Strides Dev Med Educ. 2019 December; 16(1):e81991. doi: 10.5812/sdme.81991.

Published online 2019 September 25. **Research Article**

Modelling the Budget Determination of Educational Sector in Iran's Medical Sciences Universities

Ali Akbar Haghdoost [1], Reza Goudarzi [2, *], Maryam Ramezanian [2], Amir Javadi [3], Ali Darvishi [2], Ali Hosseinzadeh [1], Masoud Abolhallaje [4] and Masoumeh Rahimi [5]

[1] Research Center for Modelling in Health, Institute for Future Studies in Health, Kerman University of Medical Sciences, Kerman, Iran
[2] Research Center for Health Services Management, Institute for Future Studies in Health, Kerman University of Medical Sciences, Kerman, Iran
[3] Iran Healthcare Info. Observatory, Ministry of Health and Education of Iran, Tehran, Iran
[4] Budget and Performance Monitoring, Ministry of Health and Education of Iran, Tehran, Iran
[5] Center of Budgeting and Performance Evaluation, Ministry of Health and Education of Iran, Tehran, Iran

[*] *Corresponding author*: Research Center for Health Services Management, Institute for Future Studies in Health, Kerman University of Medical Sciences, Kerman, Iran. Tel: +98-2181455692, Email: reza0083@gmail.com

Received 2018 July 11; **Revised** 2019 January 13; **Accepted** 2019 January 14.

Abstract

Background: Because of resources deficiency, a well-funded budget system is very important for achieving organizational goals. Hence, providing a specific pattern for performance analysis is important to allocate funds to medical universities
Objectives: In this study, econometric method and linear regression estimation were used to investigate the economic behaviour of the budget allocation process.
Methods: Data used in the present study were panel data from medical universities obtained during an eight-year period. The explanatory variables in this model included the numbers of faculty members and students. Also, separate linear regression was estimated as a dependent variable for the levels of expenditure budget and total budget.
Results: Our findings showed that if budgeting is done solely based on faculty members, allocation of public budget for each faculty member is 113.7 million Tomans, and if it is performed based on students, the allocated budgets are 9.8, 2.2, and 25.9 million Tomans for each undergraduate, professional doctorate (medicine, pharmacy, and dentistry) and postgraduate student, respectively.
Conclusions: In general, budget allocation for university education sector had a strong relationship with faculty members and students. However, the place of budget consumption and performance quality indicators still remain unclear. The results of this study can be applied for quantitative modelling to predict and allocate budget to medical universities.

Keywords: Academic Medical Centers, Budget Modeling, Resource Allocation

1. Background

Universities and higher education institutions are responsible for the dissemination of knowledge and the provision of higher education to train professional human resources, hence contributing to social development. The most basic administrative system of universities is the financial system, and any small change in the external and internal environments of the university may affect the effectiveness of the respective financial system (1). Universities need to have a logical performance to optimize their resources and facilities and seek to increase their income and reduce their costs. In other words, universities' budget allocation should be in such a way that they can gain optimum outputs with a series of inputs (2). However, being predominantly funded by the government has caused the administrative body of state-run universities not to properly and reasonably allocate their resources (3). Governments apply three approaches to fund allocation, including input-based budgeting, performance-based budgeting, and output-based budgeting (4).

According to Article 49 of the Fourth Economic, Social, and Cultural Development Plan of the Islamic Republic of Iran, the allocation of budgets to universities is based on their performance and expenditure (output-based budgeting approach). That is to say, the government allocates budgets to compensate for the actual costs for different outputs (3). The aforementioned approach is applicable from the two perspectives of cost and income. In terms of costs, governments allocate budgets to universities to compensate for the costs of a certain period. Based on this approach, the actual cost of each output plays the most important role in budget allocation (5, 6).

