Pharmacophore

ISSN-2229-5402

Journal home page: http://www.pharmacophorejournal.com

Pharmacophore
an International Journal
ISSN 2229-5402

INVESTIGATION OF LONG- AND SHORT-TERM RELATIONSHIPS BETWEEN CESAREAN SECTION AND THE FACTORS AFFECTING IT

Vahid Alinejad[1], Marzieh Mahmoudi[2*], Parisa Farjami[3], Nasrin Mohammadi Azerlou[4], Sajjad Kazemalilous[5], Arash Mirtorabi[6], Mahin Alinejad[7], Shekoufeh Kazemi Asfeh[8], Arvin Alinejad[7]

1. *PhD student of biostatistics, Infertility Research Center of Motahari hospital, Urmia University of Medical Sciences, Urmia, Iran.*
2. *Ph.D. candidate of biostatistics, Department of Biostatistics, Hamadan University of Medical Sciences, Hamadan, Iran.*
3. *MSc of Midwifery, Islamic Azad University Urmia, Urmia, Iran.*
4. *MSc of Midwifery, Urmia University of Medical Sciences, Urmia, Iran.*
5. *M.D, Urmia University of Medical Sciences, Urmia, Iran.*
6. *PhD student of statistics, Islamic Azad University Tehran, Tehran, Iran.*
7. *Urmia University of Medical Sciences, Urmia, Iran.*
8. *Shiraz University, Shiraz, Iran.*

ARTICLE INFO

Received:
03th Jun 2017
Accepted:
29th Nov 2017
Available online:
14th Dec 2017

Keywords: *Long-term relationship, Short-term relationship, Cesarean, Hamadan.*

ABSTRACT

Background and Objectives: The high rate of cesarean sections in Hamadan province, Iran results from spread of wrong culture among the women. Thus, the present study aimed to identify the trend of cesarean delivery in long term and investigate the factors affecting this event.
Methods: In this cross-sectional study, the researchers used the statistical data of Hamadan province from 2006 to 2013. Co-integration techniques, mainly ARDL and ECM, were employed in this study. In addition, EVies 6 and Microfit 4.1 were utilized in order to estimate the dynamic models designed for analyzing the demand for cesarean section.
Results: The estimated coefficients in this study revealed short- and long-term elasticity of demand for cesarean section relative to elective cesarean, repeat cesarean, fetal distress, multiple birth, and clinical as well as surgical reasons. ECM (-1) coefficient was -0.5974 in short term, which was statistically significant. This coefficient shows that 0.59% of imbalance is adjusted in the next period. In addition, R2 was 98.682% in short term which implies that almost 98.682% of the changes in the total demand for cesarean section is described by the model's explanatory variables.
Conclusion: The most effective factors in demand for cesarean section in Hamadan province included multiple birth, clinical and surgical causes, repeat cesarean, fetal distress, and elective cesarean section.

To Cite This Article: Vahid Alinejad, Marzieh Mahmoudi, Parisa Farjami, Nasrin Mohammadi Azerlou, Sajjad Kazemalilous, Arash Mirtorabi, Mahin Alinejad, Shekoufeh Kazemi Asfeh, Arvin Alinejad, (2017), "Investigation of long- and short-term relationships between cesarean sec-tion and the factors affecting it", ***Pharmacophore, 8(6S),*** *e-1173569.*

Introduction

Cesarean is defined as delivery through surgical operation. Cesarean section saves the mother and the child in case they are at risk (1). This operation is performed due to various reasons, including fetal distress, abnormal presentation, placenta previa, distusia, cephalopelvic disproportion, repeat cesarean, and multiple birth (2-4). Yet, several studies have mentioned repeat cesarean as the most important effective factor in performance of cesarean section (5). Fear from natural vaginal delivery and

Corresponding Author: Marzieh Mahmoudi, Ph.D. candidate of biostatistics, Department of Biostatistics, Hamadan University of Medical Sciences, Hamadan, Iran.

unawareness from the complications of cesarean section have also been mentioned as the reasons for selection of cesarean section by the patients (3, 6).

