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Social inequality in infant mortality: What explains variation across low and middle income countries?

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ABSTRACT

Growing work demonstrates social gradients in infant mortality within countries. However, few studies have compared the magnitude of these inequalities cross-nationally. Even fewer have assessed the determinants of social inequalities in infant mortality across countries. This study provides a comprehensive and comparative analysis of social inequalities in infant mortality in 53 low-and-middle-income countries (LMICs). We used the most recent nationally representative household samples (n = 874,207) collected through the Demographic Health Surveys (DHS) to calculate rates of infant mortality. The relative and absolute concentration indices were used to quantify social inequalities in infant mortality. Additionally, we used meta-regression analyses to examine whether levels of inequality in proximate determinants of infant mortality were associated with social inequalities in infant mortality across countries. Estimates of both the relative and the absolute concentration indices showed a substantial variation in social inequalities in infant mortality among LMICs. Meta-regression analyses showed that, across countries, the relative concentration of teenage pregnancy among poorer households was positively associated with the relative concentration of infant mortality among these groups (beta = 0.333, 95% CI = 0.115 0.551). Our results demonstrate that the concentration of infant deaths among socioeconomically disadvantaged households in the majority of LMICs remains an important health and social policy concern. The findings suggest that policies designed to reduce the concentration of teenage pregnancy among mothers in lower socioeconomic groups may mitigate social inequalities in infant mortality.

Introduction

Improving the health outcomes of children has been the central focus of many public health programs (Simon et al, 2001) in the world over the last three decades. To date, there have been several international goals set out to improve child health. The Declaration of Alma Ata (1978) aimed to reduce infant mortality rates (IMR) to less than 50 death per 1000 live-births through a global strategy for "Health for All" by the Year 2000 (World Health Organization, 1981). Subsequently, the 1990 World Summit for Children Programme of Action and the Programme of Action of the 1994 International Conference on Population and Development (ICPD) encouraged countries to reduce infant mortality. Another international effort targeting infant mortality is the fourth goal of the United Nations Millennium Development Goals (MDG 4). The MDG 4 is set to reduce IMRs between 1990 and 2015 by two thirds.

Despite the remarkable improvement in child health over the past three decades, infant mortality still remains a central issue in the global health agenda. There is extremely uneven progress towards reducing infant mortality across countries and regions (World Bank, 2012a; You, Jones, & Wardlaw, 2011), Furthermore, there is a growing body of global research demonstrating a social gradient in children's health outcome within countries: children belonging to lower compared to higher socioeconomic status (SES) households have a lower probability of surviving to their first birthday (Adler & Ostrove, 1999; Adler et al, 1994; Arntzen & Nybo Andersen, 2004; Bakketeig, Cnattingius, & Knudsen, 1993; Finch, 2003; Hobcraft, McDonald, & Rutstein, 1984; Hosseinpoor et al, 2006). The vast majority of these deaths are preventable and inequitable (Hosseinpoor et al., 2006; WHO/UNICEF, 2012; WHO/World Bank, 2002).

The monitoring of socioeconomic inequalities in child health within and among countries has an important role in gauging

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progress toward the commitments made by decision makers to reduce inequalities in infant mortality (Victora et al, 2003). However, measuring socioeconomic inequalities alone is not enough to secure sustainable changes. Identifying the factors explaining the concentration of infant mortality among children born into lower SES households is essential to implementing effective policies to redress these inequalities (Hosseinpoor et al., 2006; Victora et al., 2003).

Although inequalities in health have recently received substantial attention in the economics and public health literature (Costa-Font & Hernández-Quevedo, 2012; Gwatkin, 2000; Kawachi, Subramanian, & Almeida-Filho, 2002; Marmot & Wilkinson, 2006; O'Donnell, van Doorslaer, Wagstaff, & Lindelow, 2008; Wagstaff, Paci, & Van Doorslaer, 1991), few studies (Hosseinpoor et al., 2006; Monteiro et al, 2010; Pradhan & Arokiasamy, 2010; Vapattanawong et al, 2007; Wang, 2003; Zere et al., 2007) have measured socioeconomic inequalities in infant mortality using a summary measure such as the concentration index, which accounts for inequality across the entire socioeconomic distribution. Therefore, this study aimed to provide a comprehensive and comparative analysis of social inequality in infant mortality across 53 low-and-middle-income countries (LMICs) using the most recent nationally representative samples of live births collected through the Demographic Health Surveys (DHS). In addition, following the conceptual framework developed by Houweling and Kunst (2010) we used meta-regression to analyze whether inequalities in proximate risk factors for infant mortality were associated with the magnitude of social inequality in infant mortality across countries.

