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Research Article

The Costs of Training Medical Parasitology and Mycology Students at Kerman University of Medical Sciences

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Abstract

Background: Training of expert human resources is one of the main and basic objectives of developed countries. One of the important challenges for attainment of this objective is shortage in funding and financial resources. This is while medical branches, due to being specialized and requiring vast practical courses, need spending considerable financial costs for training competent students.

Objectives: The present study aimed to estimate the costs of training medical parasitology and mycology students at Kerman University of Medical Sciences.

Methods: This was a descriptive research. The data collection tool was a form designed by researchers using various resources. Educational and non-educational costs of the academic year of 2017-2018, with a top-down approach, were analysed to estimate the costs of training and educating post-graduate students. Analyses were made using Microsoft Excel 2013 software.

Results: The costs of educating master students in parasitology, Ph.D. students in parasitology, and master students in mycology in the academic year of 2017-2018 were 11,144, 18,365, and 7,821 USD, respectively. Forty-five percent of the total of educational costs was allocated to training Ph.D. students in parasitology alone, and a major share (81%) of these costs had been paid to human resources.

Conclusion: Our findings indicated that the financial costs of training and educating students in the parasitology and mycology fields are high, needing the prompt attention of the policymakers of the national medical education system.

Keywords: Cost, Parasitology, Mycology, Kerman University of Medical Sciences, Ph.D. program, MSc. program

Background

Universities and higher education institutes are important and influential parts in each country because they are responsible for training specialized human resources. In fact, the progress and development of countries depend on the competency of its universities and higher education institutes (1, 2), and investments by governments in training specialized human resources can result in the country's economic growth in the long-term. Evidence shows that, particularly in countries with high incomes, investment in education has a positive impact on productivity and economic growth partly because educated forces can learn skills and new tasks easier and use a widespread range of new technologies, which consequently result in economic growth and prosperity (3).

However, one of the most important challenges of governments is difficulty in funding the development of higher education because of insufficient financial resources (4). Funding higher education throughout the world has

dramatically changed, especially during the 21st century (5). An increase in demand for educated and skilled workforce necessitates paying more attention to the financial costs associated with this mission (6).

On the one hand, a cost management system capable of precise identification of expenses and calculation of the cost of services can result in better management of costs and appropriate planning for allocating resources. The structure and design of the cost management system should be based on organizational needs to be capable of fulfilling them (7). In the past, traditional cost management methods (for example dividing total costs by the number of students) had been applied, which are not currently used due to their numerous deficiencies and challenges. Nowadays, applying modern cost calculation methods, we can expand scientific fields by appropriately allocating and optimizing the utilization of available financial resources throughout society.

For training students in medicine and related fields, the issue of costs is particularly important for a variety of reasons, such as increasing costs and their direct impacts on the quality of medical education, as well as the quality of training specialized resources (8).

Several researchers such as Esmaeili *et al.* in the northeast of Iran in 2018 (9), Ghasempour *et al.* in central Iran in 2016 (1), Haghdoost *et al.* in the southeast of Iran in 2014 (10), Foo in Australia in 2017 (6), and Maelah in Malaysia in 2011 (11) have conducted investigations on the costs of training students in various fields and grades.

Objectives

Therefore, considering the transformation and innovation packages in medical education in Iran and the emphasis of this policy on the realization of the costs of higher education services, as well as the lack of studies on the costs of training students in medical colleges, this study aimed to estimate the costs of educational services for training parasitology and mycology students in Kerman University of Medical Sciences.

Methods

This descriptive study enrolled post-graduate (masters and Ph.D. of parasitology and masters of mycology) students in Kerman University of Medical Sciences in the academic year of 2017-2018. The study was conducted in 2019, and required data was collected using a researcher-made form and extracted from the financial statements of the Faculty of Medicine and the data of Accrual Accounting software, Comprehensive Education Management System (i.e., the academic automation known as the Sama system), and other documents. Data was analysed using Microsoft Excel 2013 software. All costs were converted into US dollars based on the latest exchange rate reported by the Central Bank of Iran (1 USD = 42000 Rials) (12).

