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Macroeconomic Determinants of Infant Mortality in WAEMU Countries: Evidence from Panel Data Analysis

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Abstract

This paper investigates the macroeconomic determinants of infant mortality in WAEMU countries for the period 1980–2016. A panel data model from WAEMU countries was used to identify the macroeconomic determinants of infant mortality. We used fixed effects instrumental variables (FE-IV) estimator in panel data model. Our analysis using econometric estimations after correcting for endogeneity showed that female literacy, GDP per capita as a proxy for income, public health expenditure as a percentage of GDP and urbanization significantly affect infant mortality rate in a negative way.

Keywords: infant mortality, fertility, education, public health expenditure

1. Introduction

"The pleasures of life are worth nothing if one is not alive to experience them" (Cutler, 2006). Just after the World War II, life expectancy gaps between rich countries and poor countries were falling across the world. Poor countries enjoyed rapid increases in life expectancy since 1950 till 1990, with the gains in some cases exceeding an additional year of life expectancy per year (Cutler et al., 2006).

In fact, infant mortality is substantially higher in low and middle income as compared to high income countries. However, the 1990s have seen a remarkable decrease in mortality among infants in most developing countries.

In sub-Saharan Africa, these declines in infant mortality have slowed and are increasing again and reducing life expectancy. Infant mortality, defined as death within the first year of life remains a huge concern in sub-Saharan Africa today, with nearly one in ten babies still dying before his or her first birthday. It expressed the number of deaths per thousand births in a given period. Still today, close to 10 percent of babies born on the continent die before the age of one. According to Alderman and Behrman (2004) infant mortality rate is considered to be one of the strongest indicators of a country's wellbeing, as it reflects social, economic and environmental conditions in which children (and others in society) live, including their health care. Although advances in medicine and public health in the world over the course of the 20th century produced major reductions in aggregate infant mortality rates, it still remains high in sub-Saharan Africa. WAEMU[1] (West African Economic and Monetary Union) made remarkable progress in infant mortality reduction since 1970. The pace of decline has slowed down in the past decades, with the infant mortality rate (IMR) hovering around 80 deaths per thousand live births.

On the other hand, the United Nations millennium development goals of achieving a two-thirds reduction for under-five mortality by 2010 were not reached. In 2011, the probability of an infant death in sub-Saharan Africa was 1.5 times higher than in South Asia; 5.7 times higher than in Latin America; 7.4 times higher than in East Asia and 16.5 times higher than in developed regions (UNICEF, 2012).

In WAEMU countries, although the infant mortality rate has declined in all countries, it stood at 78 deaths per 1,000 births in 2012, which is still high compared to target, fixed at 37 deaths per 1,000 births.

In 2015, the infant mortality rate was 85 deaths per 1,000 births in Benin and Togo, 100 deaths per 1,000 births in Ivory Coast and 123 deaths per 1,000 births in Mali.

To determine the factors related to infant mortality over the years, several researches were performed in the worldwide. According to World Health Organization in 2007, infant mortality rate is not linked to a single factor but is affected by

[1] WAEMU countries : Benin, Burkina Faso, Cote d'Ivoire, Mali, Niger, Senegal and Togo

multiple manifestations of a disadvantaged population's living conditions particular or structural determinant. A general analysis of the determinants of mortality from an economic perspective is presented by Cutler, Angus, and Lleras-Muney (2006). Different studies demonstrated that infant mortality is associated with a country's dependency situation (Shandra et al., 2004), level of democracy (Franco et al., 2004), structural adjustments (UNICEF, 2006), neoliberal economic development (Coburn, 2004), poverty (Houweling et al, 2005), unemployment (Singh and Kogan, 2007), housing conditions such as illiteracy (Szwarcwald, 2002), mother's level of education (Schell et al., 2007), access to services such as health (Singh and Kogan, 2007), water (Moore, et al., 2003), level of economic transfers from the state to the population (Junqueira et al., 2002), level of economic inequality (Shaw et al.,2005), and gross domestic product (Cutler et al.,2006).

