



A Cross Sectional Analysis of Socio-economic Determinants on Infant Mortality in South Asian Region

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ABSTRACT

The purpose of this study to find out the reasons behind infant mortality in South Asian countries. This problem depends on many factors. For finding the fact the study has gone through the reports of the database of World Bank and World Factbook. Using time series data (2000-2014), the study explored the association between Infant Mortality Rate and Socio-Economic Determinants (birth attended by skill health staff, dependency ratio, literacy rate, mother's mean age at first birth, population growth rate and population below poverty level). Through the multiple regression analysis, the study found that out of various reasons, Birth attended by skill health staff (BASHS), Literacy rate (LR) and Population Growth Rate (PGR) have influence on Infant Mortality. In developed countries, governments ensure many facilities to prevent infant mortality whereas in developing countries, policies of government do not support. As a result, infant suffers much. The finding of the study may be useful for the policy makers that how infant mortality can be decreased.

1. INTRODUCTION

Living in 21st Century, the most modern era, we are enjoying a very sophisticated life-style. Science and technology developed a lot than any other past time. By the benefits of modern science, death rate has been reduced tremendously. Though developed countries are clearly ahead of getting more facilities of modern science, developing countries are still behind (Dahlman and Nelson, 1995; Peters et al, 2008). The area of the study is based on the developing countries among South Asian region. The territories consist of Afghanistan, Bangladesh, Bhutan, Maldives, Nepal, India, Pakistan and Sri Lanka (Arnall et al., 2010). An economic cooperation organization, The South Asian Association for Regional Cooperation (SAARC), was established in 1985 and includes all eight nations comprising South Asia (Ali, 2013).

Most newborn deaths are preventable (UNICEF, 2008). That is why, the study intends to find out the reasons behind infant mortality so that the study can suggest few more identical issues in case of prevent infant mortality among South Asian countries. According to the medical research, premature birth is the biggest contributor to the IMR (CDC Report, 2016). But current study will not focus regarding the issues of medical science. Being a social science research, this study focuses on the social factors that cause infant mortality.

The study aims to find out the main socio-economic factors that affect infant mortality rate using time series data in South Asian region. The study hopes to provide a useful information about unexplored issues of socio-economics factors of infant mortality rate among South Asian countries which may show a way to decrease infant mortality to the policy makers.

2. LITERATURE REVIEW

South Asian countries are developing faster but these countries are facing lots of internal problems. Out of them infant mortality plays a vital role. 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 (UNICEF, 2005; Mustafa and Odimegwu, 2008). According to Gray et al. (2009), Reidpath and Allotev (2003) and Kurinczuk et al. (2009), infant mortality rate (IMR) is an indicator of child health as well as of population health. Socioeconomic factors affecting the health of the population (such as economic development, general living conditions and social wellbeing) have an impact on the IMR. Among these countries of South Asia, adult death rate is 6.89 or 7/1000 population whereas the infant mortality rate is 69.46 or 69/1000 population (Factbook, 2017). According to United

Nations Interagency Group for Child Mortality Estimation (2015), South Asia's newborn death rate was 30 per 1000 live births in 2015, down from 58 per 1000 live births in 1990. This represented one million deaths in 2015, down from 2.1 million in 1990. All countries in the region experienced declines over this period (Figure 1). From the data of WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division (2015), it is clear that maternal mortality is strongly linked to newborn mortality and has improved since 1990 but progress is still needed to meet the global target of less than 70 per 100,000 live births by 2015 (Figure 2).

Infant Mortality Rate (IMR) is also considered as an important nationally used indicator for assessing the health status of a population and it is closely related to the well-being of the community and its development (Rezaei et al, 2015). Moreover, mortality in this age group in compared to the other age groups, is mostly dependent on the socio-economic conditions of a community (Reidpath and Allotey, 2003; Rosicova et al, 2011; Fantini et al, 2006; Madise et al, 2003).