To calculate the costs of education in the mentioned fields and performing accounting operations, the top-down cost calculation approach via the direct allocation method was performed in four steps as follows:

First step: Identification and definition of educational and non-educational activities: The objective of this step was to familiarize ourselves with organizational structures and separate educational from non-educational activities. Educational activities include those that are directly related to the education and training of students (such as teaching of courses by professors).

Non-educational activities are those that are not directly related to student education (such as administrative activities, installations, library staff, etc.).

Second step: Identification and determination of the resources spent for education: In this step, all the costs of the resources related to student education and training, both direct and indirect, were identified and calculated. The resources studied included human resources (faculty members and staff), medical and non-medical supplies, logistic services, deputies, the depreciation of equipment, assets, and buildings, energy expenditure, and other resources (Table 1).

Table 1. Description of the Types of Costs and the Formula Used for Their Calculation

Item	Type of cost	Details of costs	Allocation basis	Method of calculation
1	Human resources	Salary and fringe benefits, overtime working, teaching fee, the fee of deprivation from having an office, new year bonus and allowance	No. of credits and No. of students	$\text{Salary of the faculty member} \times \frac{\text{No. of taught credits in the parasitology group}}{\text{Total of taught credits}} \times \frac{1}{\text{No of students}}$
2	Consumables	Administrative, Student and Laboratory Consumables	No. of students and volume of utilization	$\text{Total cost of consumables} \times \frac{1}{\text{Amount of utilization}} \times \frac{1}{\text{No.of students}}$
3	Logistic services	Repair, maintenance, installations, publication contracts	Area in Sq. meters	$\text{Total costs of logistic services of the medical college} \times \frac{\text{Area of the parasitology department in sq. meters}}{\text{Area of the medical college in sq. meters}}$
4	Deputies	Per capita student from Student, R&D deputies	No. of students	$\text{Total costs of deputies} \times \frac{1}{No.\,of\ students}$
5	Depreciation of equipment, assets, and buildings	Accumulated depreciation of administrative and laboratory equipment and accumulated depreciation of the building	No. of students	$\frac{\text{Costs of assets} - \text{salvage value}}{\text{Useful life}} \times \frac{1}{\text{No.of students}}$
6	Energy	Cost of utilities: water, power, gas, telephone	Area in Sq. meters	$\text{Total energy costs of the medical college} \times \frac{\text{Area of the parasitology department in sq. meters}}{\text{Area of the medical college in sq. meters}}$
7	Other costs	Miscellaneous costs and costs of purchase of new books during the studied years	No. of students	$\text{Other costs} \times \frac{1}{\text{No. of students}}$

Third step: Allocation of resources' costs to activities: The objective of this step was to allocate costs to related activities using the allocation basis method to determine the amount of the work spent on a particular activity. In this study, the allocation basis for faculty members (professors of parasitology and mycology, as well as visiting professors) was the number of their course credits. It is remarkable that in other educational groups, the teaching fee was deducted from the total allocated cost. For example, to calculate the salary share of faculty members of the parasitology group, our calculations were as follows:

First, the ratio of the number of course credits taught by a professor in the parasitology group (for example, for parasitology master students) to the total number of course credits taught by him/her (for all the parasitology and other groups) was determined. His/her salary was then multiplied by that ratio and finally divided by the total number of students (in this example, parasitology MSc. students). Other allocation bases included the number of students, area in sq. meters, and the duration of the activity.

Fourth step: Calculation of Cost of Education of Student: In this step, all the costs of educational and non-educational activities were calculated and summed up, and finally, based on the number of students at each program and the field of study, the cost was estimated.

Results

In this study, the number of students studying parasitology and mycology was 31. Nine of them were students in the master program in parasitology; nine others were in the Ph.D. course of parasitology, and finally 13 students were studying in the master program in mycology. The total number of the professors working in this educational group was 19, of whom 10 were resident faculty members, and nine were visiting professors (Table 2).