Also, demographic factors, such as women's age at birth of the children, birth order and birth interval, have been found to be important determinants of infant and child mortality. Mother's education is recognized as a persuasive factor affecting child survival. Mother's education is known to be associated with enhanced knowledge of medical services and has a significant negative impact on child mortality (Pradhan et al., 2006).

Most of studies were focused on social, microeconomic, nutritional and demographic determinants of child mortality. However, very few studies have looked into macroeconomic determinants of infant mortality.

Understanding of macroeconomic main factors of infant mortality and its relative importance for health policy making and health planning is essential tool to implementation of effective programs in order to reduce infant mortality in each country.

Therefore, the purpose of this paper is to investigate the macro determinants of infant mortality and to examine some of the factors that may be involved in the infant mortality.

Within a framework of reducing infant mortality, the WAEMU adopted the millennium development goals in September 2000. Goal 4 of the millennium development goals (MDG 2015) aimed at reducing infant and child mortality. In 2015 it was reported (CEA, 2015) that globally WEAMU countries failed between the period 1990 and 2015 to reach the target of a two-third reduction of infant mortality. With the objectives of sustainable development, the new target of less than 25 deaths per 1000 live births must be reached by all countries by 2030. It is, therefore, necessary to explore the macro determinants of infant mortality in the WAEMU sub-region in order to strengthen health policy and planning.

The principal objective of this paper is to investigate the macro determinants of infant mortality in WAEMU countries.

The rest of the study is organized as follows: in the next section trends are presented about the evolution of infant mortality during the last decades. Section 2 reviews the theoretical and empirical literature. In Section 3 the methodological approach is presented. Section 4 presents the results of the econometric estimations. In the last section, a number of conclusions are given.

2. Trends of Infant Mortality in WAEMU Countries

Between 1990 and 2016, the infant mortality rate dropped dramatically in sub-Saharan Africa from 108 deaths per 1,000 births to 53. However, compared to other regions, it is still very high. The mortality rate fell over the same period from 92 to 39 in South Asia, from 25 to 8 in Europe, from 9 to 5 in North America. Specifically in WAEMU, since the years of independence with peak infant mortality rates, there has been a decline in mortality due to massive investment to improve access to health-care, nutrition, hygiene and sanitation, economic, social factors and technological diffusion.

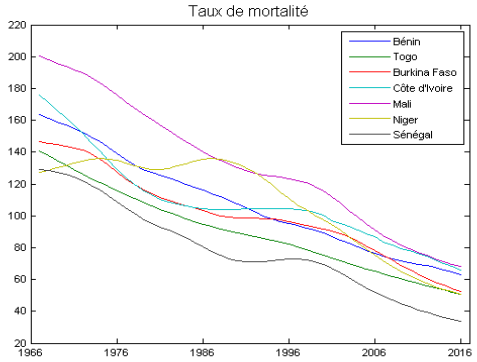

Figure 1. Infant mortality in WAEMU (1960-2016)

The figure shows the efforts undertaken by the WAEMU countries since independence and which have led to a considerable decline in infant mortality. The infant mortality dropped from 190 deaths per 1,000 births in 1960 to 63 in 2016 in Benin, from 156 deaths to 53 in Burkina, from 212 deaths to 66 in Ivory Coast, from 130 deaths to 34 in Senegal and from 161 deaths to 51 in Togo on the same period.

Table 1. Infant mortality in WAEMU (deaths per 1,000 births)

Countries	Infant mortality in WAEMU	
	1960	2016
Benin	190	63
Burkina Faso	156	53
Cote d'Ivoire	212	66
Mali	-	68
Niger	-	51
Senegal	130	34
Togo	163	51

Also, there is unbalanced infant mortality according to gender. Between 1990 and 2016, male infant mortality remains very high compared to female mortality. We denote more dying baby boys than dying girls.

