

Performance Analysis of Hospitals Affiliated to Mashhad University of Medical Sciences Using the Pabon Lasso Model: A Six-Year-Trend Study

Rohollah Kalhor,¹ Fatemeh Darzi Ramandi,² Sima Rafiei,³ Seyed Saeed Tabatabaee,⁴ Mohammad Azmal,⁵ and Leila Kalhor^{6,*}

¹Social Determinants of Health Research Center, Qazvin University of Medical Sciences, Qazvin, IR Iran

²School of Public Health, Qazvin University of Medical Sciences, Qazvin, IR Iran

³Health Services Management Department, School of Public Health, Qazvin University of Medical Sciences, Qazvin, IR Iran

⁴Health Services Management Research Center, Institute for Futures Studies in Health, Kerman University of Medical Sciences, Kerman, IR Iran

⁵Bushehr University of Medical Sciences, Bushehr, IR Iran

⁶Student Research Committee, Hormozgan University of Medical Sciences, Bandar Abbas, IR Iran

*Corresponding author: Leila Kalhor, Student Research Committee, Hormozgan University of Medical Sciences, Bandar Abbas, IR Iran. Tel: +98.763337192, Fax: +98.763337192, E-mail: r.kalhor@gmail.com

Received 2016 April 26; Revised 2016 June 18; Accepted 2016 June 30.

Abstract

Background: Nowadays, productivity and efficiency are considered a culture and a perspective in both life and work environments. This is the starting point of human development.

Objectives: The aim of the present study was to investigate the performance of hospitals affiliated to Mashhad University of Medical Sciences using the Pabon Lasso Model.

Methods: The present study was a descriptive-analytic research, with a cross-sectional design, conducted during six years (2009-2014), at selected hospitals. The studied hospitals of this study were 21 public hospitals affiliated to Mashhad University of Medical Sciences. The data was obtained from the treatment Deputy of Khorasan Razavi province.

Results: Results from the present study showed that only 19% of the studied hospitals were located in zone 3 of the diagram, indicating a perfect performance. Twenty-eight percent were in zone 1, 19% in zone 2, and 28% in zone 4.

Conclusions: According to the findings, only a few hospitals are at the desirable zone (zone 3); the rest of the hospitals fell in other zones, which could be a result of poor performance and poor management of hospital resources. Most of the hospitals were in zones 1 and 4, whose characteristics are low bed turnover and longer stay, indicating higher bed supply than demand for healthcare services or longer hospitalization, less outpatient equipment use, and higher costs.

Keywords: Hospitals' Performance Evaluation, Pabon Lasso Model, Efficiency, Key Performance Indicators, Mashhad University of Medical Sciences, Iran

1. Background

In the recent years, transformations in illnesses, increasing hospital costs, rapid changes in hospital technology and equipment, and higher public expectations have challenged managers and policy makers of health care systems (1). On the other hand, hospitals have been considered as the most costly and most important part of health care systems, and require greater attention; in developing countries, more than 70% of resources of healthcare systems is allocated to hospitals (2). Shortage of resources in the health system and also higher contribution of hospitals in specific resources is one of the most important reasons for paying more attention to productivity and proper utilization of available resources (3). Hospitals' efficiency in resource utilization is also measurable by specific in-

dicators so that one can expect a promoted productivity in the system, by analyzing and planning for a better efficiency index (4). Nowadays, productivity and efficiency are considered a culture and a perspective in both life and work environments. They are also the starting point of human development (5). Therefore, efficiency is the most important and the commonest mechanism to evaluate and measure the performance of enterprises like hospitals (6). There are numerous indicators that allow the evaluation of the productivity or lack of productivity of a hospital. Most studies have introduced three indicators as the most important when evaluating hospitals' efficiency: bed occupancy rate (BOR), bed turnover rate (BTR), and average length of stay (ALS). Studies have also indicated that ALS and BOR have positive effects on hospitals' efficiency (7, 8). Since evaluating one of the above indicators does not de-