Based on the standard of World Health Organization (WHO), the annual rate of cesarean section should not exceed above 15% of all the deliveries (7, 8). Nonetheless, since cesarean section is accompanied by less pain, it has been greatly welcomed by the women (9). In Iran also, the number of cesarean sections is quite higher than the global standard and even follows an increasing trend; such a way that it has passed 50% in some areas. Hamadan province is among the provinces which show a high rate of cesarean delivery. In 2011, 46.3% of all the deliveries were carried out through cesarean section in Hamadan province, which is quite higher than the global standard. In fact, a total of 31,694 deliveries were performed in Hamadan in 2011 and the rate of cesarean section showed a 4.3% increase compared to 2009. It should be noted that in private clinics, more than 90% of the deliveries are carried out through the cesarean section (10).

Unfortunately, most pregnant women have a low level of knowledge and think that cesarean section is a better delivery mode. Thus, culturalization and educating the pregnant women are necessary in order to decrease the rate of cesarean section. In fact, women should be educated regarding the advantages of natural delivery and complications of cesarean section because cesarean surgery is followed by damages to mothers' health and increase of postpartum care (10, 11).

The high rate of cesarean sections in Hamadan province, Iran results from unawareness and spread of wrong culture among the women. Thus, the present study aims to identify the trend of cesarean delivery using Auto Regressive Distributed Lag (ARDL). It also aims to investigate the factors affecting this event in order to plan appropriate policies for decreasing this improper delivery mode. In this way, maternal and fetal mortality resulting from inappropriate delivery mode can be decreased. In time series studies, the sample includes all the cases occurring in a certain period of time. Hence, the statistical community of the current study included all the referrals for cesarean section and the reasons for mothers' tendency towards this mode during the past 32 seasons.

Materials and Methods

The present study was a cross-sectional investigation of the number of deliveries and cesarean sections in Hamadan province, Iran. Hamadan province is located in west of Iran. It is the 14th province of the country regarding population and the 23rd one concerning area. According to the census in 2011, the population of this province was 1758268 individuals with 874832 ones being female. The largest cities of Hamadan province are Hamadan, Nahavand, and Malayer (12, 13).

In the present study, the data were obtained from the registered data in the department of health of Hamadan University of Medical Sciences, Hamadan, Iran. These data included the seasonal information of delivery status based on various cities and hospitals of Hamadan province from the beginning of 2005 to the end of 2012. The study variables and factors affecting cesarean section included elective cesarean section (performance of surgery due to mother's demand), repeat cesarean (performance of cesarean section for a woman with a history of at least one cesarean delivery), fetal distress (disturbance in fetal oxygenation affecting fetal heart rate and movements), multiple birth, and clinical as well as surgical reasons (history of pelvic surgeries).

Co-integration techniques, mainly ARDL and ECM, were employed in this study. In addition, EVies 6 and Microfit 4.1 were used in order to estimate the dynamic models designed for analyzing the cesarean section demand in Hamadan province (14, 15).

Referral pattern of the performed cesarean sections

Function of the rate of cesarean section in Hamadan is as follows:

$$\mathbf{Ce = AP + \beta_1\ Cee + \beta_2\ Cer + \beta_3\ FD + \beta_4\ Twin + \beta_5\ MASF}$$

Where Ce is the logarithm of the rate of demand for cesarean section, Cee is the logarithm of elective cesarean section, Cer is the logarithm of repeat cesarean, FD is the logarithm of fetal distress, Twin is the logarithm of multiple birth, and MASF is the logarithm of clinical and surgical reasons.

Results

Considering stationarity and non-stationarity and existence of unit root, augmented Dickey Fuller test was utilized in the present study. In case the absolute value of the statistic is larger than that of the critical quantity, H_0 or existence of unit root is rejected. In this study, the critical quantity at level condition, with no trend, and CI=95% was -2.96. According to table 1, the absolute value of the Dickey Fuller test statistic for each variable at level was smaller than the absolute value of the critical quantity. Therefore, H_0 or existence of unit root could not be rejected and all the variables of cesarean section were non-stationary.

Table 1. The results of augmented Dickey Fuller test for the model variables at level (intercept, with no trend)

Variable	Number of lags	Augmented Dickey Fuller test statistic	P-value
Ce	1	-1.55	0.49
Cee	1	-1.14	0.68

Cer	1	-2.36	0.16
FD	1	-2.59	0.051
Twin	1	-1.75	0.4
MASF	0	-2.8	0.071
At 5% level			ADF=(-2.96)

Table 2. The results of augmented Dickey Fuller test for model variables at first-order difference (with intercept, without trend)

Variable	**Number of lags**	**Augmented Dickey Fuller test statistic**	**P-value**
Ce	1	-8.19	0.000
Cee	1	-7.87	0.000
Cer	1	-8.78	0.000
FD	1	-5.74	0.000
Twin	1	-7.12	0.000
MASF	0	-7.29	0.000
At 5% level			ADF=(-2.96)

As Table 2 depicts, the augmented Dickey Fuller test statistic became larger than the critical quantity after first-order differencing the variables. Therefore, stationarity of the variables was confirmed. Consequently, all the model variables were first order and stationary.

