http:// ijp.mums.ac.ir
Original Article (Pages:749-756)

Decomposition Socioeconomic Inequality in Infant Mortality in EMRO Countries

Sara Emamgholipour sefidashti[1], Majid Nakhaei[2], Ali Kazemi Karyani[3], *Sadegh Ghazanfari[4]

[1]Assistant Professor, Department of Management and Health Economics, School of Public Health, Tehran University of Medical Sciences, Tehran, Iran.
[2] PhD Student in Health Policy, School of Health Management and Information Sciences, Iran University of Medical Sciences, Tehran, Iran.
[3] Health Management and Economics Research Center, Iran University of Medical Sciences, Tehran, Iran.
[4] Department of Management and Health Economics, School of Public Health, Tehran University of Medical Science, Tehran, Iran.

Abstract

Introduction

The preservation and promotion of the health in children who are one of the most vulnerable parts in any society has an important role in the health system of each country. In this study, the socioeconomic factors affecting the infant mortality in Eastern Mediterranean Regional Office (EMRO) countries have been examined during the time period from 2000 to 2013.

Materials and Methods

This study was a panel data type estimated by using the method of random effects. The Likelihood ratio (LR) and Wooldridge tests have been applied to investigate the hetereoskedasticity and autocorrelation. The data used in this study have been collected from the websites of the World Bank and the World Health Organization (WHO). The studied panel has been evaluated by Feasible Generalized Least Squares (FGLS) method due to the existence of hetereoskedasticity.

Results

The results showed that the variables of per capita national income logarithm, vaccination coverage of Measles, the education level of 15 to 24-year-old women, per capita health expenditures, and the accessibility of improved health facilities, had an inverse association with the mortality rate of children. All variables except vaccination coverage for Measles had significant association. The per capita national income also had the greatest impact in decreasing the mortality rate of children.

Conclusion

The findings indicate that socioeconomic inequality in infant mortality in EMRO countries is determined not only by health system functions but also by factors beyond the scope of health authorities such as education system, and economic variables.

***Keywords*:** Infant mortality, EMRO, Fixed and random effects, Panel data, Socio-economic.

* ***Corresponding Author:***
Sadegh Ghazanfari, School of Public Health, Tehran University of Medical Science, Tehran, Iran.
E-mail: Sadegh.ghazanfari@gmail.com

Received date: May 12, 2015; Accepted date: Jun 12, 2015

Introduction

The preservation and promotion of the health in children who are one of the most vulnerable parts in any society has an important role in the health system of each country so that the level of child mortality is not only one of the most important and decisive indexes of the progress and development of various communities, but also is considered as a serious challenge for health systems in developing countries which the Millennium Development Goals (MDS) and many reports of human and social development emphasize the importance of this index (1, 2).

Fortunately, the child mortality has been significantly decreased in recent years coinciding with the expansion of health services and health promotion of communities (3). But there are the large inequalities in reducing child mortality in different parts of the world. According to data from the World Bank, the mortality rate of children under five years in Japan and Luxembourg are 3 and 2 per thousand live births, respectively, while this index in Mali and Somalia is 123 and 146 per thousand live births, respectively (3, 4).

The above example shows that the development level of various communities is effective in the child mortality rate (5). As a result, child mortality is not distributed equally among various countries and socio-economic classes (6-10). According to previous studies, the most important factors affecting child mortality can be classified into three categories: economic, social and access to health care. The most important factors affecting each of these categories are as follows: The level of household income (per capita national income at macro level). The education levels of parents, especially the mother. Level and quality of services provided by the health system are also considered as effective factors on child mortality (14-11 ,4).

Nearly 11 million children per year, 30 thousand children per day and 20 children per minute die in the world. More than 42 percent of these deaths occur in children under 5 years and about 80% of these deaths are for children under one year (15). The factors affecting an important part of the child mortality can be identified by studying these factors, but unfortunately despite many conducted studies over the past decade about the mortality of children under one year in connection socio-economic indexes in different parts of the world [Sherry study (11), Houweling (4), Hisham (16) and Newacheck (17)], they focused mostly on developed countries to reduce the burden of disease and mortality in children. Therefore, the necessity of a study about the determinants of mortality in children under one year in developing countries has been fully felt.