We present respectively during the last three decades, the evolution of infant mortality by gender in WAEMU.

Table 2. Mortality rate, by gender (per 1,000 live births)

	Infant Mortality by gender in WAEMU			
	1960		2016	
Countries	male	female	male	female
Benin	100	115	58	68
Burkina Faso	91	106	48	57
Cote d'Ivoire	94	114	74	58
Mali	120	140	63	73
Niger	125	140	46	55
Senegal	66	78	30	37
Togo	81	97	45	56

Source: World Bank (2016)

3. Literature Review

According to Schultz, in low income countries, both infant mortality rate and birth rate are generally high. He argued that demography is a main determinant of infant mortality. It has been suggested that fertility may affect mortality and vice-versa.

Hojman (1996) found that economic performance is a major determinant of infant mortality. He explained that there are at least three different ways in which national income may affect infant mortality. First, there is a direct positive association between wealth and survival chances. Secondly, national income may also affect survival chances indirectly, through its impact upon the birth rate. The demand for children is positively affected by their parent's income, in the same way in which the demand for any normal good or service depends on some income variable.

Thirdly, a higher income is usually associated with a higher degree of female participation in the labour force. If a woman has the possibility, or faces the need, to choose between staying at home and having children or, alternatively, not having children, taking a job and contributing to a higher family income, it follows that the relationship between family income and the demand for children may not be linear but possibly more complex. The interaction of these three, factors makes the relationship between GDP per capita and mortality among children complex.

Nishiyama (2011) investigates the effects of GDP per capita on infant mortality using panel data from 83 developing countries over a period of 40 years. Changes in per capita GDP are divided into economic booms and slumps, and the asymmetrical effects of economic booms and slumps on changes in infant mortality are investigated. He found that although economic growth broadly decreases infant mortality, the impact of economic growth on infant mortality for the periods of economic booms and slumps is asymmetrical. Positive economic growth may have weak, mixed effects

on a reduction in infant mortality, but negative economic growth has a strong, adverse impact. Increased GDP per capita decreases infant mortality in developing countries. Statistical procedures indicate that this is a causal relationship from GDP per capita to infant mortality.

The statistical relationship between infant mortality and GDP per capita is sought, and the estimated coefficient of GDP per capita is believed to capture the private and public investments in nutrition inputs that are made possible by increased household and national income (Smith and Haddad, 2002, p.64).

Using instrumental variable estimations and panel data for middle and low-income countries, Pritchett and Summers (1996) regressed infant mortality on GDP per capita and found that raising GDP per capita reduces infant mortality.

Ensor et al., (2010) use 20th century time series data from 14 high and middle income countries to investigate associations between previous economic recession and boom periods on infant mortality (1936 to 2005). A first difference logarithmic model is used to investigate the association between short run fluctuations in GDP per capita and infant mortality. The results suggest a modest but significant association between infant mortality and economic growth for early periods (1936 to 1965) but not more recent periods. Recessions do have a negative association with infant outcome particularly in earlier stages of a country's development while boom phases are positively associated with infant mortality decrease.

Advocates for increased female education have maintained that even a few years of education can empower women with skill necessary to increase their entire household productivity, to raise healthier children and to make better economic decisions (Papageorgiou and Stoytcheva, 2008). According to Cutler, Deaton and Lleras-Muney (2006) “The importance of women’s education is likely a result of the fact that as primary care takers, they are most likely to implement the health behaviors that can improve their children’s health. To the extent that education improves an individual’s ability to undertake these changes, more educated mothers will have healthier babies.”

Papageorgiou (2008) and Stoytcheva (2008) have constructed a cross-country dataset on female human capital inequality. Then they used this dataset to examine the relationship between female human capital inequality and infant mortality. They showed that higher education inequality among women, measured by the Gini coefficient, leads to substantially higher infant mortality.

