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Stillbirths and Neonatal Mortality

DO INEQUALITIES PRESENT AT THE TIME OF DEATH MIRROR LIFE SPAN ECONOMIC DISPARITIES?


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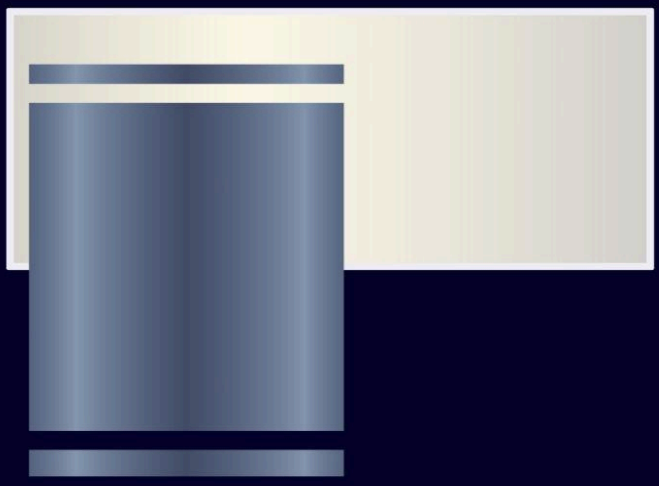

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Introduction

The human development approach prompts an evaluation of the well-being of people in developing countries, based on the following questions: “Do they live long? Do they escape preventable morbidity? Do they avoid mortality during infancy and childhood? (Anand & Ravallion, 1993). The answers to these questions reflect a bleak reality for the Third World, and spurred the creation of Millennium Development Goals (MDG) to redress inequalities that keep many, in developing countries, disenfranchised.

Historically and globally, for a newborn child, life expectancy estimates - when juxtaposed with cause of death, quality of life and socioeconomic correlates - vary in disparate proportions by reason of development at the country level, with interregional spillover effects (Sell and Kunitz, 1986). The global pattern of mortality has changed (Sell and Kunitz, 1986); more specifically, the dire socioeconomic signature of development distressed countries, reveals a striking chronological parallel between trends in economic development and a rise in infant mortality figures (Gwatkin, 1980). The era of unprecedented gains in life expectancy has collided with ballooning global indebtedness (Sell and Kunitz, 1986) with unfavorable consequences in the wake.

Infant mortality figures are used to gauge the social, environmental and medical status of a nation (Garrett, Galley, & Shelton, 2007). There are identifiable relationships between maternal and neonatal mortality and overall health system indicators (Lawn et al., 2011). Infant mortality and birth outcomes are key population health indicators that carry socioeconomic implications (Kim & Saada, 2013) for the human development index, thus infant mortality and birth outcome indicators are both high on the MDG agenda. Infants depend entirely on their care-takers for survival and this level of vulnerability between mother and newborn is crucial to the infant survival count. According to Garrett, Galley, and Shelton (2007), the rate at which infants die is a critical measure of a society’s well-being. A nation’s ability to provide up-to-date health care for its citizens has socioeconomic implications that defy development odds in terms of poverty reduction and the overall well-being of the society in question.

It is important to note the inherent difficulties with using infant mortality as dependent variable and unit of *observation*[1]. Although mortality is a straightforward count, its causes are of a varied, sometimes intricate nature, often involving more than one intervening factor. A mortality cause can thus be isolated as a dependent variable on its own. Technically speaking, and for the sake of argument, infant mortality can be viewed, essentially, as a dependent variable composed of dependent variables. Aware of these intricacies, the authors cited in the literature examined in this paper have tried to overcome these intricacies by adding controls and establishing infant mortality as an exploitable index placed within a single dimension of development in order to reduce exogenous influences, and decrease endogenously generated systematic bias and random errors within their respective models.

As Deaton (2001) elucidates, historically high rates of economic growth have done little to dramatically reduce poverty levels, which, the author believes, substantiates the argument that economic growth does not reduce poverty (p.1). Several countries, Deaton writes, show large and growing discrepancies between the survey data (i.e., differences between the source of poverty counts) and the national income accounts - both of which are sources of the measure of economic growth. The resultant measurements of economic growth reveal weak relationships with poverty measures (Deaton, 2001).

