Socioeconomic Determinants of Infant Mortality in Iranian Children: A Longitudinal Econometrics Analysis

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Abstract

Introduction

Infant Mortality Rate (IMR) is one of the main indicators of the general level of health status as well as well-being. The aim of this study was to investigate the main components of IMR in Iran from 1967 to 2012 years.

Methods and Materials

Using time series data of national level (1967 to 2012 years), we explored the association between Total Fertility Rate (TFR), Gross Domestic Product (GDP) per capita, number of physician per 1000 populations, female labor force participation rate, percentage of people living in rural regions and mean years schooling for each people with infant mortality rate of Iran. These data were obtained from Central Bank of Islamic Republic of Iran (CBI) data bank and Iranian statistical center. Time series analysis was done for this purpose.

Results

This study showed that there are positive relationships between total fertility rate, percentage of people living in rural regions with mortality rate of infant. In addition, IMR had inverse relationships with number of physicians and mean years of schooling. The per capita GDP and female labor force participation rate had not significant correlation with IMR.

Conclusion

Many predictors of infant mortality were identified. The total fertility rate, number of physician per 1000 populations, percentage of people living in rural regions and mean years schooling of each people were strongly associated with infant mortality. These findings may be very useful for policy makers that how death of infant can be decreased.

Key words: Collinearity Statistic, Determinants, Infant mortality, longitudinal study.

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Introduction

Infant mortality defined as the death of a child before reaching the age of one and it is one of the most important items in the Millennium Development Goals (MDG) (1, 2).

Infant Mortality Rate (IMR) is also considered as an important nationally used indicator for assessing the health status of a population. It is closely related to the well-being of the community and its development. In addition, mortality in this age group in compared to the other age groups , is most dependent on the socio-economic conditions of a community (3-6). There are many studies which have been conducted to determine the main Socio-economic and demographic factors affecting IMR in both developed and developing countries (7-11).

According to these studies, these factors are national income or distribution in income, level of education of the mother, unemployment rate, access to health services, public health spending, fertility rate, female participation in labour force, etc. It should be mention that these factors may be different for developed and developing countries. Moreover, this is demonstrated that IMR is bigger in countries which have suffered with health inequalities, unsuitable socioeconomic condition and unfavorable environmental factors tends (12, 13).

 The United Nations report, published in 2009, about MDGs indicated that the infant mortality for developed countries was 5 per 1000 live births, while it was 51 for the developing countries. Therefore, it is important to understand the determinants of IMR in each of country. Understanding the main determinants of IMR and its importance relative is essential tool for public health planning by health policy makers in order to reduce IMR in a country (14).

The aim of the present work was to identify the main factors affecting infant mortality rate using time series data of Iran. We hope our study provide useful information about unexplored aspects of socio-economics, demographic, and health-related factors of IMR in Iran and helps to policy makers how to decrease infant mortality.

Methods and Materials

This was a time series study. An econometrics model was used to analyze components effect infant mortality rate. Macroeconomics data of Iran from 1967 to 2012 were used for this purpose. Data were gathered from Central Bank of Islamic Republic of Iran (CBI) data bank and Iranian Statistical Center.

Infant mortality model is one of the mortality models. Mortality models are not in linear form and for making them estimable they must be changed in to log-log form. The econometrics model of infant mortality determinants used in this study is shown below:

$$LnIMR_t = \beta_0 + \beta_1 LnGDP_t + \beta_2 LnTFR_t +$$

$$\beta_3 LnRur_t + \beta_4 LnSch_t + \beta_5 FLP_t + \beta_6 LnDOC_t + u_t$$

These terms are explained below:

LnIMR is the logarithm of infant (children under 1 years old) mortality rate in 1000 births.

LnGDP is the logarithm of per capita gross domestic product at purchasing power parity.

LnTFR is the logarithm of Total Fertility Rate.

LnRur is the logarithm of the percentage of people living in rural regions.

LnSch is the logarithm of mean years schooling for each people. LnFLP is the logarithm of female labor force Participation rate. LnDOC is the logarithm of the number of doctors (physicians and specialists) per 1000

population. In this model, each "β" was the symbol of coefficients and u was the symbol of residuals. After estimating the model, Variance Inflation Factor (VIF) test was used to detecting the collinearity in the model.

If the model had high degrees of collinearity, confounding variables must be found and solved then estimated the model again. In this study, R^2 statistics and F-statistics were reported too.

First we estimate the model without any changes. The VIF statistics of this estimation was 32.94 and it showed that there was high multicollinearity in the model. Reporting a model with high collinearities in variables would lead to wrong coefficients and t-statistics, so the source of collinearity must be found and deleted. For finding collinearity we used VIF statistics and correlation matrix for independent variables (Tables 1, 2). The results showed that LTFR and LDOC were the main sources of collinearity in the model.