With regard to the gap in the field, this study has been conducted to evaluate the effect of socioeconomic variables on the infant mortality in the EMRO countries. The data provided in this study can offer effective solutions for the existing measures to reduce infant mortality in developing countries.

Materials and Methods

This study is considered as retrospective time series with the panel analyzer. The data used in this study have been collected from the websites of the World Bank and the World Health Organization for 20 countries in Eastern Mediterranean Regional Office (Afghanistan, Bahrain, Djibouti, Egypt, Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Pakistan, Qatar, Saudi Arabia, Sudan, Syria, Tunisia, UAE and Yemen) for the time period between 2000 and 2013 (Somalia was removed due to lack of information). So far different indexes have been applied to investigate the socio-economic factors affecting the mortality of children under one year. In

this study, the most important indexes have been utilized based on previous as follows:

First, the per capita national income index and per capita health expenditure index have been selected as the representative of economic situation. About the both indexes it was expected that the mortality rate for children under one year would be decreased by increasing these indexes. In order to consider the fact that the effect of income on the mortality of children under one year would be decreased by increasing the income, the per capita national income logarithm have been applied.

The indexes of the access to health facilities and Measles vaccination also have been selected as the representatives of health status. About the two indexes it is also expected mortality rate in children under one year should be decreased by increasing these two indexes.

The education levels of 15 to 24-year-old women and the raw birth rate also have been considered as the representatives of social status. It is expected that mortality of children under one year should be decreased by increasing the education level of 15 to 24-year-old women through increasing their awareness. It is also expected for the index of raw birth rate that mortality of children under one year should be increased by reduction in the per capita cost and time spent by parents for their children.

According to the panel data analysis, while lost data can have many negative impacts on the validity of research results, imputation technique has been applied to complete the lost data (18, 19).

The tests of sectional dependency and unit root performed before the analysis are essential to investigate the panel models, because all calculations related to unit root and co-integration tests will be invalid if there is a sectional dependency. Raising the possibility of regression is one of the serious complications associated with unit root. In this study, Pesaran test has been used to investigate the sectional dependency. Then the Im-Pesaran-Shin tests have been applied to evaluate the unit root. The results of sectional Pesaran test have been shown in Table.1.

Table 1: Results of sectional pesaran test

Variables	Pesaran test	P value
Infant mortality rate	50.75	<0.001
Ln (GNI)	42.63	<0.001
Immunization, measles (% of children ages 12-23 months)	6.07	<0.001
Female literacy rates between 15-24	64.80	<0.001
Health expenditure per capita (current US$)	44.88	<0.001
Birth rate, crude (per 1,000 people)	24.02	<0.001
Improved sanitation facilities (% of population with access)	58.26	<0.001

The zero hypothesis has been rejected in all the variables, so all of variables are cross sectional dependency.

As shown in the Table.1, the zero hypothesis has been rejected in all the variables, so all of them were cross sectional dependency, and the evaluation of unit root and co-integration tests regardless of cross sectional dependency would lead to the wrong conclusion. Table.2 shows the results of the unit root of Im-Pesaran-Shin test (20).

It can be conceived from Table.2 that the variables of education level for 15 to 24-year-old women and per capita health expenditures had unit roots. Therefore, the co-integration test has been applied to determine the presence or absence of a long-term relationship between the variables (Table. 3). The results of this test showed that there was a relation between variables in the long term. It is ensured that the false regression has not been found by evaluating the model and results were valid.

F-limer test has been utilized to determine whether the estimation model was pooling data or panel data. The results of this test indicated that the panel data model was suitable. There are several methods for estimating panel data model such as fixed effects and random effects methods which can be used according to the case (21). Hausman test has been applied in order to determine whether the fixed effects or random effects methods was more appropriate method for estimating. According to the test results, the random effects method has been used in this study [F (18, 242) = 178.51, Prob> F = 0.0000] (22). According to the panel data, if the number of individual units is more than the period of the study (N> T), it can be expected that disturbing components have a hetereoskedasticity. LR test has been used to evaluate the hetereoskedasticity. Considering the P-value of equality test was smaller than 0.0001, the zero hypothesis of equal variance has been rejected and it was determined that the model had hetereoskedasticity. Wooldridge autocorrelation test has been applied to evaluate the autocorrelation, and the P-value was less than 0.0001 for this test which means that the zero hypothesis of the absence of autocorrelation has been rejected (23). FGLS model has been used to solve the problems caused by hetereoskedasticity and autocorrelation. Table. 5, shown the results of this test.