Estimation of function of demand for cesarean section using ARDL

In order to determine the long-term relationships and co-integration analyses, the single equation method by Pesaran and Shin (1997) and Pesaran et al. (1977) were utilized. In the method by Pesaran and Shin, the estimation process is performed at two stages. The first stage; i.e., stationarity of the variables, is the prerequisite for using co-integration methods. The superiority of ARDL to other co-integration methods is that it can estimate both short- and long-term relationships in case the model variables are non-zero-order stationary or first-order stationary. Besides, it provides quite efficient estimations (Pesaran and Smith, 1998). The second stage involves estimation of short- and long-term relationships. The results of estimation of the function of demand for cesarean section are presented in the following table.

$$\text{Ce=AP+}\sum_{i=1}^{n}\gamma_i Cee_{i-t}+\sum_{i=0}^{n}\gamma_i Cer_{i-t}+\sum_{i=0}^{n}\gamma_i FD_{i-t}+\sum_{i=0}^{n}\gamma_i Twin_{i-t}+\sum_{i=0}^{n}\gamma_i MASF_{i-t} \quad (2)$$

Table 3. The results of estimation of function of demand for cesarean section using ARDL (1,1,1,1,0,0)

Variables	**Coefficient**	**SD**	**P-value**
Ce(-1)	0.40260	0.10232*	0.001
Cee	0.93996	0.13277*	0.000
Cee(-1)	-0.49942	0.17709**	0.010
Cer	1.1709	0.09199*	0.000
Cer(-1)	-0.42996	0.16043**	0.014
FD	1.1183	0.08672*	0.000
FD(-1)	-0.46041	0.13214*	0.002
Twin	2.5275	0.68977*	0.001
MASF	1.1188	0.22054*	0.000
R^2=0.9521			F=571.5688

*, **, and *** represent significance level at 1%, 5%, and 10%, respectively.

Considering P=0.722 in the autocorrelation test, assumption of H_0 based on lack of autocorrelation is confirmed. In addition, based on P=0.89 in the true function test, assumption of H_0 based on the true function is confirmed. Besides, considering P=0.944 in the normality test, assumption of H_0 based on normality is confirmed. Based on P=0.45 in variance anisotropy test, assumption of H_0 based on variance anisotropy is also confirmed. Hence, the model is confirmed to be an appropriate one.

Co-integration test

In order to determine long-term convergence, the amount of *t* is measured using the following equation:

$$t = \frac{0.40260-1}{0.10232} = \frac{\sum_{i=1}^{p} \alpha_i - 1}{\sum_{i=1}^{p} s_{\alpha_i}} = -5.84$$

By comparison of the computed value to the critical quantity at 90% confidence level presented by Banerjee, Dolado, and Mastre, assumption of H_0 based on lack of long-term convergence among the model variables was rejected, and a long-term equilibrium relationship among the variables was confirmed.

Long-term analysis of the function of demands for cesarean section

In this part, the long-term relationship among the variables was assessed using ARDL coefficients

Table 4. The results of long-term estimation of the function of demand for cesarean section using ARDL (1,1,1,1,0,0,)

Variables	Coefficient	SD	P-value
Cee	0.73743	0.13795*	0.000
Cer	1.2403	0.12935*	0.000
FD	1.1012	0.15831	0.006
Twin	4.2308	1.3942	0.000
MASF	0.28173	0.28173	0.000
R^2=0.9521 F=571.5688			

* and ** represent 1% and 5% significance level, respectively.