Parental education, especially maternal education, plays a significant role in improving child health (Schell et al, 2007). Considering educational human capital, several authors have noticed the positive effect of education on health (Groot and Maassen van den Brink, 2006b, Grossman and Kaestner, 1997).

The economic literature has justified the positive correlation between education and health by highlighting the merit of an educated individual with useful health information (Rosenzweig and Schultz, 1983). In addition, precarious health status and high risk of mortality result from a low level of education (Currie and Hyson, 1999). For Wolfe and Zuvekas (1997), a parent's educational level is positively correlated with the well-being of their family, particularly with child and infant health. Maternal education therefore plays a vital role in reducing infant mortality.

Women's education is a source of social gains as it improves both maternal and infant health by reducing women's fertility rates and promoting spacing between births (Subbarao and Raney, 1992). For Veneman (2007), maternal education is the key to reducing infant mortality. The education of women thus has the advantage of significantly facilitating the reduction of infant mortality by the knowledge of nutritional needs, notions of hygiene, the use of contraception, which, by making it possible to avoid risky births promotes infant survival. Thus, the anthropometric status of children under 5 years would be correlated with the number of years of education of the mother, and the percentage of surviving children increases (Mingat and Zein, 2004). Tabutin and Schoumaker (2004) found for Africa between 2000 and 2004 that the infant mortality rate decreases on average, depending on whether the mother is out of school or has a secondary level or higher. Pamuk et al (1998) have noted the importance of women's education by showing that children born to mothers with less than 12 years of education have a death rate twice as high as children whose mothers have reached a higher level of education. Ijaz (2012) analysed the impact of women's education on the infant mortality rate in Pakistan and found that women's education is negatively correlated with infant mortality.

In the context of developed countries, Currie and Moretti (2003) found that, in the United States, maternal education reduces high-risk births, such as premature births or newborns with typically low birth weight. On the other hand, Chou et al (2010) found a positive effect of women's education on reducing infant mortality in Taiwan. Duflo and Breierova (2004) found that female education is the main determinant of infant mortality reduction in Indonesia even though studies by McCrary and Royer (2011), Lindeboom et al (2009) found little evidence of the positive effect of maternal education on infant mortality. For Schultz (2013), a further year of study by women reduces the infant mortality rate by 5 percent.

Women's education affects child health through several channels. Grossman (1972) establishes a health demand model, similar to a production model in which maternal health has direct and indirect effects on child health. The direct effect

comes from allocative and productive efficiency in the production process. Productive efficiency translates into the fact that educated women can obtain better health from their newborns for a given level of factors compared to less educated women. Allocative efficiency refers to a situation in which highly educated women choose combinations of factors to produce a given level of child health compared to less educated women. According to the Grossman model (1972), the indirect effect of women's education on the reduction of infant mortality is expressed through their financial autonomy. Indeed, according to human capital theory, women with high educational potential are likely to occupy highly paid positions and more easily ensure the health of their children.

Russel et al (2006) used a granger causality tests within a multivariate error correction framework to examine the relationship between female participation rates, infant mortality rates and fertility rates for Australia using annual data from 1960 to 2000. They did a decomposition of variance and impulse response functions. The main findings are twofold. First, there is unidirectional Granger causality running from the fertility rate to female labour force participation and from the infant mortality rate to female labour force participation while there is neutrality between the fertility rate and infant mortality rate. Second, in the long run both the fertility rate and infant mortality rate Granger cause female labour participation.

Barenberg et al (2016) studied the impact of public health expenditure on infant mortality in India. Using a panel data set of Indian states between 1983–1984 and 2011–2012, they studied the impact of public health expenditure on the infant mortality rate (IMR) after controlling for other relevant covariates like political competition, per capita income, female literacy. They found that public expenditure on health care reduces the IMR. Their baseline specification shows that an increase in public health expenditure by 1 percent of state-level net domestic product is associated with a reduction in the IMR by about nine infant deaths per 1000 live births.

