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MODELING AND COMPARING THE VOLUME OF NATURAL AND CESAREAN DELIVERY OF DARAB AND SURVEY OF DEPENDENT FORM VOLUME OF NEONATAL MORTALITY DUE TO BIRTH BY CESAREANS OCCURRED IN DARAB

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ABSTRACT

Introduction: Cesarean has been accounted for a high percentage of deliveries performed in Iran and the rate is increasing. The aim of this study is to investigate and predict the relationship between mode of delivery (caesarean or natural) and neonatal mortality.
Methods: This is a cross sectional study of the total number of cesarean deliveries in the city of Darab (Iran) during the period of four years. To illustrate the trends and predictions of cesarean and natural surgery volume in Darab, time series models co-integration techniques, particularly ARDL and ECM error correction techniques are used. To estimate designed dynamic models for the analysis of neonatal mortality demand in cesarean EVies 6 and Microfit 4.1 software were used.
Results: 34.62% of deliveries were as cesarean and 65.38% of the deliveries were natural. The results of estimating the volume function of neonatal mortality in the short term and long term cesarean showed that the cross-communication of cesarean volume was effective in the response function.
Discussion: Factors affecting the volume function of neonatal mortality in cesarean depends on the volume of cesarean demand. So in order to control the reduction of neonatal mortality, it is necessary to inform policies and programs for pregnant women and also use more features and adopted recruitment of highly qualified medical specialists in hospitals of cities.

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Introduction

Neonatal mortality is one of the most important indicators of the health care systems of each community and its related factors that indicate the health status of the community (1-3). Infants during the first 28 days of life, vulnerability and mortality rates are high (4) so as UNICEF has released a report that approximately 40% of the 9/7 million deaths of children under 5 years

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and about 60% of deaths of children under one year are related to the neonatal mortality rate (under 28 days) (5). Thus providing, maintaining and improving the health of infants as vulnerable groups should be included in the agenda of any community health systems.

One of the major achievements of the country is the drop in infant mortality. Figures show that in the past two decades, infant mortality has decreased in most countries, including Iran; thus, according to the World Health Organization in 2000, neonatal mortality rate per thousand live births in Iran was almost 21 infants that this rate has improved in 2011 to about 14 infants (6). However, the world average is 22 Index. However, neonatal mortality remains a health problem in the management of society's health, because neonatal mortality remains high and the rate in our country is higher than in developed countries. So requires serious planning in this area and identify the causes and contributing factors in the country (7).

Undoubtedly the necessity to increase the level of neonatal mortality is to identify the causes and risk factors and ways to avoid them (3). One of the causes of neonatal deaths in the first week of birth is the type of delivery, but this is considered as a less important factor. Delivery is usually done in two ways, natural and cesarean and the latter is more common among pregnant women. When natural delivery is dangerous for mother and baby, cesarean should be replaced by natural delivery. A birth that should be done by cesarean but is done naturally also cesarean deliveries that replace with natural delivery by no reason may also be irreparable consequences on the health of both mother and baby and increases the risk of infant death in the first month of life. Thus, an erroneous diagnosis of the type of delivery can be considered as one of the important factors for neonatal mortality. In this regard, a study has been conducted to examine the relationship between type of delivery and neonatal mortality rates in 46 countries; The results of this study have shown a negative linear relationship between cesarean delivery and neonatal mortality rates that the mortality rate for babies born by caesarean are much lower than the mortality of infants that are born naturally, especially for low-income countries it is a significant relationship (8). However, another study conducted in the U.S. shows, cesarean born infants more likely to die than infants who were born by natural delivery (9).

Due to the rural population and the high rate of cesarean in Darab city, as well as high rates of neonatal mortality in the city(10), in this study, the relationship between monthly average neonatal mortality rate in normal deliveries and caesarean performed, examined using time series analysis (VARMA) to be able to reach dramatic reductions in neonatal mortality based on the results of planning and education in order to choose the right type of delivery.

Methods:

This is a cross-sectional study of the total number of deliveries and cesarean deliveries of Darab city. Darab city is located in the southeastern province of Fars and contains four cities named Darab, Janet city is Dobarjifedamy. The city, with an area of approximately 7,500 square kilometers and a population of 189,345 (2011 census based), contains four central, Rustaq, Forg and Janet parts. It should be noted that most of the population of the city is rural (11).

Data are derived from the information recorded in Darab city health center. The data included monthly data of delivery status and neonatal mortality that were collected in the period from June 2008 to November 2012.

Variables and different factors affecting neonatal mortality volume in this study are including the type of delivery that for infants who have died in division to delivery type and total delivery volume by normal and cesarean delivery and the relationship between its long-term and short-term have been studied.

Co-integration techniques, particularly ARDL and ECM error correction are generally used in the present study. To estimate designed dynamic models for the analysis of neonatal mortality demand in cesarean in Darab city EVies 6 and Microfit 4.1 software were used. (12, 13)

Neonatal mortality volume pattern:

Form of neonatal mortality volume function due to conducted birth by cesarean in Darab is as follows:

$$\mathbf{DCe=AP+\beta_1\ Ce} \quad (1)$$

Where DCe: logarithm of neonatal mortality volume in cesarean delivery and Ce: logarithm of the volume of cesarean demand.