According to the analytical framework proposed by Mosley and Chen (1984), infant or child deaths are seen as attributable to a range of hierarchical determinants that may be proximal (e.g., maternal factors, nutrition deficiency, infections, injuries, health services utilization), intermediate (e.g., access to food, safe water, health services, vaccinations), or distal (e.g., education, unemployment, national income, income distribution, public health spending). Genowska et al. (2015) in his research mentioned that there are various sorts of environmental and socio-economic determinants of infant mortality.

Many studies which have been conducted to determine the main Socio-economic and demographic factors affecting IMR in both developed and developing countries (Arceo et al, 2016; Ashworth and Waterlow, 1982, Dallolio et al, 2012; Flegg, 1983; Genowska et al., 2015; Hanmer et al., 2003; Heron, 2013; Houweling and Kunst, 2009; Iram and Butt, 2008; Kochanek et al., 2016; Mathews and MacDorman, 2013; Mosley and Chen, 1984; Murphy et al., 2015; Rezaei et al., 2015; Rutstein, 2000; Singh and Kogan, 2007; Suriyakala et al, 2016; Titaley et al, 2008; Wagstaff, 2000; Xu et at. 2014; Yoon et al., 2014; Younger, 2001; Zakir and Wunnava, 1999).

3. METHODOLOGY

3.1 Proposed Model

This research is a quantitative research and a time series study. An econometrics model was used to analyze components effect on infant mortality rate. To research, the study has gone through the secondary data only. Macroeconomics data of eight (8) South Asian countries from 2000 to 2014 were used for this purpose. Data were gathered from the database of World Bank and World Factbook which are an open access resource. The econometrics model of infant mortality determinants used in this study is shown below:

$$IMR = \beta_0 + \beta_1 BASHS + \beta_2 DR + \beta_3 LR + \beta_4 MMAFB + \beta_5 PGR + \beta_6 PBPL + \varepsilon_i$$

These terms are explained below:

IMR = Infant Mortality Rate (%)

BASHS = Birth attended by skill health staff (%)

DR = Dependency Ratio (%)

LR = Literacy Rate (%)

MMAFB = Mother's mean age at first birth (years)

PGR = Population Growth Rate (%)

PBPL = Population below poverty line (%)

ε_i = Stochastic Error Term

After estimating the model, Variance Inflation Factor (VIF) test was used for detecting collinearity in the model. If the model had high degrees of collinearity, confounding variables must be found and solved then estimated the model again (Rezaei et al., 2015). Pearson correlation coefficients were calculated to measure the correlation between IMR and socio-economic determinants. Univariate linear regression analyses were performed to determine the magnitude and direction of the effect of the socioeconomic variables on IMR.

The study then carried out a multiple linear regression, with a significance level of entry and removal equal to 0.05. If certain assumptions are met, and this is the case of our data, linear regression is the best method for quantifying the strength of the linear relationship between a dependent variable and one or more predictors (Dallolio et al., 2012). In this study, R^2 and F-statistics were reported too. The collection of data was analyzed by using Statistical Package for the Social Science (SPSS) version 25 (IBM Corporation, NY, USA).

3.2 Hypotheses

Infant Mortality Rate gives the number of deaths of infants under one year old in a given year per 1,000 live births in the same year; included is the total death rate, and deaths by sex, male and female. This rate is often used as an indicator of the level of health in a country (Factbook, 2017). From the existing literature, the study selected six (6) potentially important socio-economic determinants which are birth attended by skill health staff (Rezaei et al, 2015), dependency ratio (Yoon et., 2014), literacy rate (Zakir and Wunnava, 1999; Lamichhane et al, 2017), mother's mean age at first birth (Friede et al, 1987), population growth rate (Yoon et., 2014), and population below poverty line (Gortmaker, 1979) on Infant Mortality Rate. Based on this, the hypotheses of the study are:

- H1: Birth attended by skill health staff has a significant relationship influence on Infant Mortality
- H2: Dependency ratio has a significant relationship influence on Infant Mortality
- H3: Literacy has a significant relationship influence on Infant Mortality
- H4: Mother's mean age at first birth has a significant relationship influence on Infant Mortality
- H5: Population growth rate has a significant relationship influence on Infant Mortality
- H6: Poverty has a significant relationship influence on Infant Mortality

4. Data Analysis and Results

In statistics, the variance inflation factor (VIF) quantifies the severity of multicollinearity in least squares regression analysis. Multicollinearity is analyzed through tolerance and variance inflation factor (VIF). As a rule of thumb, if the VIF of a variable exceeds 10, that variable is said to be highly collinear and will pose a problem to regression analysis Hair et al (2012). The analysis of the study, in Table 1, shows that VIF of individual variable and mean of VIF is less than 10 and the level of tolerance (1/VIF) is more than 0.10. From Table 2 and according to the suggestion of Evans (1996), it is clear that there is strong relationship among independent variables.

Table 1: Results of VIF statistics

<i>Variables</i>	<i>VIF</i>	<i>1/VIF</i>
<i>BASHS</i>	7.561	.132
<i>LR</i>	8.115	.123
<i>MMAFB</i>	6.224	.161
<i>PBPL</i>	7.507	.133
<i>PGR</i>	3.920	.255
<i>DR</i>	7.653	.131
<i>Mean</i>	6.83	

Here, *BASHS* = Birth attended by skill health staff; *DR* = Dependency Ratio; *LR* = Literacy Rate; *MMAFB* = Mother's mean age at first birth (years); *PGR* = Population Growth Rate; *PBPL* = Population below poverty line.

Table 2: Correlation matrix of independent variables

<i>Variables</i>	<i>BASHS</i>	<i>LR</i>	<i>MMAFB</i>	<i>PBPL</i>	<i>PGR</i>	<i>DR</i>
<i>BASHS</i>	1					
<i>LR</i>	.869**	1				
<i>MMAFB</i>	.801*	.671	1			
<i>PBPL</i>	-.881**	-.822*	-.807*	1		
<i>PGR</i>	-.602	-.725*	-.474	.664	1	
<i>DR</i>	-.574	-.769*	-.265	.632	.814*	1

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

Table3: Results of main determinant of infant mortality rate in South Asian Countries

<i>Variables</i>	<i>Coefficients</i>	<i>Standard error</i>	<i>P-value</i>
<i>BASHS</i>	.826	.022	.017
<i>LR</i>	-1.842	.035	.012
<i>MMAFB</i>	-.876	.249	.178
<i>PBPL</i>	.324	.090	.173
<i>PGR</i>	43.621	.735	.011
<i>DR</i>	-.370	.050	.085
<i>Constant</i>	98.478	5.886	.038
<i>R2</i>	.998		
<i>F-statistics</i>	4724.559		

Dependent Variable: IMR

Here, IMR = Infant Mortality Rate; BASHS = Birth attended by skill health staff; DR = Dependency Ratio; LR = Literacy Rate; MMAFB = Mother's mean age at first birth (years); PGR = Population Growth Rate; PBPL = Population below poverty line.

5. DISCUSSION

H1 proposed that Birth attended by skill health staff (BASHS) has a significant influence on Infant Mortality. The results from Table 3 showed BASHS's coefficient value resulted .826, standard error of .022 and significant effect $p = .017$ though Rezaei et al. (2015) showed female labor force participation rate were not significantly related to the infant mortality rate in Iran. Current research shows that in South Asian countries BASHS has a positive significant on infant mortality rate. Therefore, H1 is supported. H2 emphasized on significant influence of literacy on Infant Mortality as like as Zakir and Wunnava (1999) and Lamichhane et al. (2017). Result of data analysis showed the coefficient value of LR is negatively correlated (-1.842) with standard error of 035 and significant value .0081. As a result, H2 is supported too.