It is therefore clear that when budgeting to universities is cost-based, universities will have an incentive to over-report their past expenditures. This causes state-run universities to seek a larger share of the budget rather than lowering their expenditures, which leads to inefficient and ineffective management of universities. In contrast, from the income viewpoint, which has a quasi-market perspective, governments allocate budgets to universities irrespective of the actual costs of outputs. Accordingly, what is important to the state is the individual and social effectiveness of the outcomes. Therefore, universities need to strive to increase their output in terms of both quality and quantity in order to be able to gain more budgets from the government, making universities function more efficiently (5-7).

If budgeting criteria are not properly adjusted and transparent, the quality and efficiency of the system will be undermined and the system's performance will face serious problems. Further, if budgeting is carried out based on the number of students, universities will move towards increasing student admissions to enhance their share of budgets and may refrain from recruiting academic staff, which unsettles the existing balance. In a similar scenario, if the budget and higher education expenditures are not correctly depicted, universities that have a larger share of graduate education will be adversely affected and the vitality and growth of universities will be negatively overwhelmed in the medium-term.

Several studies have been conducted to model budgeting at different universities. For instance, Melin et al. studied different models of budgeting at universities in six European countries in 2016 (8). Volk (9) and d'Sylva (10) did the same at Arizona University. In Iran, Saketi and Saeidi (1) and Safari and Sardari (11) conducted similar studies at Shahed University, and Keyzouri (7) and Saeedi (12, 13) examined the methods and models of budgeting in universities affiliated to Iran's Ministry of Sciences.

In Iran, the budgets of medical universities are allocated under headlines of health, treatment, research, and education, while there is usually no concrete benchmark for allocating these budgets. Moreover, even in the presence of criteria for budgeting, it will undoubtedly be changes in the way of parliamentary approval and allocation by the planning and budget organization. Therefore, in the absence of a model for analyzing budgeting allocation at the level of medical universities, further attempts should be made to develop a model for this purpose. The provision of such a model requires formulating a financial policy for public universities. Therefore, more accurate analysis of budget allocation to universities of medical sciences and the factors affecting the allocation is mandatory.

2. Objectives

This study was conducted to analyze the trend of budget allocation in the education sector of medical sciences universities in Iran.

3. Methods

This is an applied research that has analytically examined the educational budgeting process in universities of medical sciences in 2016. The econometric methodology and linear regression model were used to study the economic behaviour of the budget allocation process. The study population included all the medical sciences universities and affiliated faculties, because the budgets of these universities are provided by governmental resources.

3.1. Data Collection

Data used in the present study were panel data and the following variables were collected in the form of an eight-year time series from 2008 to 2016 from 78 universities and medical faculties. It should be noted that the universities during the study period varied from 40 to 78 universities. Information required for analyzing budget allocation to the medical sciences universities was extracted from a booklet entitled "Health Sector Credits", published annually by the Ministry of Health and Medical Education and reports from the Budget and Performance Monitoring Centre of the Ministry of Health and Medical Education. The factors that may theoretically be effective in determining the budget of the education departments include the numbers of faculty members, postgraduate students, and undergraduate students, which were obtained from the report of the Board of Trustees of the Universities.

3.2. Variables

The factors that may theoretically affect the budgeting of education departments were used as the criteria for modelling. In other words, the explanatory variables in this model include the numbers of faculty members (assistant professors, associate professors, and professors), undergraduate and lower-level undergraduates (B.Sc. and under B.Sc. degree), professional doctorate students (MD students in medicine, pharmacy and dentistry) and postgraduate students (M.Sc. and Ph.D.).

It is worth mentioning that the budget allocated to the education sector is classified into four levels of expenditure budget, belongings and property budget, special incomes and total budget, and we used separate linear regression models for two levels of budget (expenditure budget and total budget) and reported the results of each

level distinctively. It should be considered that based on the model under our study, the dependent variable in this study is either expenditure budget or total budget of the entire education departments. Due to scarcity of data on the belongings and property budget, the total budget of the education departments is calculated excluding the belongings and property budget.