Methodology

Data

The data for this study were obtained from the Demographic Health Surveys (DHS). The DHS typically are cross-sectional surveys of nationally representative household samples for selected LMICs (Corsi, Neuman, Finlay, & Subramanian, 2012). The DHS surveys collect comparable information concerning a wide range of topics, with a special focus on maternal and child health (Rutstein & Rojas, 2006). These surveys are an important source of comparative population health data in LMICs due to their data quality, coverage, and comparability (Pullum, 2008; Vaessen, 1996; Wirth et al., 2006). DHS respondents are selected by a multistage sampling procedure and most samples are stratified by urban and rural status and/or by country specific administrative or geographic regions (Demographic and Health Survey, 1996). In order to ensure standardisation and comparability of surveys across time and countries, the DHS uses trained and experienced interviewers, standardized measurement techniques and tools, and an identical core set of questions (Demographic and Health Survey, 2006; Subramanian, Perkins, Özaltin, & George, 2011). The DHS have been conducted in more than 85 countries worldwide since 1984 (Corsi et al., 2012). This study uses information from 53 DHS surveys carried out between 2003 and 2011. For countries with more than one DHS for the study period, only the most recent survey was included in the analysis.

Measures

The analysis of infant mortality in each country is based on information on live births over a 5 year period. We examined the outcomes of all births that occurred between 6 years prior to the survey and one year prior to the survey. This observation period allowed us *first* to have a follow-up period of at least one year for each live birth and *second* to provide recent estimates while ensuring adequate births to reduce sampling error in the analysis (Anand et al., 2001; Hosseinpoor et al., 2006).

A constructed wealth index provided in all standard DHS was used as a measure of socioeconomic status of infants. The wealth index is calculated using available information on a household's ownership of selected assets (e.g. bicycle and televisions), type of water source used by household, sanitation facilities and materials used for housing construction. The DHS uses the method suggested by Filmer and Pritchett (2001) to construct the wealth index (Rutstein & Johnson, 2004). The average Gross Domestic Product (GDP) per capita was used as an indicator of country-level socioeconomic status. We calculated the average GDP per capita by using the World Bank's World Development Indicators and Global Development Finance (WDI and GDF) database (World Bank, 2012a). The average GDP per capita was adjusted for purchasing power parity (PPP) and logged to correct for skewness.

In the health literature, several measures have been proposed to examine inequalities, including the index of dissimilarity, the relative index of inequality, the Gini coefficient and the concentration index (Nikolaou & Nikolaou, 2008). We used the concentration index to quantify socioeconomic inequalities in infant mortality. As described by Wagstaff et al., (1991), the concentration index, unlike the commonly used Gini coefficient, satisfies three qualities for a favorable socioeconomic inequality index, namely that: 1) the index should reflect the health inequalities that arise from the socioeconomic characteristics; 2) it should be representative of the whole population; and 3) it should be "sensitive to changes in the distribution of the population across socioeconomic groups". There has been extensive discussion on whether to use absolute or relative measures of inequalities in health (Asada, 2010). We used both relative and absolute measures of the concentration index in our study because there is general agreement on the use of both measures to describe social inequalities in health (Asada, 2010; Harper et al., 2010; King et al., 2010).

The relative concentration index (RC) for infant mortality within each country was calculated with reference to the relative concentration curve, which plots the cumulative percentage of live births, ranked in ascending order of a socioeconomic factor, in this case household wealth, on its *x*-axis (see Fig. 1(a)). The relative concentration curve allows us to determine, for example, the proportion of infant mortality that occurs in a certain wealth quintile, and to make statements such as '15% of total infant mortality occurred among the poorest 10% of infants'. In a special case in which each quintile of live birth, ranked by wealth, has an equal share of infant mortality, the relative concentration curve coincides with the diagonal line representing perfect equality. The RC is computed as twice the area between the relative concentration curve and the line of perfect equality. The index is negative if the relative concentration curve lies above the line of equality, indicating that infant mortality is concentrated among poorer households (and is positive if the curve lies below the line of inequality indicating greater concentration among wealthier households) (World Bank, 2012b). The RC ranges from −1 to 1, with a value of zero representing "perfect equality". Koolman and Van Doorslaer (2004) demonstrated that if we multiply the magnitude of the RC by 75, it will give us the fraction of the health variable that would need to be redistributed from the poorer half of the population towards the wealthier half (in the case that ill health is concentrated among the poor) in order to achieve perfect equality.

The RC is attractive to those who want to examine relative differences in health between SES groups. It is also possible to generalize the concentration curve such that it becomes sensitive to changes in the population mean of the outcome and reflects