H3 and H4 are not supported as the results of both are more than the level of significant (0.05). Though more than three decades, Friede et al (1987) and Gortmaker (1979) showed that there was significant relation among MMAFB, PBPL and IMR. So, H3 and H4 are rejected. On the other hand, as like as Yoon et al., (2014), the report of data analysis shows that H5 (Population growth rate has a significant relationship influence on Infant Mortality) is accepted as it's significant effect is .011 which is less than 0.05 and correlated by 43.621. So, H5 is accepted and there is a positive relationship with PGR and IMR. On the contrary, H6 is rejected as the level of significance is .085 which is more than .05 which indicates that there is not relationship between DR and IMR among South Asian countries. Moreover, the result of R^2 of the study is 0.998. It showed that there was high correlation among dependent variable and independent variables and it was 99.8%. The result of F-statistics confirmed the null hypothesis that at least one independent variable was not zero.

6. CONCLUSION

This study suggests that, in South Asian countries, population growth rate, literacy rate and birth attended by skill health staff affect much for the infant mortality rate rather than dependency ratio, mother's mean age at first birth and poverty. From the study is it clear that over population creates most of the problems. Whenever, people increases much, they create several sorts of problems. It is recommended that the future study will focus on the effect of over population in the socio-economic development, how to convert the population into resource and reasons behind poor literacy rate among South Asian countries. Throughout the analysis, the study tried to provide useful information and valuable insights for policy makers that how infant mortality rate among South Asian countries can be prevented.

REFERENCES

- Ali, M. M. Y. (2013). SAARC Documentation Centre: An overview. *Pakistan Library Association*, 92, 91.
- Arceo, E., Hanna, R., & Oliva, P. (2016). Does the effect of pollution on infant mortality differ between developing and developed countries? Evidence from Mexico City. *The Economic Journal*, 126(591), 257-280.
- Arnall, A., Oswald, K., Davies, M., Mitchell, T., & Coirolo, C. (2010). Adaptive social protection: mapping the evidence and policy context in the agriculture sector in South Asia. *IDS Working Papers*, 2010, (345), 01-92.
- Ashworth, A., & Waterlow, J. C. (1982). Infant mortality in developing countries. *Archives of Disease in Childhood*, 57(11), 882-884.
- CDC Report (2016) Developing and Sustaining Perinatal Quality Collaboratives a Resource Guide for States Version
- Dahlman, C. J., & Nelson, R. (1995). Social absorption capability, national innovation systems and economic development. In *Social capability and long-term economic growth* (pp. 82-122). Palgrave Macmillan UK.
- Dallolio, L., Di Gregori, V., Lenzi, J., Franchino, G., Calugi, S., Domenighetti, G., & Fantini, M. P. (2012). Socio-economic factors associated with infant mortality in Italy: an ecological study. *International journal for equity in health*, 11(1), 45.
- Evans, J. D. (1996). *Straightforward statistics for the behavioral sciences*. Brooks/Cole.
- Factbook, C. I. A. (2017). The world factbook. See also: <https://www.cia.gov/library/publications/the-world-factbook>. This page was last updated on August 17, 2017
- Fantini, M. P., Stivanello, E., Dallolio, L., Loghi, M., & Savoia, E. (2006). Persistent geographical disparities in infant mortality rates in Italy (1999–2001): comparison with France, England, Germany, and Portugal. *The European Journal of Public Health*, 16(4), 429-432.
- Flegg, A. T. (1983). On the determinants of infant mortality in underdeveloped countries. *International journal of social economics*, 10(5), 38-51.