Table 2: Results of the unit root of Im-Pesaran-Shin test

Variables	CADF	P value
Infant mortality rate	-3.0362	0.0012
Ln (GNI)	-4.252	<0.001
Immunization, measles (% of children ages 12-23 months)	-6.3197	<0.001
Female literacy rates between 15-24	-0.4264	0.3349
Health expenditure per capita (current US$)	-0.9989	0.1589
Birth rate, crude (per 1,000 people)	-13.0482	<0.001
Improved sanitation facilities (% of population with access)	-4.604	<0.001

*CADF: Covariate-Augmented Dickey Fuller. According to this table, education levels for 15 to 24-year-old women and per capita health expenditures have unit roots.

Table 3: Results of Westerlund Co-integration test

Statistic	Value	z-value	P value
Gt	-	-	-
Ga	0.014	8.132	1.000
Pt	-	-	-
Pa	-0.083	6.083	1.000

Co-integration test to determine the presence or absence of a long-term relationship between the variables. According to this table, there is a relation between variables in the long term.

Results

Table 4 shows the association between socioeconomic variables and infant mortality. According to this table, variables such as logarithm per capita national income, measles vaccination coverage, education level for 15 to 24-year-old women, per capita government health expenditure and access to improved health facilities had an inverse association with infant mortality. Furthermore, vaccination coverage of measles had no significant association (P>0.05). The variable of raw birth rate had a positive and significant association with infant mortality. The results also showed that the coefficients of all the variables were also compatible with existing theories.

Table 4: Association between socio-economic variables and infant mortality

Variables	Coefficient	Standard error	Z	P value
Ln (GNI)	-0.1211765	0.0155	-7.80	>0.001
Immunization, measles (% of children ages 12-23 months)	-0.0001678	0.004525	-0.37	0.711
Female literacy rates between 15-24	-0.0071878	0.0014949	-4.81	>0.001
Health expenditure per capita (current US$)	-0.000071	0.000019	-3.74	>0.001
Birth rate, crude (per 1,000 people)	0.0165862	0.0030385	5.46	>0.001
Improved sanitation facilities (% of population with access)	-0.0121169	0.0014069	-8.61	>0.001
Intercept	5.307993	0.1914788	27.72	>0.001
R-Squared	0.9877			
Adjusted R-Squared	0.9865			
Wald			1382.42	>0.001

This table shows the association between socioeconomic variables and infant mortality.

Discussion

The mortality rate of children had various evolutions in different periods so that in the past child mortality was high due to lack of access to health facilities. Epidemics and various diseases caused numerous of mortality in children, but gradually with the progress of medical science and health care, child mortality rates has been declining. This reduction of mortality rates occurred differently among countries so that one of the main challenges facing the world today is increasing inequality in child mortality rates in the world (24, 25). The results of this study showed that the increase in per capita national income, the educational level of 15 to 24-year-old women, the amount of government expenditure in the health sector and improved health facilities, caused the mortality reduction, and the infant mortality has been increased by increasing fertility rates.

The results of the model also showed that per capita income had the greatest role in reducing infant mortality. It can also be explained by economic theory that the higher income in the country leads to the higher average of households' income and subsequently more money spent on health care of the family as a result. Therefore, according to economic perspective, economic development is one of the most powerful factors that can reduce infant mortality (26). On the other hand, studies such as Sherry (11) and Hisham and et al. (16) also showed that one of the most important factors in reducing child mortality was increase in the level of income. Furthermore, the government

expenditures in the health sector have been increased by increasing the amount of income for each country which would reduce the mortality in children under one year (27).