Table 2. Description of the parameters used in this study for calculating the costs of parasitology and mycology educational groups

Description	Parasitology		Mycology
	Master's degree	Ph.D.	Master's degree
No. of students	9	9	13
No. of credits	42	56	35
No. of academic staff	8	8	2
No. of visiting professors	5	6	5
Total number of students of the medical college	1825		
The total area of the medical college in square meters	18000		
Area of the parasitology and mycology departments in square meters	530		

Table 3. Description of the studied costs by the program and field of study in the parasitology and mycology departments (Costs in USD)

Item	Costs' topics	Costs' items	Parasitology				Mycology		Total
			Masters	Proportion of each costly item (%)	Ph.D.	Proportion of each costly item (%)	Master	Proportion of each costly item (%)	
1	Human Resources	Academic staff	39,843	39.73	53,125	32.14	37,261	36.65	130,229
2		Visiting professors	38,925	38.81	44,004	26.62	33,520	32.97	116,450
3		Administrative staff	341	0.34	1,389	0.84	493	0.48	2,223
4		Laboratory staff	801	0.80	801	0.48	1,157	1.14	2,760
5		Library staff	111	0.11	454	0.27	161	0.16	726
6		Ph.D. candidates' awards	0	0.00	44,777	27.09	0	0.00	44,777
7	Consumables	Administrative and student consumables	86	0.09	86	0.05	125	0.12	298
8		Laboratory consumables	667	0.67	1,124	0.68	763	0.75	2,554
9	Logistic Services	Installations	183	0.18	183	0.11	265	0.26	631
10		Repair & maintenance	8	0.01	8	0.00	11	0.01	27
11		Publications	24	0.02	24	0.01	35	0.03	83
12	Deputies	Vice chancellor's office in student and cultural affairs	6,773	6.75	6,773	4.10	9,783	9.62	23,328
13		Vice chancellor of research	9,643	9.61	9,643	5.83	13,929	13.70	33,214
14		Vice chancellor of administration and resources development affairs	213	0.21	213	0.13	308	0.30	733
15		Vice chancellor of academic affairs	89	0.09	89	0.05	129	0.13	307
16	Depreciation	Equipment & assets	2,257	2.25	2,257	1.37	3,260	3.21	7,774
17		Building & rental	61	0.06	61	0.04	87	0.09	208
18	Energy	Water, power, gas, telephone	270	0.27	270	0.16	390	0.38	930
Total			**100,296**	**100**	**165,281**	**100**	**101,676**	**100**	**367,253**
Cost per Student			**11,144**		**18,365**		**7,821**		

Table 4. The share of each educational program from the costs (Percentage)

Topics of costs	Master in Parasitology	Ph.D. in Parasitology	Master in Mycology	Total
Human resources	21.79	39.36	19.77	80.92
Consumables	0.21	0.33	0.24	0.78
Logistic Services	0.06	0.06	0.08	0.20
Deputies	4.53	4.53	6.54	15.6
Depreciation	0.63	0.63	0.91	2.17
Energy	0.07	0.07	0.11	0.25
Others	0.02	0.02	0.04	0.08
Total	27.32	45.01	27.69	100

Our findings showed that the total financial cost of the parasitology and mycology groups of Kerman University of Medical Sciences during one academic year was 367,253 US dollars (USD). The highest share of this was related to the Ph.D. course in parasitology. Moreover, the costs of the master and Ph.D. programs in parasitology, as well as the master program in parasitology during one academic year were 11,144, 18,365, and 7,821 USD, respectively (Table 3).

As it has been shown in Table 4, the largest share (81%) of the total cost was related to human resources, and the least (0.08%) was related to other costs (purchasing books, etc.). Also, 45 percent of the total cost was related to the Ph.D. program of the parasitology group.

Discussion

This study assessed the costs related to the educational and non-educational activities of the parasitology and mycology groups of the Medical College of Kerman University of Medical Sciences in the academic year of 2017-2018. Numerous studies have reviewed the cost of training students in different educational programs and fields of study in medical universities (1, 2, 9, 10, 13-19). However, no study has focused on the financial costs of the parasitology and mycology groups in Iran and other countries.