Since a logarithmic model was employed in the current study, the coefficients of the variables represent the elasticity of elective cesarean, repeat cesarean, fetal distress, multiple birth, and clinical as well as surgical reasons. According to Table 5, long-term elasticity of the total demand for cesarean relative to elective cesarean was 0.73743. This implies that by 1% increase (decrease) in the rate of elective cesarean in long term, the rate of cesarean section increased (decreased) by 0.73743%. This was statistically significant, revealing the effectiveness of changes in the rate of elective cesarean section in the rate of total cesarean demand. Moreover, the long-term elasticity of the total demand for cesarean section relative to repeat cesarean was 1.2403. Thus, 1% increase (decrease) in the rate of repeat cesarean led to 1.2403% increase (decrease) in the total demand for cesarean delivery. Furthermore, long-term elasticity of the total demand for cesarean section relative to fetal distress was 1.1012. This shows that by 1% increase (decrease) in the rate of fetal distress in long term, 1.1012% increase (decrease) could be observed in the rate of total demand for cesarean delivery. This was statistically significant, indicating the effectiveness of changes in the rate of fetal distress in the total demand for cesarean section. In addition, the results showed that the long-term elasticity of demand for cesarean delivery relative to multiple birth was 4.2308. This implies that 1% increase (decrease) in the rate of multiple birth resulted in 4.2308% increase (decrease) in the total demand for cesarean section. Finally, clinical and surgical reasons were also significantly effective in the rate of total demand for cesarean delivery. According to Table 5, by 1% increase (decrease) in clinical and surgical reasons, 1.8728% increase (decrease) could be observed in the rate of total demand for cesarean delivery.

Short-term analysis of the demands for cesarean delivery using ECM

This section deals with the short-term analysis of the function of demand for cesarean delivery. The coefficients of ECM which represent the relationships between cesarean section and independent variables in short term have been presented in Table 5.

$$\Delta Ce = \Delta AP + \sum_{i=1}^{n} \gamma_i \Delta LCee_{i-t} + \sum_{i=0}^{n} \gamma_i \Delta LCer_{i-t} + \sum_{i=0}^{n} \gamma_i \Delta LFD_{i-t} + \sum_{i=0}^{n} \gamma_i \Delta LTwin_{i-t} + \sum_{i=0}^{n} \gamma_i \Delta LMASF_{i-t} + \Theta esm_{t-1} \quad (3)$$

Table 5. The results of short-term estimation of the function of demand for cesarean section using ARDL (1,1,1,1,0,0,)

Variables	Coefficient	SD	P-value
dCee	0.93996	0.13795*	0.000
dCer	1.1709	0.091986*	0.000
dFD	1.1183	0.086719*	0.006
dTwin	2.5275	1.68977*	0.000
dMASF	1.1188	0.22054*	0.000
Ecm(-1)	-0.59740	0.10232*	0.000
R^2=0.98682			F=329.467

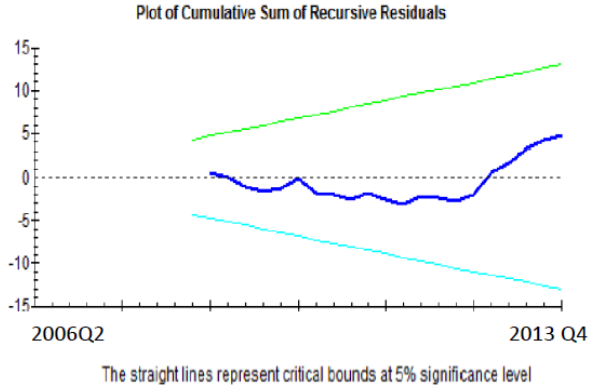
* and ** represent 1% and 5% significance level, respectively.

The estimated coefficients represent short-term elasticity of the rate of demand for cesarean delivery relative to elective cesarean, repeat cesarean, fetal distress, multiple birth, and clinical as well as surgical reasons. According to the results, by 1%

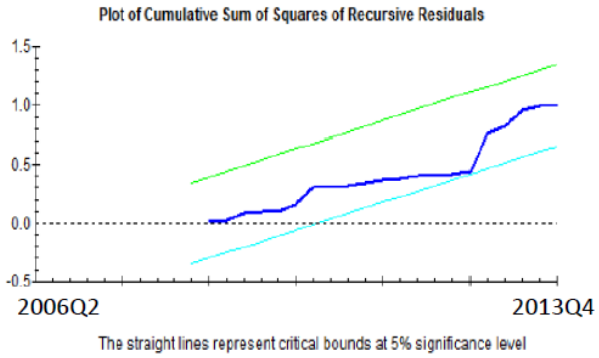
increase (decrease) in elective cesarean, the total demand for cesarean delivery would increase (decrease) by 0.93996%. Besides, 1% increase (decrease) in the rate of repeat cesarean led to 1.1709% increase (decrease) in the rate of total demand for cesarean delivery, which was statistically significant. Moreover, 1% increase (decrease) in fetal distress resulted in 1.1183% increase (decrease) in the rate of demand for cesarean section. Furthermore, by 1% increase (decrease) in the rate of multiple birth, 2.5275% increase (decrease) could be observed in the rate of total demand for cesarean delivery. Finally, 1% increase (decrease) in clinical and surgical reasons led to 1.1188% increase (decrease) in the rate of total demand for cesarean delivery, which was statistically significant. In this study, ECM (-1) coefficient was -0.5974 in short term, which was statistically significant. This coefficient shows that 0.59% of imbalance is adjusted in the next period. In addition, R^2 was 98.682% in short term which implies that almost 98.682% of the changes in the total demand for cesarean section is described by the model's explanatory variables. Besides, highness of both F and R^2 confirm the appropriateness of the model.