The evaluation of the accessibility to the improved health facilities and the vaccination coverage of measles as representatives the quality of health services in each country showed that despite the existence of an inverse association between these indexes and mortality, only accessibility to improved health facilities had a significant relationship while impact of this variable was weaker than other variables. World Health reports, published by the World Health Organization, emphasized that health indexes had a weak and sometimes non-significant relationship with the child mortality despite the many economic indexes such as per capita income which had a great impact on child mortality (28, 29). This can be attributable to the fact that a large part of community health, especially the health of children, may be determined by the factors that are beyond the control of the health sector. Better nutrition, the increase in health level and accessibility to better health care services can be usually occurred by increasing income (income could be considered as a key to achieve effective factors of health level) that could have a significant impact on community health.

The educational levels of 15 to 24-year-old women are an important index in two respects. First, the knowledge and skills obtained through training influence the cognitive function of women and make them ready to accept health education messages. Second, the education is an important factor in determining the employment status and the income (30, 31). The results showed that the infant mortality has been decreased by increasing the education levels of 15 to 24-year-old women which are compatible with existing theories and assumptions. Investigation showed that the increase in the raw birth rate led to more infant mortality. According to studies such as the study of Hosseinpoor and et al. conducted in Iran, infant mortality was higher in poorer communities where they did not comply with policy of family planning and had high fertility (32). The fertility rate would be usually high to compensate for the gap caused by the mortality of children in communities where child mortality is high, which is usually lowering the quality of life of children and increasing the child mortality. Therefore, there is a mutual relationship between child mortality and fertility rates in low-income countries (33).

Conclusion

This study has examined the socioeconomic determinants of infant mortality in EMRO countries. Results from the FGLS models show that per capita national income, measles vaccination coverage, education levels for 15 to 24-year-old women, per capita government health expenditure and access to improved health facilities are strongly associated with infant mortality.

The findings indicate that socioeconomic inequality in infant mortality in EMRO countries is determined not only by health system functions, but also by factors beyond the scope of health authorities such as education system, and economic variables. This implies that in order to decrease the infant mortality policy makers must investment in sanitation facilities and education system through widespread health education campaigns and strengthening sanitation facilities in addition to economic environment.

Conflict of Interest: None.

Acknowledgement

We wish to thank Sajad Ghazanfari, and others who helped us in this research.

References

1. Tajedini F, Ehdaievand F, Farsar A. Epidemiological features of children mortality in the area covered by Shahid Beheshti university of medical sciences in 2012. Journal of Clinical Nursing and Midwifery 2014;3(1):62-71.
2. Organization WHO. The Millennium development goals report. United Nations: DESA ;2008.
3. World Bank. Mortality rate, under-5 (per 1,000 live births) 2013. Available at: http://data.worldbank.org/indicator/shdyn. Accessed May 2015.
4. Houweling TA, Kunst AE, Looman CW, Mackenbach JP. Determinants of under-5 mortality among the poor and the rich: a cross-national analysis of 43 developing countries. International journal of epidemiology 2005;34(6):1257-65.
5. Organization WHO. World Health Report. Global Health: today's challeng; 2013.
6. Hosseini H. Introduction to socio-economic demography and family planning. Tehran: Boali university; 2004. 600 p.
7. Di Cesare M, Bhatti Z, Soofi SB, Fortunato L, Ezzati M, Bhutta ZA. Geographical and socioeconomic inequalities in women and children's nutritional status in Pakistan in 2011: an analysis of data from a nationally representative survey. The Lancet Global Health 2015;3(4):e229-e39.
8. Hosseinpoor AR, Mohammad K, Majdzadeh R, Naghavi M, Abolhassani F, Sousa A, et al. Socioeconomic inequality in infant mortality in Iran and across its provinces. Bulletin of the World Health Organization 2005;83(11):837-44.
9. Rana H, Akazi A. Investigatin cause of death in children and teenages whom referred to Tehran legal medicine oraganization in 2005. Legal Medicine 2009; 2(3): 49.
10. Zayeri F, Kazemnejad A, Ganjali M, Babaei G, Khanafshar N, Nayeri F. Hypothermia in Iranian newborns. Incidence, risk factors and related complications. Saudi medical journal 2005;26(9):1367-71.
11. Sherrt N. An econometrics Investigation Into The Determinants of Infant Mortality Rates 2008; 42: 230.
12. Gbesemete KP, Jonsson D. A comparison of empirical models on determinants of infant mortality: a cross-national study on Africa. Health policy 1993;24(2):155-74.
13. Jewell RT, Martinez J, Triunfo P. Infant mortality in Uruguay: the effect of socioeconomic status on survival. The Journal of Developing Areas 2014;48(2):307-28.
14. Liu D. Determinants of Infant Mortality in Kenya-Analysis of Kenya DHS 2003 and 2008/9. Available at: http://lup.lub.lu.se/luur/download?func=downloadFile&recordOId=4647031&fileOId=4647032. Accessed Jan 2015.
15. Davazdah-Emammi S. Investigating Association between Social Factors and Infant Mortality Rate. Journal of Shahrekord University of Medical Science 2001;2(3):62-72.
16. Mustafa HE, Odimegwu C. Socioeconomic determinants of infant mortality in Kenya: analysis of Kenya DHS 2003. J Humanit Soc Sci 2008;2(8):1934-722.
17. Newacheck P, Jameson WJ, Halfon N. Health status and income: the impact of poverty on child health. Journal of School Health 1994;64(6):229-33.
18. Cheng A-L, Lin H, Kasprow W, Rosenheck RA. Impact of supported housing on clinical outcomes analysis of a randomized trial using multiple imputation technique. The Journal of nervous and mental disease 2007;195(1):83.
19. Sterne JA, White IR, Carlin JB, Spratt M, Royston P, Kenward MG, et al. Multiple imputation for missing data in epidemiological and clinical research: potential and pitfalls. Bmj 2009;338(5):b2393.
20. Im KS, Pesaran MH, Shin Y. Testing for unit roots in heterogeneous panels. Journal of econometrics 2003;115(1):53-74.
21. Ebrahimi M, Aghaei Chadegani A, editors. The relationship between earning, dividend, stock price and stock return: evidence from Iranian companies. International Conference on Humanities, Society and Culture, IPEDR; 2011.
22. Bartels B (2008) Beyond ‘‘fixed versus random effects’’: A framework for improving substantive and statistical analysis for panel, time-series crosssectional, and multilevel data. Working paper. Available: http://home.gwu. edu/,bartels/cluster.pdf. Accessed 5 June 2013.