3.3. Modelling

The following functional form was used for modelling:

$$Y_{it} = \alpha_{it} + \beta_1 FM_{it} + \beta_2 US_{it} + \beta_3 MS_{it} + \beta_4 PS_{it} + \beta_5 T_{it} + U_{it}$$

Where i represents cross-sectional observations for universities, t indicates a period, α is a scalar value, βs are the coefficients of the explanatory variables of the model, and *FM* represents the faculty members. Also, *US* is the number of lower-level undergraduates, *MS* is the number of professional doctorate students, *PS* is the number of postgraduate students, and T indicates trend. In addition, *U* is a randomized error term of the model that has a normal distribution with a mean of zero and a constant variance. In addition, *Y* could include one of two levels of budget according to various models that are estimated. In order to select the optimal model, criteria such as significant coefficients, theoretical consistency, goodness of fit (R^2) and the Akaike-Schwartz criterion are used.

The F-Limer test showed that the data model was a type of panel data (F [75.349] = 1.98, P = 0.0001), and with this result, it is necessary to use the Hausman test to decide upon using fixed effects model or random effects model. The results of the Husman test showed that the model with random effects was more suitable for these conditions (χ^2 = 7.57, P = 0.108). Also, the Breusch-Pagan heteroscedasticity test showed that the variance of the study data was heterogeneous (χ^2 = 1118.46, P = 0.0001). All the models and related tests were analyzed at the significance level of 0.05 using STATA version 12.

4. Results

In this study, budget allocation to 78 medical universities and faculties across the country has been studied. Table 1 presents a description of the funding status of universities over the eight years of the study. In this table, the universities of medical sciences are classified into small, medium and large groups based on the number of faculty members. The average number of faculty members in small universities over the course of eight years was about 28, while in large universities, this parameter was 537. The growth rate of the total budget allocated to education departments over the course of study showed that small universities had the lowest growth rate of 43% and large universities had the largest growth of 735%. In other words, during this period, the growth rate of the budget allocated to education departments for large universities was 17 and 5 times greater than the budget growth of small- and medium-size universities, respectively.

According to the results of tests conducted for combined data and random effects, different models were estimated using the generalized least squares (GLS) method. In the light of the measures of goodness of fit, six models have been selected to analyze the budget allocated to the education departments of universities of medical sciences. As shown in Table 2, the distinction among the six models is with respect to the explanatory variables, that is, the determinants of expenditure budget.

Table 1. Describing the Status of Studied Medical Sciences Universities

Mean Parameter	University		
	Small	Medium	Large
Faculty member	27.53	143.79	537.26
Students			
Undergraduate	326.72	982.45	2272
Professional doctor	76.46	442.04	1545.26
Postgraduate	63.2	249.04	1300.96
Budget (million Tomans)	3319	17254	62772
Growth rate over the 8 years	43.5	154.3	735.7

4.1. The General Budget of the Education Sector

According to the measures of the goodness of fit (R^2), most models were well-fit, and over 82% of the budget variations of the education departments were explained by the included variables. Considering that the unit of measurement in the models is million Iranian Tomans, each of the estimated coefficients means that every one unit increment in the explanatory variable will increase the allocated budget by several million Tomans.

Model 1 shows that with every increase in the number of faculty members in the university, the educational budget increased by an average of 11.43 million Tomans. In addition, it was found that universities received 5.43, 7.53, and 22 million Tomans for every undergraduate, professional doctorate and postgraduate student admission, respectively. It should be stressed that this model, enjoying higher R^2 and lower Akaike-Schwartz criterion, was selected as the best model (Table 2).