Evaluation of the stationarity of CUSUM and CUSUMQ coefficients

This test has been suggested for investigation of stationarity of the model coefficients. In this method, first a regression equation including the intended variables is estimated by the minimum estimable observations. Then, an observation is added to the previous equation and estimation is performed again and the process continues. In this way, after estimation of each stage, a coefficient is obtained for each variable, eventually resulting in a time series of the variables coefficients. In case the model is stationary, the changes in the coefficients are expected to be slight and random.



Graph 1. Evaluation of the stationarity of short-term coefficients



Graph 2. Evaluation of the stationarity of long-term coefficients

The results of these tests which have been shown in Graphs 1 and 2 revealed the stationarity of the estimated coefficients of short- and long-term models. It should be noted that the straight lines indicate 5% significance level.

Conclusion

The results of estimation of function of demand for cesarean section in long term and short term showed that the cross-elasticity of multiple birth was larger than elasticity of elective cesarean, repeat cesarean, fetal distress, multiple birth, and clinical as well as surgical reasons. Therefore, it can be concluded that the most effective factors in demand for cesarean section in long term in Hamadan province were multiple birth, clinical and surgical causes, repeat cesarean, fetal distress, and elective cesarean section. Besides, the most effective factors in demand for cesarean section in short term in Hamadan province were multiple birth, repeat cesarean, clinical and surgical reasons, fetal distress, and elective cesarean. These results are in agreement with

those of other studies conducted on the issue. For instance, Williams has stated multiple birth, fetal distress, repeat cesarean, placenta previa, distusia, and cephalopelvic disproportion as some factors affecting cesarean delivery (2). However, controversial results have been obtained regarding the importance of these factors. One study reported fetal distress as the most important factor affecting the necessity for cesarean delivery (16, 17). One other study showed repeat cesarean as one of the factors affecting cesarean section (4, 18). Yet, another study revealed multiple birth as the most important effective factor in cesarean delivery (19). Of course, multiple birth, itself, can lead to other factors such as cephalopelvic disproportion, distress, or distusia. Thus, it should be considered as a major factor in cesarean delivery. The findings of the present study also confirmed the importance of this factor.

In spite of the fact that cesarean section is considered superior to natural delivery in case mothers and infants' lives are threatened by risk factors, it has a large number of negative complications (10, 11,20-25). Thus, it should not replace natural vaginal delivery because of fear from pain. Hence, in order to prevent unnecessary cesarean sections and their negative outcomes and to reduce the extra expenses, policies should be taken to improve the pregnant women's knowledge and eliminate their wrong beliefs and attitudes.