Extending the discussion from weak economic measures to the effect of capital accumulation activities (meant as an economic remedy) on health measures, Shandra et al. (2004) examine sociological models detailing cross-national variation in infant mortality rates. Using panel regression analysis of a sample of 59 developing countries, Shandra et al. tested four theoretical models for the effects of economic and social modernization on infant

[1] A unit of observation is the level at which data is collected, whilst a unit of analysis is the level at which conclusions are established. The unit of analysis is usually established as a higher level of aggregation than the unit of observation (Rules of Reason, 2012). These two terms may be similar in some contexts, but in this context, the distinction is required because of the composite nature of the infant mortality variable.

mortality. One of the four models evaluated in the study was based on the theory of dependency, which posits that in a world system that supports a global division of labor, poverty-inducing economic distortions trickle down to the domestic economy of many developing nations, inhibiting growth, increasing inequality, and adversely affecting population well-being (p. 323). Preliminary testing, based on additive models, yielded evidence in support of the hypothesized relationship between capital accumulation activities–like MNC penetration–and a high level of infant mortality.

In contrast, a study by Daly and Wilson (2013) aggregated U.S. county-level data for 1990 and 2000 on mortality rates and Census data on local income inequality (Gini index and three income percentile ratios), and found evidence, based on panel data estimation model, of a statistically significant *negative* relationship between mortality and inequality. Conflicting findings concerning the relationship between inequality and mortality rates are not uncommon in development literature and warrants further investigation into the nature of the underlying relationship between economic inequality and infant mortality figures.

This paper presents a thematic review on the status of global infant mortality in order to examine the relationship between economic growth and human development outcomes via an investigation of the relationship between economic inequality and infant mortality. Economic inequality will be examined in the context of poverty and infant mortality rates will be assessed as a proxy for human development.

How does child development respond to capital accumulation?

Economic development hinges on the neo-classical worldview that draws a parallel between economic growth and a gradual development process that ought to be marginalist (to inoculate against shocks to the economic system), non-disruptive, equilibrating (versus inducing inequality), and largely painless (Nugent and Yotopoulos, 1979, p. 542; as cited in Hettne, 1983). Expectation that economic growth translates into human development continues to provoke

enquiry, particularly within the African milieu. Within the confines of the capitalist model of economic growth, when considering normative conceptions of desirable outcomes, consensus exits anent the idea that increases in capital input, along with skill upgrades, ought to lead to economic expansion, rising real incomes, and ultimately, higher human development indicators - yet, this expectation is not always realized (Hersch, 2006; Kristjansdottir, 2007; Preston, 1976).

Stillbirths, maternal and neonatal mortality rates are significant gauges of the status of a nation's health care system; and, by extension, national health care is functionally dependent on the economic status of the nation in question. Economic conditions prevailing at the onset of an infant's early years have life expectancy consequences, both short-and-long term. Grossman (1972) proposed a stock-based approach to health, wherein health is the response variable, which varies over time based on the behavior of investment and depreciation predictors. With each successive time period, Grossman expects that the effect of investments on health stock fades/depreciates.

The intertemporal utility function for any given individual over the course of their life, as outlined by Grossman (1972), can be stated as follows:

$$U = U(\phi_0 H_0, \dots, \phi_n H_n, Z_0, \dots, Z_n) \quad (1)$$

With H_0 representing the inherited stock of health; H_i is the health stock in the *i*th period; ϕ is the level of service flow per unit of stock; *n* denotes a fixed length of life and is endogenous to the system; and, Z_i being the total consumption of any specified commodity in the *i*th period. Death is the expected outcome when $H_i = H_{min}$; thus life expectancy is dependent on H_i quantities that both maximize utility and are subject to identified production and resource limitations. Grossman (1972) equates net health stock investments to the gross investment amount less depreciation, mathematically represented as:

$$H_{i+1} - H_i = I_i - \delta_i H_i \quad (1.1)$$

here, I_0 is the gross investment amount and δ_i is the depreciation rate during the *i*th period, which is assumed exogenous, but with variations based on individual age. I_i and Z_i can be further disaggregated into their unique utility functions as follows:

$$I_i = I_i(M_i, TH_i; E_i) \quad (1.1a)$$

$$Z_i = Z_i(X_i, T_i; E_i) \quad (1.1b)$$

where M_i is the medical care indicator, X_i represents the input of good into the production function of the Z_i commodity. TH_i and T_i are time-related factors and E_i is a measure of human capital stock. If we consider *h* as health or human capital when infancy phase is completed, then, according to Currie and Almond (2010), an elementary two-period childhood can be modeled as follows:

$$h = A[\gamma I_1 + (1-\gamma) I_2], \quad (1.2)$$

where: *A* is a factor of productivity; γ represents the share parameter; I_1 is approximately equal to the level of investment from infancy to age 5; and, I_2 approximates the level of investment beyond age 5.

Currie and Almond suggest that if the total investment level is ; $I_1 + I_2$, then investment allocations between the two time periods will affect health when the share parameter, γ, does not equal 0.5. If γ is greater than 0.5, the implication is that, for the end of the first period, investments play a larger role on *h*, when compared to second-period investments. For the scenario where γA is greater than 1, *h* may be affected at a rate greater than 1:1 with period one investments. Thus model (1.2) outlines the likelihood that during certain childhood time periods, investments (capital accumulation) may exert a disproportionate influence on health outcomes that do "...not necessarily decline monotonically with age. This functional form…suggests that early-childhood events may be more influential than later childhood events" (2010, pg 5).

Based on the preceding, the core proposition of the Grossman model "is that health is a durable commodity" (1972, pg. 1). An individual is expected to inherit solid health at the onset of life, but this stock of health is expected to depreciate over time. This depreciation is also expected to be compounded - depending on the level of investment allocations (a capital accumulation factor) available as time elapses. When the health stock drops below a certain threshold, death is the result (Grossman, 1972).

Defining poverty

Poverty is widely associated with lack of income. According to Collier (2007), close to one billion people on earth are considered rich; most of the remaining - approximately 5 billion - live in rapidly developing countries. The real challenge of development, according to Collier, is with the cohort of countries that house those who live at the bottom of the group 5 billion - most of these countries, concentrated in Africa and South Central Asia (with a few elsewhere), are falling behind in terms of economic growth. Between the end of the Cold War and September 11, 2001, incomes within this group declined by 5%, leaving a total of approximately 1 billion people stuck at the bottom (Collier, 2007, p. 3). The ability to command commodities is often equated with a person's well-being (Anand & Ravallion, 1993). However, the non-income dimensions of poverty are significant in terms of measuring poverty and providing interventions.

The concept of the development trap, as illustrated by world renown development economist, Jeffery Sachs, focuses on addressing issues that keep the disenfranchised trapped in poverty -- such as the lack of agricultural support (subsidies that could help poor farmers buy fertilizer, etc); malnutrition; access to medicine; functioning medical facilities; running water; infrastructure (lack of roads often leading to isolation); transportation; income; food; electricity; and communications -- to name a few (Sachs, 2005; Collier, 2007, p. 5).

Most poor people do not have access to more than one, if not all, of these inputs, keeping them trapped in a cycle of need. Of the eight MDGs, the fourth targets a reduction in child mortality. Although this is an indirect poverty reduction measure, it remains an essential development component in terms of solidifying healthcare advancements that can address health-related poverty traps. Inadequate health care has been identified as a major contributor to the declining health stock in developing countries.

Inequality and its influence on health measures

According to Kim and Saada (2005), income disparities and variations in social policies (e.g., maternal leave policies) are associated with cross-country differences in infant mortality rates; and intra-country evidence shows that neighborhood socioeconomic status (USA, Western Europe) and income inequality (USA) are key determinants in the poverty equation.