Results:

This study was a time series that has been done in the timeframe of four years and six months. In this study, with modeling of two variables of cesarean volume and delivery we seek to evaluate the proportion of cesarean volume to the total volume in Darab. Then we will survey the form of neonatal mortality volume function by cesarean in Darab.

In Darab city 34.62% of the deliveries is done as cesarean and 65.38% as natural while the average volume of the surgeries during this study and as natural and cesarean deliveries are 209.5 and 111, respectively. Given the time-series studies it is noteworthy that natural delivery volume increased in cold season and reduced in warm season, while the cesarean rate is relatively constant during the year. Mean delivery in Darab city in the next 4 months have predicted the 208 cases about a month and the confidence interval is 95% (208±4.4) and the mean natural delivery in Darab city in the next 4 months is predicted to 110 cases per month and confidence interval is 95% (110±0.6) this prediction is estimated with {and VAR (2) and $\mu \neq 0$} model. Also the proportion of natural delivery to the total delivery in Darab in these four months is predicted 65/34% also the proportion of cesarean delivery to the total delivery in this four months in Darab is predicted 34/66% that a modest growth is seen in its volume compared to previous years.

In order to investigate the reliability and non-reliability and presence of unit root Dickey - Fuller test is used(14,15). The critical quantity in level model and the absence of a trend is -2/96 and 95% confidence level. According to Table 1 it can be seen that the absolute value of the statistic generalized Dickey - Fuller calculated for each variable at the level is less than the absolute value of the critical statistic and thus H0 hypothesis or unit root cannot be rejected. Therefore, all variables are unstable in the caesarean section.

Table 1. Results of generalized Dickey - Fuller test for model variables in level (intercept and non-trend)

P-Value	Generalized Dickey-Fuller t-statistic	Number of Interrupts	Variable
0.49	-1.55	1	Ce
ADF=(-2.96)		In 5%	

Source: research findings

Table 2: Results of generalized Dickey – Fuller test for first-order difference variables in the model (with intercept and without trend)

P-Value	Generalized Dickey-Fuller t-statistic	Number of Interrupts	Variable
0.0001	-8.19	1	Ce
ADF=(-2.96)		In 5%	

Source: research findings

However, as shown in Table (2) with one time difference of variables, generalized Dickey - Fuller statistics related to them become greater than critical statistics, and reliability of the variables is proved. So, all the variables in the reliable model are of I (1) degree.

Estimation of cesarean demand functions by ARDL:

To determine long-term relationships and a collective analysis of the single-equation method of boys and Shin (1997) and Sons and colleagues (1977) have been used. The great advantage of ARDL approach compared to other methods is the ability to collectively estimate the long-term and short-term relationships in a condition that even reliable model variables are not of zero order and reliable is of first order and provides consistent and efficient estimates (Sons & Smith, 1998).

The second stage is related to estimation of short-term and long-term relationships. Estimation results of cesarean demand function are provided in Table (3):

$$\text{DCe}=\text{AP}+\sum_{i=1}^{n}\gamma_i Cee_{i-t} \qquad (2)$$

Results of cesarean demand function estimation with ARDL (1,0)

P-Value	SD	Coefficient	Variable
0.003	0.1254*	0.38714	DCe(-1)
0.001	0.0032*	0.93996	Cee
F =7.71		R^2= 0.127	

Source: research findings

*, **, *** Respectively indicate significance level at 1, 5 and 10 percent.

According to the p-value for the test of self-correlation that is equal to 0/13. Hypothesis of H0 is accepted based on lack of self-correlation and with respect to the p-value for the test that the correct functional form is 0/68 is. Hypothesis of H0 is accepted based on the correct functional form and according to the p-value for the test of normality that is equal to 0/059. Hypothesis of H0 based on the normality is accepted and with respect to the p-value for the test of equal variance anisotropy that is equal to 0/165. Hypothesis of H0 is accepted based on the variance anisotropy. The above evidences confirm the model.

The co-integration test:

To recognize the convergence of long-term t-statistics value is obtained by the following equation:

$$t=\frac{\sum_{i=1}^{p}\hat{\alpha}_i-1}{\sum_{i=1}^{p}s_{\hat{\alpha}_i}}=\frac{0.38714-1}{0.12541}=-4.89$$

Comparison of the calculated and the critical parameters provided by Banerjee, Dolado and Master at 90% confidence level the null hypothesis based on the lack of long-term convergence between the variables of the model and a long-term equilibrium relationship between the variables of the pattern was confirmed.

Analysis of long-term demand cesarean reference:

In this section by the dynamic model coefficients using ARDL long-term relationship between the variables are tested:

Table 4- Long-term results of estimating the cesarean demand function ARDL (1,0)

P-Value	SD	Coefficient	Variable
0.000	0.0035521*	0.018525	Cee

Source: research findings

*, ** Respectively indicate significance levels at 1 and 5 percent

Because the model used in this study is logarithmic model, the variable coefficient suggests the volume of caesarean section. According to Table 4 long-term stretch of neonatal mortality volume in cesarean section compared to the variable of cesarean section volume is equivalent to 0.018525. This means that one percent increase (decrease) in long-term caesarean section volume; the volume of neonatal mortality in the cesarean section 0.018525% increases (decreases) and is statistically significant.