23. Drukker DM. Testing for serial correlation in linear panel-data models. Stata Journal 2003;3(2):168-77.
24. Tanimura S, Shima M. Quantitative measurements of inequality in geographic accessibility to pediatric care in Oita Prefecture, Japan: Standardization with complete spatial randomness. BMC health services research 2011;11(1):163.
25. You D, New J, Wardlaw T. Levels and trends in child mortality. Report 2012. Estimates developed by the UN Inter-agency Group for Child Mortality Estimation. New York, New York, UNICEF, 2013; 34. Available at: http://www.popline.org/node/574539. Accessed Dec 2013.
26. Filmer D, Pritchett L. Child mortality and public spending on health: how much does money matter?: World Bank Publications; 1997.
27. Kumar K, Ram F, Singh A. Public health spending on infant and child mortality in India during the years 1980–2006. The Lancet 2013; 381:S76.
28. Homaee Rad E, Samadi A, Bayazidi Y, Hayati R. Examine Socio-economic Factors Affecting Infant Mortality Rate in MENA Countries. Economic Modeling Research 2013;4(12):135-51.
29. WHO. The World health report: 2000: Health systems: improving performance. 2000.
30. Kazemi T, Rezvani MR, Sharifzadeh G-R, Sadri A, Moghaddam M, Reza H, et al. The Prevalence of Traditional Cardiovascular Risk Factors in Low Socioeconomic Use individuals in Birjand 2008 (East IRAN). Journal of Cardio-Thoracic Medicine 2015;3(1):263-9.
31. Street B, Pishghadam R, Zeinali S. Changes and Challenges of Literacy Practices: A Case of a Village in Iran. International Journal of Society, Culture & Language 2015;3(1):16-27.
32. Hosseinpoor AR, Van Doorslaer E, Speybroeck N, Naghavi M, Mohammad K, Majdzadeh R, et al. Decomposing socioeconomic inequality in infant mortality in Iran. International Journal of Epidemiology 2006;35(5):1211-9.
33. Hanushek EA. The Trade-off Between Child Quantity and Quality. Journal of Political Economy 1992; 100(1):84–117.