Maternal and infant mortality rates find parallels with the quality of available health care. A cesarean section (C-section) is, oftentimes, the difference between life and death for both mother and child. A C-section is as procedurally intensive as it is costly. Globally, the numbers of babies born alive through cesarean sections continues to increase - for example, in 2010, an estimated 25% of all births were by cesarean section, as compared to a mere 2% in 1950 (O'Neill, 2014). The difference in the number of caesarean sections is also greater between urban and rural areas -- for instance, urban areas in South Asia record a c-section rate of 14% versus 5% in rural areas; Africa records a c-section rate of 5% in urban areas versus 1% in rural areas; “Burkina Faso, Chad, Ethiopia, and Niger all have rural caesarean section rates of almost zero” (Lawn et al., 2011, p. 5). Unskilled birth attendants and little-to-no caesarian section services contribute to high stillbirth rates in developing countries.

Records show that child mortality is highest and most widespread in developing nations (Likens, Singh, Ndukwe, & Bae, 2009). Ten densely populated countries (India, Pakistan, Nigeria, China, Bangladesh, Democratic Republic of the Congo, Ethiopia, Indonesia, Tanzania, and

Afghanistan) account for nearly two-thirds of global third-trimester stillbirths; more than one-half of all stillbirths, maternal and neonatal deaths occur in five of these countries -- redressing the stillbirth challenges in these countries would equal crucial gains in worldwide mortality reduction goals (Lawn et al., 2011).

Birth outcomes and infant mortality rates are unequally distributed globally; deeply contrasting cross-country and within-country patterns exist, even among western industrialized nations (Kim & Saada, 2013). In the United States, trends in child death rates show differences based on cause of death, age, and race, with the sizable mortality rate gap between black and non-black children narrowing only in the last two decades of the twentieth century (Currie & Hotz, 2003). In 2012, only 55.7% of pregnant women in Dallas County received adequate prenatal care, and the infant mortality rate was recorded at 6.5%, in the same year (Children's Medical Center, 2013). Serious birth defects, preterm birth or low birth weight, sudden infant death syndrome (SIDS), maternal complications during pregnancy, and unintended accidents or injuries were listed among the top five causes of newborn deaths in Dallas County (Children's Medical Center, 2013).

"The mortality rate for black infants is more than twice that of Hispanic and white infants" (Children's Medical Center, 2013, p. 31). Sixty percent of newborn deaths in the United States occur on the first day of life; for premature and low birth weight babies, in particular, the first day of life is reported to be the most critical (Children's Medical Center, 2013). The United States ranks 30th in the world, according to Save the Children's 2013 list of "best and worst places to be a mother," whilst both mothers and infants living in sub-Saharan Africa face the greatest risk (Children's Medical Center, 2013).

According to the WHO, neonatal deaths in developed countries are rare events -- around 4 deaths per 1000 live births -- stillbirth rates are also lower (4/1000 total births) (2006). Much progress in declining childhood mortality and undernutrition rates can be attributed to expensive, highly effective, evidence-based research interventions that have been implemented

over the past decades (Carrera et al., 2012, p. 1). Although western nations have made gains in terms of reducing child mortality rates, the issue still persists in many industrialized countries and is often accompanied with misclassifications when stillbirths are not included in mortality counts.

Global infant mortality figures obscure stillbirths -- stillbirths are simply not counted. Oftentimes, stillbirths are misclassified by some developing country governments because they are largely ignored and excluded from infant mortality counts. Frøen et al. (2009) argue that, in global burden disease reports authored by the WHO, and in the United Nations Millennium Development Goals and targets, stillbirths have remained largely invisible.

Lawn et al. (2011) reiterate the claim that stillbirths are ignored by NGOs and governments of developing nations, explaining that stillbirths are not included in the MDGs, they are not monitored by the UN, and are not included in the Global Burden of Disease metrics. When still births are mentioned in surveys, they are counted with early neonatal mortality figures and reported as perinatal mortality, which confounds essential differences, contributes to systematic misclassifications, masks trend variations, muddies possible solutions for the varying causes and further reduces visibility for the issue (Lawn et al., 2011). By extension, stillbirth misclassification obscures the health and economic conditions present at the time an infant is still born. At the center of the issue of stillbirths is poverty, as impoverished communities have the highest rate of neonatal deaths.