The most important variables affecting budget allocation are the numbers of faculty members and postgradu-

Table 2. Estimated Regression Coefficients for Allocating General Budget of Universities Education Using GLS Method

Explanatory Variable	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE
Faculty member	114.34[a]	68.10	17.88	77.23					1143.83[b]	22.71	1137.01[b]	25.27
Undergraduate students	54.33[b]	13.29	96.40[b]	14.62	65.30[b]	11.59	98.03[b]	12.88				
Professional doctorate students	75.34[b]	23.20	20.50	25.96	85.97[b]	22.36	22.34	24.83				
Post graduate students	220.02[b]	14.63	257.12[b]	16.32	236.29[b]	10.99	259.60[b]	12.37				
Trend	29207[b]	2492			28701[b]	2479			32662[b]	3185		
Constant	-150889[b]	14271	-17938[a]	9890	-150652[b]	14300	-18266[a]	9835	-176029[b]	18246	-13622	10087
						Goodness of Fit Criteria						
R^2	0.922		0.896		0.921		0.896		0.857		0.823	
AIC	11233.65		11352.29		11234.5		11350.35		11668.31		11761.13	

[a] P value < 0.1.
[b] P value < 0.05.

ate students. According to Model 1, the general budget increased by 11.43 million Tomans for every increment in the number of faculty members, which was statistically significant. Also, for every admission of postgraduate student, a budget of 22 million Tomans was granted in addition to the university's education budget, which is statistically significant. Therefore, the numbers of postgraduate students and faculty members play a decisive role in the amount of budget allocated to the medical sciences universities. The trend variable also suggested that over the course of an eight-year period, the average annual educational budget increased by 2920 million Tomans.

On the other hand, Model 3 shows that if the allocation of educational budget is set based on the number of students, budgets of 6.73, 8.59, and 23.63 million Tomans will be allocated to universities for every undergraduate, professional doctorate and postgraduate student, respectively.

If the allocation of educational budget is merely based on the number of faculty members (Model 5), the regression coefficient indicates that for every unit increase in faculty members, the budget will increase by 114.38 million Tomans. In other words, for each academic faculty member in the university, the amount of budget allocated to education department will increase by 114.38 million Tomans.

Based on the coefficients of most models for all levels of budget allocation, the number of undergraduate and professional doctorate students has a less significant role in budgeting. In models 1, 3 and 5, the trend variable, that is time, has been also considered as an influential variable in education budgeting. Based on these models, the education budget of universities has increased on average by 3000 million Tomans annually.

In general, it can be stated that according to the data collected in the study period, on the one hand, each academic staff has injected an average budget of 114.38 million Tomans to the medical university, on the other hand, the trend variable reveals an increase of 3000 million Tomans in the average annual budget of universities. Therefore, in order to predict the next year budgets of universities, one should multiply the number of each parameter by its coefficient, and then, taking one-year elapsed time into consideration, an amount of 3000 million Tomans should be added to the budget as the time parameter. In models wherein only students are considered, the budget is predictable similarly.

4.2. Total Budget of the Education Sector

The results of the total budget allocation model (including expenditure budget and special incomes) for education departments using the GLS method are shown in Table 3. Among the various estimated models, three models were considered as final models for modelling total budget allocations of the education sector in medical universities. In these models, the unit of measurement is million Iranian Tomans. Therefore, each of the coefficients of the model means that every one unit increase in the explanatory variable will increase the total budget by several million Tomans.

The goodness of fit criterion for the estimated models suggests that all the models are well fitted and explain a high percentage of total budget changes across the departments of education. Model 1 shows that with every increase in the number of faculty members in the university, the budget of the entire department of education will increase by an average of 8.99 million Tomans. In addi-

Table 3. Estimated Regression Coefficients for Allocating Total Budget of Universities Education Sector Using GLS Method

Explanatory variable	Model 1		Model 2		Model 3	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Faculty member	89.97	95.97			1378.57[a]	30.89
Undergraduate students	70.53[a]	18.73	79.16[a]	16.30		
Professional doctorate students	69.39[a]	32.69	77.75[a]	31.45		
Post graduate students	292.88[a]	20.62	305.68[a]	15.45		
Trend	42124.66[a]	3512.52	41726.62[a]	3486.28	46825.87[a]	4332.6
Constant	-218578[a]	20111	-218391[a]	20107	-256935[a]	24819
			Goodness of Fit			
R^2	0.898		0.898		0.827	
AIC	11528.69		11527.58		11937.23	

[a] P value < 0.05.

tion, universities have been granted 7.05, 6.94 and 29.29 million Tomans for every student admission in undergraduate, professional doctorate and postgraduate levels, respectively.