References

1. Wikipedia (nd). wikipedia: The free encyclopedia on the internet. http://fa.www.wikipedia.org/cesarean section.[Persian].
2. Cunningham FG. Williams obstetrics. 22 ed: McGraw-Hill Professional New York; 2005.
3. Matias JP, Parpinelli MA, Cecatti JG. Factors associated with mode of delivery among primipara women with one previous cesarean section and undergoing a trial of labor. Revista da Associação Médica Brasileira. 2007;53(2):109-15.
4. Lukanova M, Popov I. Effect of some factors on obstetrical care of women with previous cesarean section]. Akush Ginekol (Sofiia). 2002;41(6):44-8.
5. Ghoreishi Z, Esmailzade Sh. The Comparison Risks of Normal Vaginal Delivery and Cesarean Section in Women With a Positive History of Cesarean Section. Scientific Journal of Kurdistan University of Medical sciences. 2004;8(31):32-40.[Persian].
6. Amir Farahani L, Abbasi Shavazi Mj. Review of trends and demographic factors associated with cesarean delivery rate in the last three decades. Journal of Fasa University of Medical sciences. 2012;2(3):127-34.[Persian].
7. Betrán AP, Merialdi M, Lauer JA, Bing-Shun W, Thomas J, Van Look P, et al. Rates of caesarean section: analysis of global, regional and national estimates. Paediatric and perinatal epidemiology. 2007;21(2):98-113.
8. World Health Organization: Monitoring emergency obstetric care: a handbook. Geneva, Switzerland; 2009.
9. Stavrou EP, Ford JB, Shand AW, Morris JM, Roberts CL. Epidemiology and trends for Caesarean section births in New South Wales, Australia: a population-based study. BMC pregnancy and childbirth. 2011;11(1):8.
10. Website of the Ministry of health, treatment and medical education: www.behdasht.gov.ir/index.aspx?siteid=1&pageid=33178&newsview=62577
11. Duff P. A simple checklist for preventing major complications associated with cesarean delivery. Obstetrics & Gynecology. 2010;116(6):1393-6.
12. Website of the Statistical Center of Iran,1390: http://www.amar.org.ir/Portals/2/pdf/jamiat_shahrestan_keshvar3.pdf
13. Wikipedia (nd). wikipedia: The free encyclopedia on the internet. http://fa.www.wikipedia.org/ Malayer .[Persian].
14. Bandaranaik, R.D. and Munasinghe, (1983). "The demand for electricity service and the quality of spply".Energy journal Vol 4, No 2, PP: 49-71.
15. Hondroyiannis, G. (2004)," Estimating residential demend for Electricity in Greece", Energy oeconomic, 26: 319-334.
16. Chauhan SP, Magann EF, Scott JR, Scardo JA, Hendrix NW, Martin Jr JN. Cesarean delivery for fetal distress: rate and risk factors. Obstetrical & gynecological survey. 2003;58(5):337-50.
17. Lowdermilk DL, Perry SE, Bobak IM. Maternity & women's health care: Mosby; 2004.
18. mohamadbeigi A, tabatabaee S, mohammad salehi N, yazdani M. Factors Influencing Cesarean Delivery Method in Shiraz Hospitals. IJN. 2009; 21 (56) :37-45[Persian].
19. Suzuki S. Risk factors for emergency cesarean delivery of the second twin after vaginal delivery of the first twin. Journal of Obstetrics and Gynaecology Research. 2009;35(3):467-71.
20. Alinejad V, Shadmehr A. Investigation of the factors affecting the positivity of the transplant result. Social Sciences (Pakistan),Volume 11, Issue 6, 2016, Pages 906-909
21. Alinejad V, Mahmodi M, Alinejad M, Besharat E, Gholizade R, Tabbakhi E, Shojaei Pour A, Gharaaghaji R. Investigation of long- and short-term relationships between cesarean delivery and its effective factors in Malayer. Glob J Health Sci. 2014 Sep 18;6(7 Spec No):1-7. doi: 10.5539/gjhsv6n7p1.
22. Hosseinlou A, Alinejad V, Alinejad M, Aghakhani N. The effects of fish oil capsules and vitamin B1 tablets on duration and severity of dysmenorrhea in students of high school in Urmia-Iran. Glob J Health Sci. 2014 Sep 18;6(7 Spec No):124-9.doi: 10.5539/gjhs.v6n7p124.

23. Farrokh-Eslamlou H, Oshnouei S, Alinejad V. Novel restricted access to vasectomy in Iran: addressing changing trends in vasectomy clients' characteristics over 16 years in northwestern Iran. Contraception. 2015 Nov;92(5):488-93. doi: 10.1016/j.contraception. 2015.07.010. Epub 2015 Jul 28.
24. Alinejad V, Shadmehr A, kazemi Asfeh Sh, Gholizade R , Tabbakhi E. Examine the Relationship Between Organizational Citizenship Behavior and Organizational Health in Specialty and Subspecialty Seyyed-al-Shohada Hospital Staff, Urmia. The Social Sciences. 2016 , Volume: 11 , Issue: 6, Page No.: 910-917 DOI: 10.3923/sscience.2016.910.917.
25. Baghaee R, Zadeh H.K, Feyzi A, Alinejad V, Niknejad E. Attitude and performance of nurses in oral care in intensive care unit patients. Journal of Global Pharma Technology,Volume 8, Issue 12, 2016, Pages 215-220.