- Friede, A., Baldwin, W., Rhodes, P. H., Buehler, J. W., Strauss, L. T., Smith, J. C., & Hogue, C. J. (1987). Young maternal age and infant mortality: the role of low birth weight. *Public Health Reports*, 102(2), 192.
- Genowska, A., Jamiołkowski, J., Szafraniec, K., Stepaniak, U., Szpak, A., & Pająk, A. (2015). Environmental and socio-economic determinants of infant mortality in Poland: an ecological study. *Environmental Health*, 14(1), 61.
- Gortmaker, S. L. (1979). Poverty and infant mortality in the United States. *American Sociological Review*, 280-297.
- Gray, R., Hollowell, J., Brocklehurst, P., Graham, H., & Kurinczuk, J. J. (2009). Inequalities in infant mortality project briefing paper 2. Health inequalities infant mortality target: technical background. *Oxford: National Perinatal Epidemiology Unit*.
- Hair, J. F., Ringle, C. M., & Sarstedt, M. (2012). Partial least squares: the better approach to structural equation modeling?
- Hanmer, L., Lensink, R., & White, H. (2003). Infant and child mortality in developing countries: analysing the data for robust determinants. *The Journal of Development Studies*, 40(1), 101-118.
- Heron, M. P. (2013). Deaths: leading causes for 2010.
- Houweling, T. A., & Kunst, A. E. (2009). Socio-economic inequalities in childhood mortality in low-and middle-income countries: a review of the international evidence. *British medical bulletin*, 93(1), 7-26.
- Iram, U., & Butt, M. S. (2008). Socioeconomic determinants of child mortality in Pakistan: Evidence from sequential probit model. *International Journal of Social Economics*, 35(1/2), 63-76.
- Kochanek, K. D., Murphy, S. L., Xu, J., & Tejada-Vera, B. (2016). Deaths: final data for 2014. *National vital statistics reports: from the Centers for Disease Control and Prevention, National Center for Health Statistics, National Vital Statistics System*, 65(4), 1-122.
- Kurinczuk, J. J., Hollowell, J., Brocklehurst, P., & Gray, R. (2009). Inequalities in infant mortality project briefing paper 1. Infant mortality: overview and context. *National Perinatal Epidemiology Unit, University of Oxford, Oxford*.
- Lamichhane, R., Zhao, Y., Paudel, S., & Adewuyi, E. O. (2017). Factors associated with infant mortality in Nepal: a comparative analysis of Nepal demographic and health surveys (NDHS) 2006 and 2011. *BMC public health*, 17(1), 53.
- Madise, N. J., Banda, E. M., & Benaya, K. W. (2003). Infant mortality in Zambia: socioeconomic and demographic correlates. *Social Biology*, 50(1-2), 148-166.
- Mathews, T. J., & MacDorman, M. F. (2013). Infant mortality statistics from the 2010 period linked birth/infant death data set. *Natl Vital Stat Rep*, 62(8), 1-26.
- Mosley, W. H., & Chen, L. C. (1984). An analytical framework for the study of child survival in developing countries. *Population and development review*, 10(0), 25-45.
- Murphy, S. L., Kochanek, K. D., & Xu, J. (2015). Deaths: final data for 2012.
- Mustafa, H. E., & Odimegwu, C. (2008). Socioeconomic determinants of infant mortality in Kenya: analysis of Kenya DHS 2003. *J Humanit Soc Sci*, 2(8), 1934-722.
- Peters, D. H., Garg, A., Bloom, G., Walker, D. G., Brieger, W. R., & Hafizur Rahman, M. (2008). Poverty and access to health care in developing countries. *Annals of the New York Academy of Sciences*, 1136(1), 161-171.
- Reidpath, D. D., & Allotey, P. (2003). Infant mortality rate as an indicator of population health. *Journal of Epidemiology & Community Health*, 57(5), 344-346.
- Rezaei, S., Karami Matin, B., & Homaie Rad, E. (2015). Socioeconomic Determinants of Infant Mortality in Iranian Children: A Longitudinal Econometrics Analysis. *International Journal of Pediatrics*, 3(1.1), 375-380.
- Rosicova, K., Geckova, A. M., van Dijk, J. P., Kollarova, J., Rosic, M., & Groothoff, J. W. (2011). Regional socioeconomic indicators and ethnicity as predictors of regional infant mortality rate in Slovakia. *International journal of public health*, 56(5), 523-531.
- Rutstein, S. O. (2000). Factors associated with trends in infant and child mortality in developing countries during the 1990s. *Bulletin of the World Health Organization*, 78(10), 1256-1270.
- Singh, G. K., & Kogan, M. D. (2007). Persistent socioeconomic disparities in infant, neonatal, and postneonatal mortality rates in the United States, 1969–2001. *Pediatrics*, 119(4), 928-e939.
- Suriyakala, V., Deepika, M. G., Amalendu, J., & Deepa, G. (2016, September). Factors Affecting Infant Mortality Rate in India: An Analysis of Indian States. In *the International Symposium on Intelligent Systems Technologies and Applications* (pp. 707-719). Springer International Publishing.
- Titaley, C. R., Dibley, M. J., Agho, K., Roberts, C. L., & Hall, J. (2008). Determinants of neonatal mortality in Indonesia. *BMC public health*, 8(1), 232.
- UNICEF. (2005). *The state of the world's children 2006: excluded and invisible*. Unicef.
- UNICEF. (2008). *The state of the world's children 2009: maternal and newborn health* (Vol. 9). Unicef.