Our findings showed that the annual costs of educating students in the master and Ph.D. programs of parasitology and the master program of mycology at Kerman University of Medical Sciences were 11,144, 18,365, and 7,821 USD, respectively. The annual cost of training a Ph.D. student in clinical and laboratory fields is estimated to be 1.5 to 2.4 times of the cost spending for students in master's educational programs of the same fields. In the study of Ghasempour *et al.*, it was shown that this ratio was 2.2 (i.e., the cost ratio of training Ph.D. to master's students) in the laboratory hematology and blood banking field, which is in compliance with the findings of the present study (1). However, in the study of Ebadifard Azar *et al.*, the ratio of the annual costs of the Ph.D. and master's educational programs in non-clinical fields was 1.1 (20), reflecting the lesser practical credits and courses in non-clinical and non-laboratory fields, in which there is a little difference between the educational costs of the Ph.D. and master programs. In general, the costs of training students in medical colleges is high due to numerous laboratory-based courses and practical credits, as well as expensive consumables and equipment, resulting in higher costs of training students in medical vs. non-medical colleges. In Maelah's study, it was shown that the cost of educating students in medicine was about two times that of other study fields (engineering, economics, law, etc.) (11). Moreover, Razavi *et al.* in their study mentioned that parasitology and mycology are relatively costly fields (21).

A review of studies showed that the highest share of educational costs was related to direct costs (9, 10, 18, 22). In the present study, the largest share of these costs was related to human resources (81%), and in particular, professors' salaries (68%), which was in compliance with the findings of similar studies. This implies that the most costly educational activity is related to the salaries of professors, to which some studies have referred (23, 24). It is notable, the higher the professor's scientific grade is, the higher the costs of educating courses are (25). However, any endeavor to decrease professors' salaries can have a direct impact on the quality of training (24).

Based on the data of the present study, professors of parasitology and mycology spent about 60 percent of their time for the training and teaching of the course credits of other educational groups, and in this study, such costs were deducted and excluded from the costs of educating parasitology and mycology students.

Some discrepancies in the costs reported in this study and those mentioned in previous studies may be related to the fact that we reviewed post-graduate programs while the other studies mainly investigated professional doctorate periods. As another reason for the differences in the costs of various educational programs, one can refer to the difference in the number of course credits, which is the most important allocation basis. In other words, course credits in each semester are lower in post-graduate programs, increasing the costs of these educational programs. Furthermore, the allocation of different coefficients to educational programs, including bachelor, master, and Ph.D., causes numerous and significant changes in the costs of educating students. In Rajabi's study (15), the reasons for higher costs of post-graduate programs were noted to be a lower number of students and more facilities and equipment used in these programs, which increased the cost of educating these students compared to other groups.

This study has a number of strengths and limitations.

One of the strengths of this study was the adjustment of different costs by the importance of activities in each of the master and Ph.D. programs in the cost calculation process, which has been largely neglected in other studies. Moreover, we can refer to a number of limitations, like not considering what semester each student was studying in, as well as ignoring the costs of university offices and directing offices, as well as overhead costs like those related to facilities and maintenance.

Finally, we should argue that it is not appropriate to consider the number of students as a basis for paying per capita awards to faculties or universities. Likewise, Kojouri *et al.* (17) indicated in their study that differences among universities, their equipment and research capabilities, the scientific grades of professors, etc. could be among the factors resulting in a difference in the cost of a student for universities. Therefore, this basis is not an appropriate criterion for allocating financial resources to different educational groups and universities.

Conclusion

One of the most important objectives of cost analysis studies is to disclose the real costs of services, which is also among the policies of the packages of transformation and innovation in medical education. In the present study, the costs of educating and training students in parasitology and mycology were assessed in Kerman University of Medical Sciences in the academic year of 2017-2018. Parasitology and mycology are among the costliest medical fields due to having numerous practical and laboratory credits. Monitoring the costs of an education service leads to an optimal allocation of educational resources and budget to different parts (i.e., human resources, equipment, and educational requirements) and may, in long run, help purchase required advanced educational and research equipment. It may also serve as a basis for determining the costs of internationalization of education and attracting international students. So, this research can be an appropriate guide to policymakers for decision-making in order to improve the national educational system and optimally utilize financial resources.

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