termine the level of performance in hospitals, Pabon Lasso Model, which combines these key indicators, is a useful method to evaluate hospital performance (9). Pabon Lasso Model is one of the most useful models for comparing hospital performances from efficiency aspect. This technique was introduced in 1986 by Pabon Lasso after which it has been widely applied to evaluate hospitals' efficiency (10). In this model, mean percentage of indicators of bed occupancy and bed turnover in hospitals form the vertical and horizontal vectors, respectively. According to this model, hospitals are placed in four zones. Then, based on the information of each hospital, their location on the is determined (11). As such, a study in Ardabil, in which the above-mentioned model was used, showed that 42% of the studied hospitals were in zone 1, 0% in zone 2, 35.71% in zone 3, and 21.43% in zone 4. The mean of ALS, BOR, and BTR was 2.44 days, 55.4% and 80.85 times in a year, respectively (12). Miraki et al. reported that BOR, by itself, is 62% and BTR is 79 times a year, pointing out that 8% of the studied hospitals lacked efficiency and 42% had perfect efficiency (13). Kavusi's study as well as some central African studies reported that 35% and 50% indicated that the hospitals were efficient (14, 15).

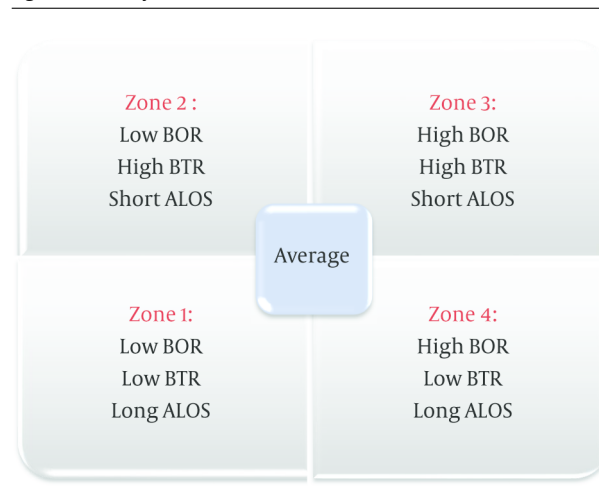
2. Objectives

The aim of the present study was to compare performances of hospitals related to Mashhad University of Medical Sciences based on the Pabon-Lasso model from 2009 to 2014.

3. Methods

The present study was a descriptive-analytic research, with a cross-sectional design, conducted during six years from 2009 to 2014, at selected hospitals. The hospitals of this study were 21 public hospitals affiliated to Mashhad University of Medical Sciences. All hospitals were affiliated to Mashhad University of Medical Sciences, and were actively included in this study. Private and charity hospitals were excluded from the study. To map the of of Pabon-Lasso performance evaluation model, three indicators are required: bed occupancy rate (BOR), bed turnover rate (BTR), and average length of stay (ALS), the data of which were obtained from the treatment deputy of the Khorasan Razavi Province. The Excel software was used for data analysis. Data analysis was conducted using simple descriptive statistical methods. Each of the hospitals was placed in one of the four zones of the Pabon-Lasso Model (Figure 1).

Figure 1. Efficiency Indicators of the Four Zones in the Pabon-Lasso Model



Zone 1, number of offered hospital beds is more than what is demanded; zone 2, unnecessary hospitalization and extra bed especially in women and delivery blocks; zone 3, these hospitals have desirable efficiencies, they also use the least number of beds they have; zone 4, longer hospitalizations, using little outpatient facilities, high costs especially in Psychiatric and Nursing homes.

4. Results

In total, 10 teaching hospitals and 11 non-teaching hospitals affiliated to Mashhad University of Medical Sciences were entered in the study, each of which were specified with a specific code based on their specialty.

Table 1 shows the hospitals according to specialty type, region and tasks. Most of the hospitals (N=10) were public and non-teaching and six of the specialty hospitals had five different specialties.

As indicated in Table 2, mean of bed turnover was 106.99 to 136.56 from 2009 to 2014. Mean of bed occupancy was from 62.63 to 69.56 and the range of average length of stay was 4.08 to 4.59. The highest mean bed turnover was during year 2011 and the lowest during 2014. The highest and lowest bed occupancy rates were for 2014 and 2009.

were were mapped for all hospitals based on the means of bed occupancy and bed turnover and the situation of each hospital was mapped according to the Pabon-Lasso Model.

Figure 2 shows the situation of all hospitals in 2009. Location of the hospitals in the mentioned year in the Pabon model shows that six hospitals (5 general and 1 specialty) were in zone 1, and seven (two specialty and five general) were in zone 2. Two hospitals (one general and one specialty) were in zone 3, and, finally, six hospitals (two specialty and four general) were in zone 4.