In Latin America, and in high-income countries, most still births are recorded in urban areas; whilst in south Asia and sub-Saharan Africa, more than two-thirds of all stillbirths are in rural areas -- these figures are consistent with low skilled birth attendance numbers (Lawn et al., 2011) in the same geographical areas. Low-and-middle income countries, unable to shoulder the burden of health care costs, pay the price, on an annual basis in intrapartum and antepartum deaths by the numbers.

Nearly 99% of stillbirth and neonatal deaths occur in low- and middle-income countries -- approximately half occur in homes where they go uncounted (Lawn, Cousens, & Zupan, 2005), and in regions with inadequate or non-existent vital registration systems (Vergnano, 2012).

"Investment in stillbirth research, even in high-income countries, is low compared with the burden of stillbirths and is almost entirely absent in low-income countries, even in studies that examine maternal or neonatal outcomes" (Lawn et al., 2011, p. 14). The 1% of deaths in developed countries are often the focus of most health intervention research on neonatal survival (Lawn, Osrin, Adler, and Cousens, 2008). Underserved communities with the highest stillbirths and neonatal deaths are the least informed and have little-to-no access to cost-effective interventions (Lawn, Osrin, Adler, and Cousens, 2008). From a public health standpoint, information on the timing, circumstances, associated conditions and underlying causes of death is crucial to determining the quality of care, which will in turn guide prevention efforts and ultimately improve quality of care (Frøen et al., 2009).

Frey and Field (2000) approach the explanation of the variation that exists in infant mortality rates within less developed regions with a microscope based on five macro-social change theories: Modernization theory, dependency/world-systems theory, gender stratification theory, economic disarticulation theory, and the developmental state theory (p. 216). Frey and Field investigated the concurrent impact of industrialization juxtaposed against four different factors that they believed to have explanatory power about the root causes of economic dependence: Female educational attainment, economic disarticulation, state strength, and a control variable, Sub-Saharan African status. These four alternative measures of dependence were measured against infant mortality rates based on 1991 data for a sample of 59 less developed countries. Eight regression models and five theoretical narratives later, Frey and Field conclude that debt dependence, economic disarticulation, female education, and Sub-Saharan African status have deleterious effects on infant mortality.

Lawn et al. (2011) explain that the wide range of variations in current data, monitoring systems, calibration methods, current (inaccurate, largely ignored) stillbirth measures, and unequal access to health care leads to intervention inconsistencies, which support inadequacies in terms of health care policy planning. These variations are largely evident in cash-strapped economies. Once the spatial variations in child deaths have been narrowed down, evidence suggests that a large number of infant deaths are preventable, and with the decline in birth rates in recent years, preventing infant mortality is all the more vital (Garrett, Galley, & Shelton, 2007).

A large percentage of the recent gains made in improving childhood mortality and undernutrition rates can be attributed to the identification and implementation of practical, evidence based interventions -- if marginalized communities are unable to benefit from these improvements in knowledge and interventions because of economic restraints, achieving the fourth MDG, which aims to reduce childhood mortality, will be further out of reach (Carrera et al., 2012). The most deprived and underserved populations within countries bear the global burden of childhood mortality, morbidity, and undernutrition, partly because major maternal and child health coverage and nutrition interventions are unavailable to them (Carrera et al., 2012). “Progress on child mortality … has seen widening inequities and a concentration of child deaths and … in the most deprived communities, threatening the achievement of the Millennium Development Goals” (Carrera et al., 2012, pg 1).

Conclusion

Eberstein (2009) proposes that “inequality in death is a reflection of inequality in life”, and that, at the core of these inequalities lay fundamental social and economic differences. Said differently, socioeconomic forces are at the root of the “fundamental causes” of differential mortality, in spite of the biological variations that exist between groups (Eberstein, 2009).

Eberstein does not contend that socioeconomic processes are multi-factorial and work in tandem with biological, epidemiological, demographic, technological, behavioral, environmental and other factors. The poor and underserved bear the brunt of the global burden of child mortality, morbidity, and undernutrition because of either unequal or inadequate coverage of key maternal and child health and nutrition interventions (Carrera et al., 2012).

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