4. Methodological Approach

A model is presented for the derivation of an estimable equation for WAEMU zone. Many authors exposed the problem of heterogeneity between infant mortality and macroeconomic variables. Yamada (1984) found bidirectional causality between infant mortality and fertility. Barenberg (2016) found bidirectional causality between infant mortality and public health expenditure and also between economic performance and infant mortality. If the bi-directional causality between some variables and the IMR holds, then the OLS estimate of the impact of these variables will be biased.

4.1 The Empirical Model

For the analysis of the effect of macro determinants on infant mortality, the framework of Barenberg (2016) is adopted, in which a linear regression is estimated. To address the question of causal effect, we use a method of instrumental variables. Instrumental Variables (IV) is a method of estimation used when correlation between the explanatory variables and the error term is suspected for example, due to omitted variables, measurement error and other sources of simultaneity bias. The Method of Instrumental Variables (IV) solves the problem of endogeneity in the study of the relationship between infant mortality and macroeconomic factors. This method provides solutions to the problems of simultaneity bias, inverse causality and omitted variables. The fundamental element of any instrumental variables methodology lies on the choice of instruments. It helps to control the endogeneity by the use of a set of instrumented variables.

The estimated linear equation is expressed as:

$$IMR_t = \beta_0 + \beta_i \, Independant\ variables + \varepsilon_{i,t} \quad (1)$$

Where β_0 and β_i are parameters to be estimated and $\varepsilon_{i,t}$ is the error term.

$$IMR_t = \beta_0 + \beta_1 FEM + \beta_2 GDP + \beta_3 URB + \beta_4 FER + \beta_5 DEP + \beta_6 INF + \epsilon_{i,t} \quad (2)$$

By applying the logarithm to Equation (3) and by indicating with small letters the log of their corresponding capital letter we obtain:

$$imr_t = \beta_0 + \beta_1 fem + \beta_2 gdp + \beta_3 urb + \beta_4 fer + \beta_5 dep + \beta_6 inf + \epsilon_{i,t} \quad (3)$$

Definition of variables:

IMR = Infant mortality, defined as deaths within the first year of life per thousand births.

FEM = the female literacy rate is finding to be important because standard public health interventions that can reduce the IMR are enhanced by the ability of the mother to read and follow basic instructions.

GDP = Per capita real income is expected to be an important determinant because it acts as a proxy for the level of private expenditure that can complement public expenditure in improving health status.

URB = Urbanization is meaning to capture the relative difference in the availability of health infrastructure, such as hospitals, primary health centers, doctors, and nurses, between rural and urban areas.

FER = Demography is considered as a main determinant of infant mortality. It has been suggested that mortality may affect fertility, and also that fertility may affect mortality. The fertility rate is the total number of children that 1000 women can bear during their lifetime. Low female fertility rate reduces infant mortality.

DEP = Public expenditure on health care.

INF = Inflation is also considered as a source of infant mortality because it forces pregnant women to reduce their level of consumption and access to health, leading to increase infant mortality. On the other hand, inflation leads to a reduction in the consumption of harmful products such as smoking, thereby improving health (Alexander et al 2011, 2013). Its effect is a priori undetermined on infant mortality.

4.2 Data Sources

Our data cover a panel of the eight WAEMU countries (Benin, Burkina Faso, Côte d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal and Togo. Guinea-Bissau is the most recent country to join the union) and cover the period from 1980 to 2016. These data are from World Development Indicators 2017.

5. Results and Discussion

Table 3 presents the results for our fixed effects instrumental variables (FE-IV) panel regression analysis estimating the effects of variables on infant mortality. Furthermore, our instrument validity test confirms that our instruments are relevant (P-value = 0.3808).

In order of importance, GDP per capita, urbanization, female literacy, and health expenditure predicted 95 per cent of the decline of IMR whereas fertility was non-significant determinant.