United Nations Interagency Group for Child Mortality Estimation (2015) *Levels and trends in child mortality. Report 2015*. New York

Wagstaff, A. (2000). Socioeconomic inequalities in child mortality: comparisons across nine developing countries. *Bulletin of the World Health Organization*, 78(1), 19-29.

WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division (2015) *Trends in maternal mortality: 1990 to 2015. Estimates by WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division*. Geneva.

Xu, J., Kochanek, K. D., Murphy, S. L., & Tejada-Vera, B. (2016). *Deaths: final data for 2014*.

Yoon, M. J. W., Kim, M. J., & Lee, J. (2014). *Impact of demographic changes on inflation and the macroeconomy* (No. 14-210). International Monetary Fund.

Younger, S. D. (2001). Cross-country determinants of declines in infant mortality: A growth regression approach.

Zakir, M., & Wunnava, P. V. (1999). Factors affecting infant mortality rates: evidence from cross-sectional data. *Applied Economics Letters*, 6(5), 271-273.

APPENDIX

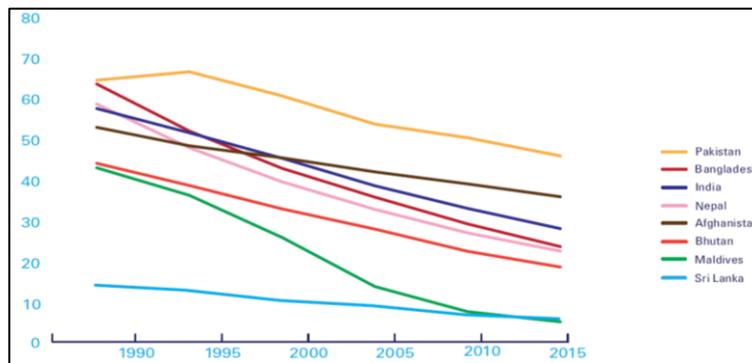


Figure 1: Newborn mortality rates in South Asia 1990-2015

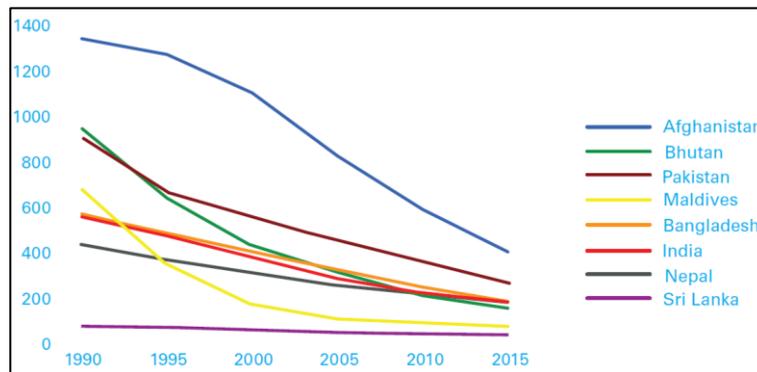


Figure 2: Trends in maternal mortality in South Asia (1990 to 2015)