Figure 3 shows the situation of the studied hospitals in 2010. Location of the hospitals in the Pabon-Lasso Model:

Table 1. General Characteristics of the Studied Hospitals

Location of Hospital	Kind of Hospital	Center of Province		District	
		Teaching Hospital	Non-Teaching Hospital	Teaching Hospital	Non-teaching Hospital
Code of hospitals	General Hospital	1-2-6-7-8	-	-	11-12-13-14-15-16-17-18-20-21
	Cancer Hospital	3	-	-	-
	Psychological Hospital	-	-	-	-
	Children's Hospital	5	-	-	-
	Eye Hospital	10	-	-	-
	Maternity and Women's Hospital	9	-	-	19

Table 2. Mean Bed Turnover Rate, Bed Occupancy Rate and Average Length of Stay from 2009 to 2014

Year	Item		
	Bed Turnover Rate (BTR)	Bed Occupancy Rate (BOR), %	Average Length of Stay (ALS)
2009	135.30	62.63	4.47
2010	131.40	64.67	4.59
2011	136.56	64.15	4.22
2012	121.83	63.77	4.32
2013	115.19	65.94	4.08
2014	106.99	69.56	4.41
Total	124.47	65.12	4.34

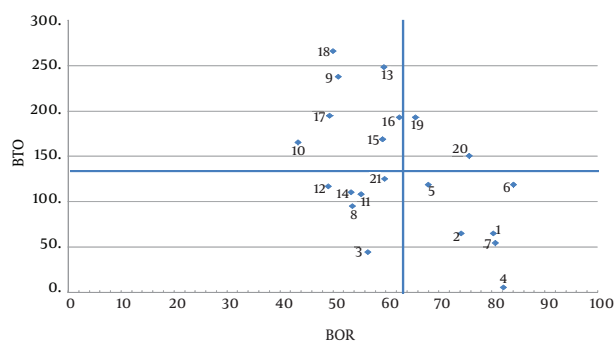


Figure 2. The Situation of the Studied Hospitals in 2009 Based on the Pabon-Lasso Model

Four general hospitals in zone 1, four general and one specialty in zone 2, two specialty and two general in zone 3, and two specialty between zones 1 and 4. In zone 4, there was six hospitals from which only one was specialty and five were general.

Figure 4 shows the situation of the hospitals in 2011. Location of the hospitals in the Pabon-Lasso Model indicates

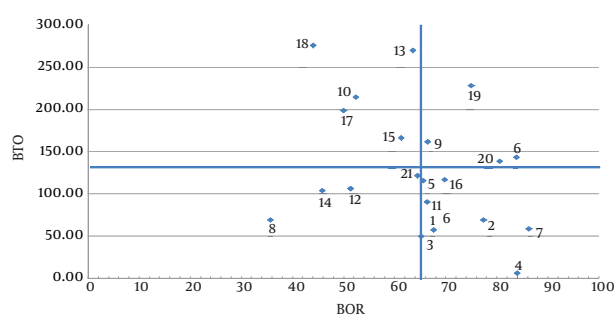


Figure 3. The Situation of the Studied Hospitals in 2010 Based on the Pabon-Lasso Model

that all of the studied hospitals located in zone 1 were general hospitals. Six hospitals were in zone 2. Zone 3 had three hospitals, one general and two specialty. One hospital was located between zones 1 and 4, and six hospitals were in zone 6.

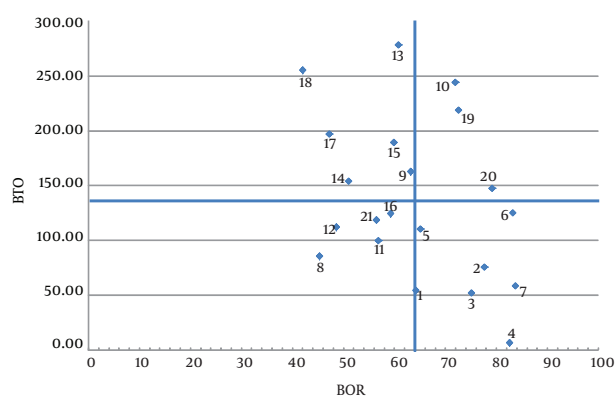


Figure 4. The Situation of the Studied Hospitals in 2011 Based on the Pabon-Lasso Model

Figure 5 shows the situation of the hospitals during year 2012. Location of these hospitals in the Pabon-Lasso Model shows that four hospitals were in zone 1, and six hospitals were in zone 2, four were in zone 3, and seven in zone 4.