Our empirical evidence reveals that there is a significant and negative relationship between infant mortality rate and real per capita GDP in selected countries. The infant mortality rate of these countries decreased as countries became rich. An increase of 1 percent of GDP per capita decreases infant mortality of 54 per 1,000 live births.

Our results show that female education is an important determinant in child health and low literacy could result in many adverse health outcomes. Literacy empowers women to create healthy households and increase their ability in use of healthcare services particularly in child bearing and child rearing periods. This could improve the family health especially for children. The result of many studies which conducted for investigating the determinant of infant mortality is consistent whit this finding. An increase of 1 percent of female literacy rate decreases infant mortality of 38 per 1,000 live births.

An increase of 1 percent of public spending on health decreases infant mortality of 39 per 1,000 births. An increase of 1 percent of the population in urban cities decreases infant mortality of 47 per 1,000 live births. Urbanization is meant to capture the relative difference in the availability of health infrastructure, such as hospitals, primary health centers, doctors, and nurses, between rural and urban areas.

Our results show that fertility increases infant mortality but is non-significant. At last, inflation rate is a non significant determinant of decreasing of infant mortality. However, an increase of 1 percent of inflation rate decreases infant mortality by 8 per 1,000 live births. This can be explained by the fact that the inflation rates remain too low in WAEMU and an increase of GDP per capita will result in an increase of inflation rate which will decrease the infant mortality.

Table 3. Estimation of fixed effects instrumental variables

	Infant Mortality in WAEMU	
Variables	Coefficients	P-value[3]
Health expenditure	-0.391**	0.009
Inflation	-0.008	0.466
Fertility	0.265	0.291
Female education	-0.388***	0.000
GDP per capita	-0.565**	0.013
Urbanization	-0.478	0.061
R^2	0.97	0.01

6. Conclusion

Developing a better understanding of the macroeconomic determinants of infant mortality is critical in order to ameliorate the economic determinants associated with poor child health and to reduce the health disparities within the population.

Our results showed that variables including health expenditures, GDP per capita, urbanization, inflation and female literacy, had inverse effects on infant mortality rate in WAEMU countries.

Then, WAEMU countries must improve public health programs in order to increase child survival by identifying these macro determinants. We noticed female literacy, the level of poverty measured by GDP per capita, the urbanization, and public spending on health as the main determinants of the decline of infant mortality in WAEMU countries. Addressing the macro drivers of infant health holds promise for preventing infant mortality Although our paper provide some keys determinants of infant mortality, considering micro data analysis and social drivers can help more to understand the causes of infant mortality and to implement policies for child survival.

References

Alkema, L., Chou, D., Hogan, D., Zhang, S., Moller, A. B., Gemmill, A., ... Say, L. (2003). United Nations Maternal Mortality Estimation Inter-Agency Group collaborators and technical advisory group. *Research Working Paper.*

Barenberg, A. J. (2017). The Effect of Public Health Expenditure on Infant Mortality: Evidence from a Panel of Indian States, 1983–1984 to 2011–2012. *Journal of Development Studies*, *53*(10). https://doi.org/10.1080/00220388.2016.1241384

Breierova, L., & Duflo, E. (2004). *The impact of education on fertility and child mortality: Do fathers really matter less than mothers?* (No. w10513). National bureau of economic research.

Coburn, D. (2004). Beyond the income inequality hypothesis: class, neo-liberalism, and health inequalities. *Social science & medicine*, *58*(1), 41-56. https://doi.org/10.1016/S0277-9536(03)00159-X

Currie, J., & Hyson, R. (1999). Is the Impact of Health Shocks Cushioned by Socioeconomic Status?The Case of Low Birth Weight. *American Economic Review American Economic Review*, *89*(2), 245-250. https://doi.org/10.1257/aer.89.2.245

