1	Ahvaz Jundishapur University of Medical Sciences	0.85
Kashan University of Medical Sciences	0.8	Gilan University of Medical Sciences	0.9
Qom University of Medical Sciences	0.8	Kerman University of Medical Sciences	0.9
Qazvin University of Medical Sciences	0.85	Rafsanjan University of Medical Sciences	0.8
Arak University of Medical Sciences	0.82	Kermanshah University of Medical Sciences	0.81
Hamadan University of Medical Sciences	0.8	Mazandaran University of Medical Sciences	0.9
Shiraz University of Medical Sciences	0.95	Babol University of Medical Sciences	0.88
Bushehr University of Medical Sciences	0.7	Golestan University of Medical Sciences	0.75
Yasuj University of Medical Sciences	0.7	Urmia University of Medical Sciences	0.8
Fasa University of Medical Sciences	0.7	Shahr-e kord University of Medical Sciences	0.75
Jahrom University of Medical Sciences	0.72	Hormozgan University of Medical Sciences	0.7
Mashhad University of Medical Sciences	0.95	Zahedan University of Medical Sciences	0.68
Birjand University of Medical Sciences	0.75	Zabol University of Medical Sciences	0.6
Gonabad University of Medical Sciences	0.65	Shahid Sadoughi University of Medical Sciences and Health Services	0.85
Sabzevar University of Medical Sciences	0.65	Zanjan University of Medical Sciences	0.86
Bojnord University of Medical Sciences	0.65	Semnan University of Medical Sciences	0.87
Tabriz University of Medical Sciences	0.96	Ardabil University of Medical Sciences	0.65
Alborz University of Medical Sciences	0.93	Shahrood University of Medical Sciences	0.63
Isfahan University of Medical Sciences	0.96	Kurdistan University of Medical Sciences	0.7

of education in each university
C_u=Average of total costs per student in a year
Q_i=Education quality coefficient
R_i=Zone coefficient
A_i=Fields' attractiveness coefficient
G_i=Universities' attractiveness coefficient
I_i=Inflation rate for related year of calculation
D_i=Portion of each level of education

In this model, tuition fees per student were calculated for year 2013; therefore, the inflation rate of the same year was used which was announced by the central bank

Table 4. Education quality coefficient in universities

University name	Education quality coefficient	University name	Education quality coefficient
Tehran University of Medical Sciences	1.1	Lorestan University of Medical Sciences	0.85
Shahid Beheshti University of Medical Sciences	1.1	Medical University of Ilam	0.7
Iran University of Medical Sciences	1.1	Ahvaz Jundishapur University of Medical Sciences	1.05
Kashan University of Medical Sciences	0.94	Gilan University of Medical Sciences	1.1
Qom University of Medical Sciences	0.94	Kerman University of Medical Sciences	1.1
Qazvin University of Medical Sciences	0.94	Rafsanjan University of Medical Sciences	0.9
Arak University of Medical Sciences	0.9	Kermanshah University of Medical Sciences	1
Hamadan University of Medical Sciences	0.9	Mazandaran University of Medical Sciences	1
Shiraz University of Medical Sciences	1.1	Babol University of Medical Sciences	0.94
Bushehr University of Medical Sciences	0.8	Golestan University of Medical Sciences	1
Yasuj University of Medical Sciences	0.8	Urmia University of Medical Sciences	1
Fasa University of Medical Sciences	0.75	Shahr-e kord University of Medical Sciences	1
Jahrom University of Medical Sciences	0.75	Hormozgan University of Medical Sciences	1
Mashhad University of Medical Sciences	1.1	Zahedan University of Medical Sciences	1
Birjand University of Medical Sciences	0.8	Zabol University of Medical Sciences	0.85
Gonabad University of Medical Sciences	0.8	Shahid Sadoughi University of Medical Sciences and Health Services	1
Sabzevar University of Medical Sciences	0.75	Zanjan University of Medical Sciences	1
Bojnord University of Medical Sciences	0.75	Semnan University of Medical Sciences	1
Tabriz University of Medical Sciences	1.1	Ardabil University of Medical Sciences	0.9
Alborz University of Medical Sciences	1	Shahrood University of Medical Sciences	0.85
Isfahan University of Medical Sciences	1.1	Kurdistan University of Medical Sciences	0.9

of Iran (18). Application of the model showed that there was a 92% satisfaction. Therefore, this model is used by Iran's medical sciences universities.