Among the parameters for allocating the total budget, similar to the general budget, faculty members and postgraduate students have the highest shares in the total budget. According to Model 1, for every one unit increase in the number of faculty members, the total budget will increase by about 9 million Tomans. In addition, for every admitted undergraduate student, 29 million Tomans will be added to the total budget of the university, which is statistically significant. The trend variable also suggests that over the course of the eight years of the study, the total education budget has increased by an average of 4212 million Tomans on a yearly basis.

If the total budget allocation is merely based on the number of faculty members (Model 3), the regression coefficient shows that for every unit increase in the faculty members, the education budget will be increased by 137.85 million Tomans. In a model where the number of students is considered as the determining variable of the total education budget, the number of postgraduate students with a weight of 30 million Tomans has the highest impact on budget allocation.

5. Discussion

The budgeting of the education sector is strongly influenced by the numbers of postgraduate students and faculty members in particular. This is, by all mean, justified by the monthly salary paid to faculty members and the per capita spent on postgraduate students. In other words, a university with more faculty members and more M.Sc. and Ph.D. students will receive more budgets in order to pay the current salaries and expenses.

If the number of students be considered as the basis for the education budget allocation of universities (Model 3), the results showed that the university is granted 6.5, 8.5, and 23.6 million Tomans budgets for every undergraduate, professional doctorate and postgraduate student admission, respectively. Based on this model, the costs of postgraduate students are 3 - 4 times higher than those of undergraduate students. However, it is worth mentioning that the budget assigned per each professional doctorate student is much lower than that assigned per each postgraduate student, while the general belief is that professional doctorate students should have a higher share of budget allocation and a high proportion of the allocated budget should be spent on this category. A number of studies have been conducted in this regard among which are: the studies of Haghdoost et al. (14) on the cost analysis of education of students at schools of Public Health, Ebadifard Azar et al. (15) on unit cost calculation of student training at different levels at Schools of Management and Medical Information and Ghasempour et al. (16) on calculating the final cost of student training at schools of paramedicine. All these studies, consistent with our study, have confirmed that the total cost of postgraduate student training is about 3 - 4 times higher than that of undergraduate students.

The educational costs of postgraduate students were 4.3, 6.2 and 9.8 million Tomans in 2006 (15), 2011 (14) and 2012 (16), respectively. In the present study, it can be concluded that the educational cost of postgraduate students is about 22 million Tomans; and considering the five-year time interval since the last study and adjusting costs to today's prices, we arrived at approximately the same cost per

student. In the model of total budget, as previously noted, postgraduate students have the largest share in the budget. Considering that special incomes are also taken into account in the model, it is predictable that postgraduate students have a significant role in the special incomes of universities through paying tuitions. In other words, large universities have the power of admitting tuition payers and international students who are mostly postgraduate students.

Therefore, it is recommended that the total budget should be directed in a way to cover the shortage of special incomes in the medium- and small-size universities. However, the cost of academic staff in large universities may be higher because academic staff with higher experience and ranks are paid more. Therefore, in addition to the models mentioned in the Results section, such issues call for much attention in order to determine the budget.

The results of the designed budgeting models are presented only in terms of quantitative value and in fact, do not indicate the process of improvement or decline in the quality of performance in universities, and it is not clear that the allocated budget per each student category is spent on what section from an activity-based perspective. Keyzouri (7) studied the quality indicators in academic budgeting and pinpointed poor attention to the process of improving the quality of education, as well as the lack of coordination between the methods of distribution of higher education budgets among universities. He claimed that there are flaws in the method of distributing educational budgets in higher education system and uncertainty remains whether the absorbed budget due to the admission of postgraduate students is spent on training of this category.