Results

Table 1: Results of VIF statistics

Variables	VIF	1/ VIF
LnTFR	71.16	0.014
LnDOC	57.85	0.017
LnRur	43.63	0.022
LnSch	15.36	0.065
LnFLP	7.08	0.141
LnGDP	2.54	0.393
Mean	32.94	-

Table 2: Correlation matrix of independent variable

Variables	LnTFR	LnDOC	LnRur	LnSch	LnFLP	LnGDP
LnTFR	1.00					
LnDOC	0.52	1.00				
LnRur	0.89	0.33	1.00			
LnSch	-0.94	-0.41	-0.91	1.00		
LnFLP	0.83	0.23	0.84	-0.92	1.00	
LnGDP	-0.98	-0.46	-0.90	0.95	-0.82	1.00

For deleting the effects for collinearity in LTFR and LDOC and other variables, we replaced the first difference of these

variables in the model. The results of estimating the model with first differences of LTFR and LDOC is shown (Table.3).

Table3: Results of main determinant of infant mortality rate in Iran (1967 to 2012)

Variables	Coefficients	Standard error	P-value
d.LnTFR	0.672	.0388	0.007
d.LnDOC	-0.124	0.233	0.000
LnRur	2.29	0.095	0.000
LnSch	-0.232	0.046	0.000
LnFLP	0.005	0.045	0.900
LnGDP	0.076	0.029	0.055
Constant	6.49	0.378	0.000
R^2	0.997		
F-statistics	2806.53		

The VIF statistics for the new model was 7.50 and so it was confirmed that the variables of model did not suffer with collinearity. In the estimated model, total fertility rate and living in rural regions had positive relationships with infant mortality rate. Also number of doctors per 1000 population and mean years of school had negative relationship with infant mortality rate. The results for female labor force participation rate and per capita gross domestic product were not significant. The result of R^2 statistics showed that the independent variables of model were good predictors for infant mortality rate. Also, the F-statistics confirmed the null hypothesis that at least one independent variable was not zero.

Discussion

Infant mortality rate is commonly used as one of the most important indicators of the level of socio-economic development of a given country. This indicator is associated with well-being of a population and the one of the main items of millennium development goals. IMR could be reflected improper childcare in a country and clarifying the determinant of IMR helps to policy maker to better allocation of resources and how infant mortality can be prevented (2, 9, 14, 15). So, the aim of the present study was to assess the effect of total fertility rate, per capita GDP, years of schooling, female labor force participation rate, physician per capita and percentage of people living in rural regions on mortality rate of infant in Iran.

The results about R^2 showed that there was high correlation among dependent variable and explanatory variables and it was 99.7 % and this indicates that about 99.7 % variance of infant mortality rate are explained by the variables included in the regression. The empirical analysis showed that the total fertility rate had a positive effect on infant mortality rate and its

coefficient was 0.672. This implies that a 10% increase in total fertility rate increases infant mortality rates by 6.7%. This finding is consistence with studies conducted Zakir et al. (9), Sartorius et al. (14) and Muldoon et al. (16). Zakir et al. concluded that total fertility rate and infant mortality rate are positive correlated and the coefficient of total fertility rate was 0.820. On the other hand, their study showed that if the total fertility rate 10 % increases, the infant mortality rate will increase by 8.2 %. (9). Also, there is a significant relationship between the percentage of people lived in rural regions and mortality rate of infant. The coefficient of this variable was 2.29 and this implies that 10 % increases in the percentages of people who lived in rural regions will leads to 22.9 % decrease in IMR.

Among other findings of the present study, also indicated in other studies, the number of physician per 1000 populations and years of schooling had a positive effect on infant mortality rate which is consistence with studies conducted by Muldoon et al (16), Sartorius et al. (14) and Burlea (17). The coefficient of physicians and years of schooling in present study was -0.12 and -0.23, respectively. These findings indicated that if the number of physician and literacy rate increased, the mortality rate of infant was decreased. A study by Ester et al. in Sub-Saharan Africa indicated there was a negative significant between infant mortality rate and years of schooling and its coefficient was equal -0.4 (18). Also, Chowdhury et al concluded that the risk of infant mortality rate for illiterate mothers was 1.2 times higher than the literate mother (19).

In a study conducted by Zakir et al., the coefficient of literacy rate was 0.7 and this implies a 10 % increase in literacy rate caused IMR decrease by approximately 7% (9). The results showed that the per capita GDP and female labor force

participation rate were not significantly related to the infant mortality rate. Dallolio et al. using multiple linear regression model on infant mortality rates across Italian regions concluded there was not significant association between income and infant mortality rate. (8). In line with results of our finding, a study by Rosicova et al. in Slovakia has been shown that income was not significantly associated with infant mortality rate (4). This study had some limitations. First, macro data of Iran were used in this study. These data might have some bias in gathering.

Conclusion

This study suggests that, in Iran, the total fertility rate, the percentage of people who living in rural regions, number of physician per 1000 populations and years of schooling were strongly associated with mortality rate of infant. It is recommended the future study focus on the predictors of provincial infant mortality rate in Iran. We hope our study will provide a useful information and valuable insights for policy makers that how infant mortality rate in Iran can be prevented.

Conflict of interests: None.

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