Analysis of short-term cesarean demand ECM reference:

In this section we analyze the short-term cesarean demand function. Coefficients of the error correction model that expresses the relationship between the cesarean variable and the independent variables in the short-term caesarean section are shown in Table 5:

$$\Delta DCe = \Delta AP + \sum_{i=1}^{n} \gamma_i \Delta LCee_{i-t} (3)$$

Table (5) - Results of short-term estimation of cesarean demand function ECM

P-Value	SD	Coefficient	Variable
0.000	0.0031692*	0.011353	dCee
0.000	0.12541*	-0.61286	ecm(-1)
F=23.8796		R^2= 0.31061	

Source: research findings

*, ** Respectively indicate significance levels at 1 and 5 percent

Estimated coefficients indicate short-term relationship of neonatal mortality in cesarean section compared to the variable of cesarean section volume is equivalent to 0/011353. This means that one percent increase (decrease) in short-term caesarean section volume; the volume of neonatal mortality in the cesarean section 0/011353% increases (decreases) and is statistically significant and represents short-term speed of adjustment towards long-term equilibrium. In fact, this coefficient shows that 0/61% of non-equilibrium in the next period is adjusted (corrected). R ^ 2 value in short-term is 31.061%. Approximately 31.061% of the overall short-term changes in cesarean demand can be explained by the explanatory variable models. Also the high F and R2 statistic models are the indicators of a good model.

Coefficients stability test (CUSUMQ & CUSUM) are estimated to investigate the stability of model coefficients.

Figure 1: Short-term stability test coefficients

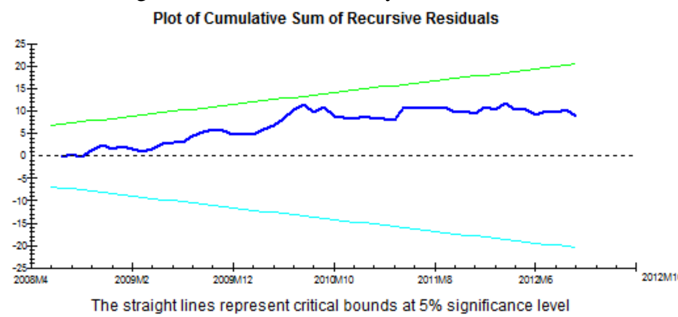
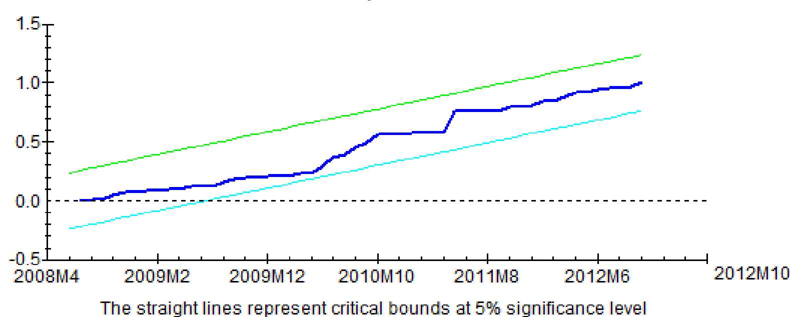


Figure 2: Long-term stability test coefficients



Source: Research findings

The results of this test that are given in Figures 1 and 2, show that the estimated coefficients of the short-term and long-term models are stable over the period studied. Note that straight lines indicate the significance level of 5 percent.

Discussion:

The rate of natural delivery and cesarean volume in 4 months has not significantly increased compared to the previous forecast that is due to the desire to reduce the fertility of mothers in cold seasons in Darab city. However, cesarean delivery index is high in this city(10).

The results of estimating the volume of neonatal mortality volume in the short-term and cross-communication section showed that cross-elasticity of cesarean volume was effective on response function. Therefore, we can say that the influencing factor on neonatal mortality volume function in cesarean section in Darab (Iran) in long-term depends on the volume of cesarean demand. Also the influencing factor on neonatal mortality volume function in cesarean section in Darab (Iran) in short-term depends on the volume of cesarean demand. Although many studies have shown the effect of cesarean section on reducing neonatal mortality (9, 16, 17) but results from studies conducted by MacDorman in the United States as the present study has been shown the relationship between cesarean section and increased mortality rates (11, 18).

Low awareness of pregnant women from the benefits of natural delivery and disadvantages of cesarean, when the fetal or mother are not at risk, eventually leads to the selection of an unsuitable delivery. Also, lack of proper medical facilities and limited medical trained and experienced staff in Darab city for cesarean section is impressive on neonatal mortality(10).

In order to control the indiscriminate and unnecessary cesarean followed to reduce neonatal mortality and to reduce additional costs, necessary policies and programs should be adopted to inform pregnant women of the benefits and disadvantages of natural delivery and cesarean and the use of more features and trained and experienced staff in city hospitals.

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