National health, higher education and research are of the main pillars of sustainable development, and a major part of this mission has been undertaken by the Ministry of Health and Medical Education and the affiliated medical sciences universities. One of the important missions of the Ministry of Health and Medical Education for sustainable development is the provision of public health and treatment as well as health services whose realization calls for huge annual financial resources. Bearing in mind the problems of budgeting system among universities of medical sciences in Iran, reforming the budgeting system is necessary. Therefore, in order to overcome such problems, the operational budgeting system, which is widely used in the world, was introduced. The ultimate goal of the operational budgeting in the health system of Iran is the promotion and establishment of public health and health equity among people (17).

Another important point to note is that the major direct costs of recruiting an academic staff, including his salary and benefits, are paid through student per capita, and recruiting new faculty members without raising the number of students will result in serious loss to the university because the faculty has brought up only 11 million Tomans budgets, while only his salary and benefits are more than 80 million Tomans. Therefore, recruitment of one academic staff should be accompanied by admission of more than 20 undergraduate or at least five postgraduate students into the system. That being the case, recruiting academic staff without increasing the admission capacity is problematic and, of course, universities with a large number of admissions and without faculty employment enjoy economic benefits.

Among the limitations of this study are the exclusion of belongings and property budget from the actual budget, sudden growth in the number of universities from 40 universities in 2008 to 78 universities and medical faculties in 2015, and non-inclusion of the academic ranks of faculty members in the model. In addition, this study was conducted using expenditure and budgeting data of 78 medical universities in Iran where some concerns remain regarding the integration of the budget of some seemingly independent medical schools in cities into the total budget of the provincial universities and the independent budget of faculties. On the other hand, one of the strengths of this study is that all the estimated econometric models have a satisfying goodness of fit and the estimation of parameters in all models has been highly accurate, which confirms that the results of this study are functional in that they could be used to accurately understand and formulate the budgeting of universities for future plans.

Also, according to the goodness of fit of the statistical models and the significant coefficients of the variables in the models presented in in our study, assigning students into three or four different groups is very important in terms of budgeting because different educational groups, as shown by studies of Haghdoost et al., Ebadifard Azar et al., and Ghasempour et al. (14-16), have non-identical educational costs across universities of medical sciences. On the same basis, dividing educational categories into groups and allocation of budget according to specific coefficients of each group could improve the accuracy and precision of analysis and planning.

5.1. Conclusions

The models built on the basis of heath section data suggest that the criteria under which we assessed the education budgeting less accurately explain the budgeting rate of medical universities in terms of general budgets and belonging and property budgets. In other words, it seems that the methods of budgeting in case of underserved areas with lower economic and social indicators

are not transparent and are adversely affected by factors other than what we would deem. Another point about the allocation of health budgets is that special incomes have attracted a larger share of total budget on a yearly basis, which is higher in more developed regions, and such a difference in the special income is not compensated by the general budgets as well as belongings and property budgets, thus gradually the gap between developed and deprived areas increases.

In sum, it can be stated that one can use the models presented in this study together with more extensive future models to formulate the results based on more accurate and detailed data to obtain a highly precise and impeccable structure for budgeting in the educational and therapeutic sections of medical sciences universities. Accordingly, similar methods should be incorporated along with the implementation of operational budgeting principles as an alternative to the traditional and inefficient budgeting systems, such as output-based budgeting, to improve the effectiveness of organizational goals on the one hand and to realize performance-based budgeting on the other. In this way, higher education budgeting planners can assess the conditions and plans of universities in comparison with the status of their comprehensive quality indicators and allocate resources and funds through scoring the performance of universities.

Acknowledgments

The authors would like to thank the Center of Budgeting and Performance Evaluation of Ministry of Health and Medical Education of the Islamic Republic of Iran for their collaboration.