Currie, J., & Moretti, E. (2003). Mother's education and the intergenerational transmission of human capital: Evidence from college openings. *The Quarterly Journal of Economics*, *118*(4), 1495-1532. https://doi.org/10.1162/003355303322552856

Cutler, D., Deaton, A., & Lleras-Muney, A. (2006). The Determinants of Mortality. *Journal of Economic Perspectives, 20*(3), *Summer 2006. (pp. 97-120).* https://doi.org/10.1257/jep.20.3.97

Ensor, T., Cooper, S., Davidson, L., Fitzmaurice, A., & Graham, W. J. (2010). The impact of economic recession on maternal and infant mortality: lessons from history. *BMC Public Health*, *10*(1), 727. https://doi.org/10.1186/1471-2458-10-727

Franco, Á., Álvarez-Dardet, C., & Ruiz, M. T. (2004). Effect of democracy on health: ecological study. *Bmj*, *329*(7480), 1421-1423. https://doi.org/10.1136/bmj.329.7480.1421

Groot, & Maassen, van den B. (2006). The Health Effects of Education. *Economics of Education Review*, *26*(2), 186–200. https://doi.org/10.1016/j.econedurev.2005.09.002

Grossman, M. (1972). Front matter, The Demand for Health: A Theoretical and Empirical Investigation available on http://www.nber.org/chapters/c3484

Grossman, M., & Kaestner, R. (1997). The social benefits of education. *University of Michigan Press.*

Hojman, D. E. (1996). Economic and other determinants of infant and child mortality in small developing countries: the case of Central America and the Caribbean. *Applied Economics*, *28*(3), 281-290. https://doi.org/10.1080/000368496328641

Houweling, T. A., Kunst, A. E., Looman, C. W., & Mackenbach, J. P. (2005). Determinants of under-5 mortality among the poor and the rich: a cross-national analysis of 43 developing countries. *International journal of epidemiology*, *34*(6), 1257-1265. https://doi.org/10.1093/ije/dyi190

Houweling, T. A., Kunst, A. E., Looman, C. W., & Mackenbach, J. P. (2005). Determinants of under-5 mortality among the poor and the rich: a cross-national analysis of 43 developing countries. *International journal of epidemiology*, *34*(6), 1257-1265. https://doi.org/10.1093/ije/dyi190

Ijaz, Z. (2012). Impact of Female Literacy Rate and Health Facilities on Infant Mortality Rate in Pakistan. *International Journal of Humanities and Social Science*, *2*(3), 135-40.

Jassal, D. S., Neilan, T. G., Pradhan, A. D., Lynch, K. E., Vlahakes, G., Agnihotri, A. K., & Picard, M. H. (2006). Surgical management of infective endocarditis: early predictors of short-term morbidity and mortality. *The Annals of thoracic surgery*, *82*(2), 524-529. https://doi.org/10.1016/j.athoracsur.2006.02.023

Jere, R., Behrman, H. A., & Hoddinott, J. (2004). Hunger and malnutrition. *Copenhague consensus challenge paper*.

Lindeboom, M., Lundborg, P., & van der Klaauw, B. (2010). Assessing the impact of obesity on labor market outcomes. *Economics & Human Biology*, *8*(3), 309-319. https://doi.org/10.1016/j.ehb.2010.08.004

McCrary, J., & Royer, H. (2011). The effect of female education on fertility and infant health: Evidence from school entry policies using exact date of birth. *American Economic Review, 101*(1), 158-95. https://doi.org/10.1257/aer.101.1.158

Mingat, A., & Zein, E. (2004). Les effets différés de l'éducation des filles dans les domaines de la pauvreté et de la population. *Working Paper, PSAST/AFTHD, Washington, Banque mondiale.*

Nishiyama, A. (2011). Economic Growth and Infant Mortality in Developing Countries. *The European Journal of Development Research, 23*(4), 630-647. https://doi.org/10.1057/ejdr.2011.17

Pamuk, E., Makuc, D., & Heck, K., et al. (1998). Prevalence of Non-Communicable Diseases and Number of Comorbidities According to Differences in Household Income Levels in Japan: Analysis from National Health and Nutrition Survey. *Food and Nutrition Sciences, 8*(1).