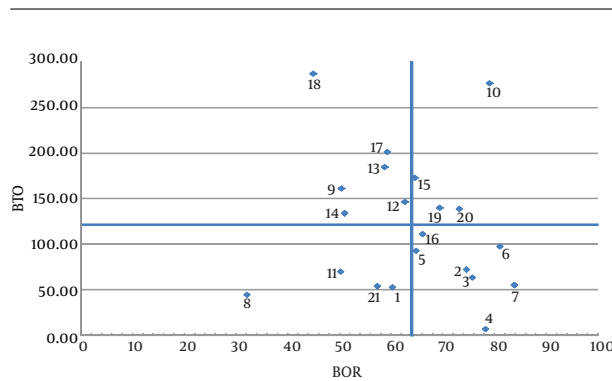


Figure 5. The Situation of the Studied Hospitals During Year 2012 Based on the Pabon-Lasso Model

Figure 6 shows the situation of the hospitals in 2013. Location of these hospitals in the Pabon-Lasso Model shows that four hospitals were located in zone 1, five in zone 2, three in zone 3, one hospital between zones 3 and 4, two hospitals between zones 1 and 4, and six hospitals in zone 4.

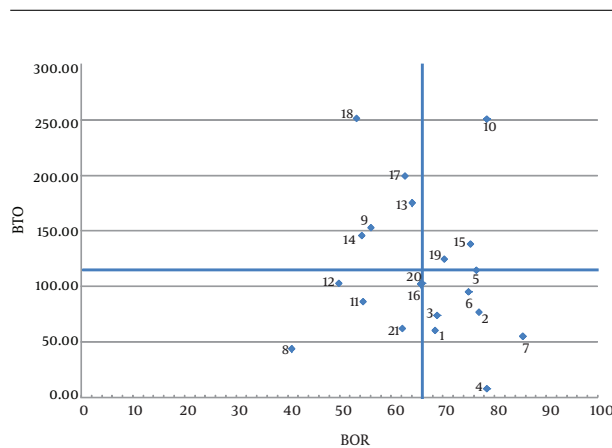


Figure 6. The Situation of the Studied Hospitals in 2013 Based on the Pabon-Lasso Model

Figure 7 shows the situation of the hospitals 2014. Location of these hospitals in the Pabon-Lasso Model shows that five hospitals were in zone 1, four in zone 2, one was between zones 1 and 2, four in zone 3, and one between zones 3 and 4, and finally, six hospitals were in zone 4.

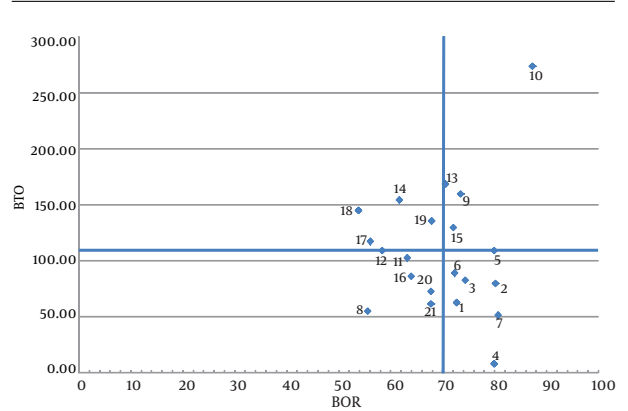


Figure 7. The Situation of the Studied Hospitals in 2014 Based on the Pabon-Lasso Model

5. Discussion

Findings of hospital performance measurement using the Pabon-Lasso Model showed that the performance of these hospitals improved during this period so that in 2009 only two hospitals were in zone 3 (hospitals 19 and 20) yet in 2014 this value was four (hospitals 9, 10, 13 and 15). Performance progress in the hospitals during this six-year period was desirable so that the number of hospitals located in zone 1 in 2009, had declined by 2014. This zone shows low performance and misuse of resources (low bed occupancy and bed turnover rates). It is therefore recommended for the available resources to be utilized properly. Intra-organizational surveys would also help identify problems and weaknesses of a hospital. Similar studies have been done in this domain. Kalhor reported that 16% of hospitals were in zone 1, while Hadi reported 6.5% in this zone. In another study, Barfar et al. concluded that 27% of the hospitals were in the mentioned zone while Nekoei-Moghadam reported no hospitals located in this zone (16-19).