Footnotes

Authors' Contribution: All authors contributed to the design and implementation of the research, analysis of the results and writing of the manuscript.

Conflict of Interests: There is no conflict of interest regarding this paper.

Ethical Approval: IR.KMU.RES.012.

Funding/Support: No specific funding has been received to conduct this study.

References

1. Saketi P, Saeidi A, editors. . *Proceedings of the First International Performance Base Budgeting Conference*. 2007; Tehran, Iran. 2007. Persian.
2. Aigner DJ, Chu SF. On estimating the industry production function. *Am Econ Rev*. 1968;**58**(4):826–39.
3. Tamogheh KY, Moradi S, Mahmoudi A, Mohammadi K, Gharibi F. [Total cost of educating the nursing and midwifery students using activity-based costing method in Medical Science University of Kurdistan]. *Tech J Engin App Sci*. 2015;**5**(5):194–7. Persian.
4. Kuo JS, Ho YC. The cost efficiency impact of the university operation fund on public universities in Taiwan. *Econ Educ Rev*. 2008;**27**(5):603–12. doi: 10.1016/j.econedurev.2007.06.003.
5. Chalos P. An examination of budgetary inefficiency in education using data envelopment analysis. *Finan Account Manag*. 1997;**13**(1):55–69. doi: 10.1111/1468-0408.00026.
6. Entezari Y. [Analysis of funding performance of public universities]. *J Res Plan High Educ*. 2010;**16**(3):1–21. Persian.
7. Keyzouri AH. [Introducing some quality indices of Iranian university system to be used in the university budgeting]. *J Res Plan High Educ*. 2007;**13**(3):57–84. Persian.
8. Melin G, Kolarz P, Zaparucha E, Johan D. *Universities' internal budget models, six European case studies*. NTNU, Norway: Technopolis Group; 2006.
9. Volk CE. *Assessing competing models of resource allocation at a public research I university through multivariate analysis of state financing [dissertation]*. Tucson: University of Arizona, Tucson; 1995.
10. d'Sylva P. *Examining resource allocation within U.S. public research universities: An income production approach [dissertation]*. Tucson: University of Arizona, Tucson; 1998.
11. Safari SA, Sardari H. Designing a mathematical model for allocating budget to university research and educational goals: A case study in Shahed University. *Iran J Manag Stud*. 2012;**5**(2):88–113. doi: 10.22059/ijms.2012.28870.
12. Saeidi A. *[Development of model for internal resource allocation in public universities of Iran, Mixed method approach] [dissertation]*. Tehran, Iran: Shahid Beheshti University; 2010. Persian.
13. Saeidi A. A survey of effective factors on financial resource allocation within Iranian public universities: Panel data approach. *J Res Plan High Educ*. 2014;**20**(1):19–39.
14. Haghdoost AA, Amirimoghadam M, Loloei M, Baneshi MR, Sabbah F, Mehrolhassani MH. [Cost analysis of the education of students in School of Public Health, Kerman University of Medical Sciences, Iran, using activity-based costing model]. *Strides Dev Med Educ*. 2014;**11**(1):13–22. Persian.
15. Ebadifard Azar FA, Gorj H, Hadian M, Mahboub Ahari AR. [Unit cost calculation of student training at different levels trough Activity Base Costing method (ABC) at the School of Management and Medical Information, Iran University of Medical Science: Academic year, 2006-2007]. *J Health Admin*. 2006;**9**(24):23–8. Persian.
16. Ghasempour S, Rahimniya R, Rajabnezhad Z, Dargahi H. [Calculating the final cost of student training by activity based costing in School of Allied Medicine, Tehran University of Medical Sciences]. *Payavard Salamat*. 2016;**10**(1):104–18. Persian.
17. Vianchi A, editor. Investigating the operational budgeting process from the point of view of the health economics. *Proceedings of the First International Operational Budgeting Conference*. 2007; Tehran, Iran. 2007.