Papageorgiou, C., & Stoytcheva, P. (2008). Education Inequality among Women and Infant Mortality: A cross-country empirical investigation.

Rosenzweig, M. P. S. (1983). Market opportunities, genetic endowments and intrafamily ressource distribution. *American Economic Review, 72*, 803-815.

Russell, J., Flood, V., Rochtchina, E., Gopinath, B., Allman-Farinelli, M., Bauman, A., & Mitchellm, P. (2006). Adherence to dietary guidelines and 15-year risk of all-cause mortality. *University of Sydney, NSW 2006, Australia.*

Schell, C. O., Reilly, M., Rosling, H., Peterson, S., & Mia Ekström, A. (2007). Socioeconomic determinants of infant mortality: a worldwide study of 152 low-, middle-, and high-income countries. *Scandinavian journal of public health*, *35*(3), 288-297. https://doi.org/10.1080/14034940600979171

Schultz, G., Otahal, P., Cleland, V. J., Blizzard, L., Marwick, T. H., Sharman, J. E., & Am, J. H. (2013). Exercise-induced hypertension, cardiovascular events, and mortality in patients undergoing exercise stress testing: a systematic review and meta-analysis. *Working Paper*

Shandra, J. M., Nobles, J., London, B., & Williamson, J. B. (2004). Dependency, democracy, and infant mortality: a quantitative, cross-national analysis of less developed countries. *Social science & medicine*, *59*(2), 321-333. https://doi.org/10.1016/j.socscimed.2003.10.022

Shaw, M., Smith, G. D., & Dorling, D. (2005). Health inequalities and New Labour: how the promises compare with real progress. *BMJ: British Medical Journal*, *330*(7498), 1016. https://doi.org/10.1136/bmj.330.7498.1016

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), e928-e939. https://doi.org/10.1542/peds.2005-2181

Smith, L. C., & Haddad, L. (2002). How potent is economic growth in reducing undernutrition? What are the pathways of impact? New cross-country evidence. *Economic Development and Cultural Change*, *51*(1), 55-76. https://doi.org/10.1086/345313

Subbarao, K., & Raney, L. (1992). Social gains from female education: a cross-national study. *Policy Research Working Paper Series 1045.*

Summers, L. H., & Pritchett, L. (1996). Wealthier is healthier. *J Human Resources*, *31*(4), 841-868. https://doi.org/10.2307/146149

Szwarcwald, C. L., de Andrade, C. L. T., & Bastos, F. I. (2002). Income inequality, residential poverty clustering and infant mortality: a study in Rio de Janeiro, Brazil. *Social science & medicine*, *55*(12), 2083-2092. https://doi.org/10.1016/S0277-9536(01)00353-7

Tabutin, D., & Schoumaker, B. (2004). The Demography of Sub-Saharan Africa from the 1950s to the 2000s. A Survey of Changes and *a Statistical Assessment. Population-E, 59*(3/4), 455-555. https://doi.org/10.3917/pope.403.0455

Tadashi, Y. (1984). Causal Relationships between Infant Mortality and Fertility in Developed and Less Developed Countries *NBER Working Paper No. 1528 Issued in December 1984.*

Tortorelli, J. T., El-Fakhouri, S., & Alexandre, R. P. (2002). Determinant factors for mortality of patients receiving mechanical ventilation and effects of a protocol muscle training in weaning. *BMJ 2002, 210,* 1011-21.

Veneman, A. M. (2007). Education Is Key to Reducing Child Mortality: The Link between Maternal Health and

Education. *Research Working Paper*

Wolfe, B., & Zuvekas, S. (1997). Nonmarket Outcomes of Schooling. *International Journal of Educational Research, 27*(6), 491-501.