Hospitals located in zone 2 during the years from 2009 to 2014 had higher BTR indicating shorter length of stay. Potentially, there is possibility of unnecessary hospitalization and extra bed in such hospitals. In the present study, 19% of the hospitals were in zone 1. Existence of only one hospital in this zone is justified because of its specialty (Maternity and Women’s Hospital). Sixteen percent of hospitals were in this zone according to Kalhor’s study, 42% according to Hadi et al. 18% as reported by Barfar et al. and 25% according to Nekoei-Moghadam et al. (16-19).

Hospitals 9, 10, 13 and 15 (19%) were at the acceptable zone (zone 3) in 2014. This may be the result of a better management of services and standardization of these hospitals. This zone was also occupied by 15% of hospitals in

2010 and 34% in 2011 according to the study of Motaghi et al., and 36%, 11%, 12.5% and 33.3% of hospitals according to the studies of Motaghi et al. Rahbar et al. Absu et al. Movahednia et al. and Goshtasebi et al. respectively (20-24). Of course this does not mean efforts should no longer be made to improve efficiency in the four hospitals of this study because efficiency has no limits. Continuing these efforts by the managers is strongly recommended. The number of hospitals in zone 4 had no change from 2009 to 2014 and during this time, six hospitals (28%) were in zone 4 each year. Studies by Motaghi, Rahbar, Absu, Movahednia, and Goshtasebi respectively, indicated that 14%, 27%, 7%, 50%, and 16% of hospitals were in zone 4 (20-24). Hospitals located in this zone have higher BOR, lower BTR and lower utilization of facilities as well as higher costs, which are characteristics of longer hospital stays such as that found in psychiatric centers and nursing homes. Thus, one can adjust placement of one hospital (psychiatric hospital) in this zone. Other hospitals were in this zone due to improper utilization of facilities and low hospital performance, which is solvable by proper planning and new ways of management and service provision and also utilization of advanced medical technologies and equipment.

5.1. Conclusions

According to the findings, a few hospitals were at an acceptable level of efficiency (zone 3), which is a result of poor performance of these hospitals, as well as poor management of the hospitals' resources. Most of the hospitals were in zones 1 and 4, characterized by low bed turnover rate and longer stay, indicating the availability of more beds than demand, longer average length of stay (ALS), lower employment of outpatient facilities, and higher costs. The trend of efficiency of the studied hospitals improved during the study period.

It is highly recommended for managing styles and planning to be reformed and reviewed in these hospitals so that the weaknesses and strengths in poor-performance hospitals are identified and strengths are developed and weaknesses are improved. Changing some internal processes in hospitals and adding new services and applying technologies will lead to improvements in the hospitals' performance.

Acknowledgments

Special thanks to Mashhad University of Medical Sciences Staff for participating in this study and completing the checklists.