In this method, after identifying the variables and their degree of importance, we put them in the numerator and denominator and finalized them in different specialized panels. The final model was presented to the Central Board of Trustees and corrected and was announced to the universities after approval by the Minister of Health.

Discussion

Tuition fee is one of the crucial issues of the universities because it should not decrease volunteer's interest in the university entrance. Furthermore, it should provide opportunities for research and development which meet the required costs in the universities. Such opportunities show the differences between the education qualities in all universities so that the volunteer pays more because of the high quality education. It is necessary to calculate exact tuition fees in different fields and universities due to the great numbers of applicants in medical fields and to develop a reliable and practicable method. Before our study, tuition fees calculation was based on universities' opinion and preferences and there was no defined method for it. Our results determined a model for calculating tuition fees for each field of medical educations considering different variables, providing a basis to avoid confusion. Based on our results, tuition fees for each student in each level of education in each university depend on the education quality, the differences between household consumption expenditure in different cities, fields' attractiveness, universities' attractiveness, inflation rate, and portion of each education level. Consistent with our results, several studies have shown that the quality of education is the most important factors affecting tuition fee calculation (9, 12). Since the application of this model in Iran's medical universities, complaints about the differences between the tuition fees in all universities have been fully resolved and paying tuition fees has become legal. With our model, university budgeting has been arranged as functional-based budgeting (FBB). The university competitiveness is another point. Because of this model, universities compete with each other to increase their quality of education and other coefficients based on our equation. Moreover, they try to increase their attractiveness coefficient with the structural reforms through different indexes such as education and welfare services.

Until this, state university budgeting was based on the previous year's budget and university requirements. Therefore, universities near to Tehran (the capital of Iran) had more chances for negotiation and more budgets due to proximity to Plan and Budget Organization (PBO) of Iran. After functional-based budgeting settlement, annual budget of the university was calculated based on the numbers of students and other variables. At first, state universities should admit students for free education. Then, equal to their empty capacities, they can admit more students among the interested ones with tuition fees. For those students, universities can calculate their tuition fees by our model. They can easily repair their budget through this mechanism.

One of the most important applications of our model is tuition fee calculation for private, non-state, and non-profit universities. According to our model, situation of all universities was clear and the unique system for tuition fee calculation was developed. Applicants are informed about tuitions before the university entrance and can make the best choices.

While Iran's health care system's demand for human resources is different and the government must cover all zones fairly, it is recommended to use this tuition fee formula for students who do not want to work in the areas which need medical professionals. For students who want to work in areas according to government's needs, costs of education based on this model must be paid by the government as a scholarship. This model was based on total costs per student in year 2013. It means that the basis of our model is total costs. However, a question raised is that larger universities might have more extra costs for departments' organization than small universities. In addition, in large universities, the number of academic members is higher which increase costs, but new universities use young academic members which costs less. Therefore, to reduce deviation factors,

average costs of all universities in Iran were assigned as a real rate of costs per student. The model designed for tuition fees was sent to the universities and they were asked to give their expert comments about how much this model is close to the reality and practice. Approximately 92% of the universities mentioned that this model is reliable and practicable. It should be mentioned that establishment and equipping costs of universities are not considered in this model. It is because these researchers supposed the government was supporting the universities with respect to their establishment and equipment according to the laws and regulations. One of the problems in the implementation of this model is inflation rate. Sometimes, the inflation rate announced by the central bank is different from universities' opinions. To solve this issue, Iran's Ministry of Health and Medical Education determines the inflation rate and announces it to all universities by considering the general inflation of the society in a year (it is announced by the central bank) and inflation rate in training and academic costs.

Conclusion

Our study was conducted to introduce and evaluate a practicable model for tuition fee calculation of each medical field in all universities of Iran. It showed that education quality, zone coefficient, fields' attractiveness, universities' attractiveness, inflation rate and portion of each education level were the most important variables affecting tuition fee calculation.

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Conflict of Interest

The author declares no conflict of interest the corresponding author of the manuscript was the deputy of education at MOHME when conducted the study.

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