References

1. Asefzadeh S. Fundamental of Health care economics. Qazvin: Management press; 2007.
2. Raiisian S, Eslamyan M, Lotfi F, Yusef_zadeh H, Kalhor R. Comparison of Productivity between University and Non-University Hospitals in Ahvaz: Using MALEMQUIST'S Index and DEA. *Jundishapur Sci Med J*. 2015;**13**(6):689-98.
3. Hatam N, Moslehi S, Askarian M, Shokrpour N, Keshtkaran A, Abbasi M. The Efficiency of General Public Hospitals in Fars Province, Southern Iran. *Iran Red Crescent Med J*. 2010;**2010**(2):138-44.
4. Mahapatra P, Berman P. Using hospital activity indicators to evaluate performance in Andhra Pradesh, India. *Int J Health Plann Manage*. 1994;**9**(2):199-211. [PubMed: [10137138](#)].
5. Rahmani N, Keshavarz A, Tabatabaei SS, Kalhor R. Assessing The Role Of Hospital Ownership On Total Factor Productivity Changes In Qazvin Hospitals Using Malemquists [U+0670] Index And DEA. *Payavard Salamat*. 2012;**6**(4).
6. Mehrtak M, Yusefzadeh H, Jaafari-pooyan E. Pabon Lasso and Data Envelopment Analysis: a complementary approach to hospital performance measurement. *Glob J Health Sci*. 2014;**6**(4):107-16. doi: [10.5539/gjhs.v6n4p107](#). [PubMed: [24999147](#)].
7. Varabyova Y, Schreyogg J. International comparisons of the technical efficiency of the hospital sector: panel data analysis of OECD countries using parametric and non-parametric approaches. *Health Policy*. 2013;**112**(1-2):70-9. doi: [10.1016/j.healthpol.2013.03.003](#). [PubMed: [23558262](#)].
8. Behzad Karami M, Rezaei S, Soofi M, Karyani A. Assessing the performance of hospitals at Kermanshah University of Medical Sciences by Pabon Lasso Model (2006-2011). *J Kermanshah Univ Med Sci*. 2014;**18**(1):53-61.
9. Zahiri M, Keliddar I. Performance evaluating in hospitals affiliated in Ahwaz University of Medical Sciences based on Pabon Lasso model. *J Hospital*. 2012;**11**(3):37-44.
10. The epidemiology unit of KwaZulu-Natal Department of Health . Use of indicators to assess the hospital efficiency (KwaZulu-Natal epidemiology bulletin Issue 7 ; 2004.
11. Garcia-Lacalle J, Martin E. Rural vs urban hospital performance in a 'competitive' public health service. *Soc Sci Med*. 2010;**71**(6):1131-40. doi: [10.1016/j.socscimed.2010.05.043](#). [PubMed: [20630645](#)].
12. Adham D, Panahi M, Barfar I, Ameri H, Sadeghi G, Salari-khah E. Contemporary use of hospital efficiency indicators to evaluate hospital performance using the Pabon Lasso model. *Eur J Business Soc Sci*. 2014;**3**(2):1-8.
13. Miraki T, Rezaei S, Jahanmeh N, Mohammadi M, Gharibi F. Assessment of performance of the hospitals of Kurdistan University of Medical Sciences by use of Pabon Lasso Model (2007-2011). *Sci J Kurdistan Univ Med Sci*. 2014;**19**(1):114-23.
14. Kavosi Z, Goodarzi S, Almasiankia A. Performance evaluation in hospitals of Lorestan University of Medical Sciences using Pabon-Lasso Model. *J Payavard Salamat*. 2013;**6**(5):365-75.
15. Nonvignon J, Tlotlego N, Asbu EZ, Nyarko EA, Kirigia JM, Sambo LG. In: Health Insurance: Issues, Challenges and Perspectives. Abrahamson E, Fagerland A, editors. Nova Science Publishers; 2012. Assessing the Efficiency of Hospitals in Botswana: An Application of the Pabon Lasso Technique.
16. Kalhor R, Salehi A, Keshavarz A, Bastani P, Orojloo P. Assessing hospital performance in Iran using the Pabon Lasso Model. *Asia Pacific J Health Manag*. 2014;**9**(2):77.
17. Hadi M, Sajadi HS, Sajadi ZS. Is there any method to compare key indicators of hospital performance simultaneity?. *Direct General*. 2011;**8**(1).
18. Barfar E, Khammarnia M, Baghbanian A, Panahi M. An Investigation of Performance at Hospitals Affiliated with Zahedan University of Medical Sciences; Using Pabon Lasso Technique. *Life Sci J*. 2014;**11**(15):77-81.

19. Nekoei-Moghadam M, Rooholamini A, Yazdi Feizabadi V, Hooshyar P. Comparing Performance of Selected Teaching Hospitals in Kerman and Shiraz Universities of Medical Sciences, Iran, Using Pabon-Lasso Chart. *J Health Dev.* 2012;**1**(1):11-21.
20. Motaghi M, Gholizade L, Ahmadi AM, Delgoshaei B. Comparison of efficiency in Kashan Medical Science University hospitals, using indicators of hospital efficiency: 2010-2011. *J Basic Appl Sci Res.* 2012;**2**(12):417-25.
21. Rahbar A, Hamidi Parsa H, Khosravi M. The Assessing Performance of Educational Therapeutic Hospitals Dependent to Qom and Kashan Medical Sciences and Health Services Universities and Their Comparison Using by the Pabon Lasso Model. *Health Inf Manag.* 2014;**11**(3):362-70.
22. Asbu E, Walker O, Kirigia J, Zawaira F, Magombo F, Zimpita P. Assessing the efficiency of hospitals in Malawi: An application of the Pabón Lasso technique. *Afr Health Monitor.* 2012;**14**(1):28-33.
23. Movahednia S, Partovishayan Z, Bastani M. Performance evaluation of teaching hospitals affiliated to tehran university of medical sciences (tums) using pabon-lasso model. *Payesh.* 2014;**13**:393-9.
24. Goshtasebi A, Vahdaninia M, Gorgipour R, Samanpour A, Maftoon F, Farzadi F, et al. Assessing hospital performance by the Pabon Lasso Model. *Iran J Public Health.* 2009;**38**(2):119-24.