Global Patterns of Sex Differentials in Child Mortality in Sub-Saharan Africa: Multivariable Analysis of 30 National Datasets

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Introduction

Although the relationships between child's sex and risk of death before the age of 5 have often been studied, the mechanisms by which sex uniquely influences childhood mortality are not well understood or empirically documented. Most research that looked at sex differences in childhood mortality showed that males have consistently higher mortality than females, especially in the early period of infancy (United Nations 1998). Addressing the problems of gender-based inequalities in child survival, both between countries and within countries, remains therefore one of the greatest challenges, and is of special appeal for policies and programs targeting child's welfare and survival (Feachem 2000; Hill and Upchurch 1995; Mishra et al. 2004). However, perspective on the problems of mortality differentials requires the intercorrelations of characteristics influencing mortality to be into account (Luther and Thapa 1999). A major limitation of the previous studies is that they mostly do not identify the relative effects of child's sex "net" of the effects of others (Retherford et al. 2010). In other words, the different mortality rate estimated hold only count of age at death and adjusts values to only with one explanatory variable, the sex of the child (Sawyer 2012). We can only be confident about any findings regarding sex-specific variation in childhood mortality when we control for potentially confounding variables. Several research hypothesizes that sex differentials in survival result from a complex interplay of biological and behavioural factors that impact mortality at different stages in the life course (Trovato and Lalu 1996; United Nations 2011; Waldron 1998; Wingard 1984).

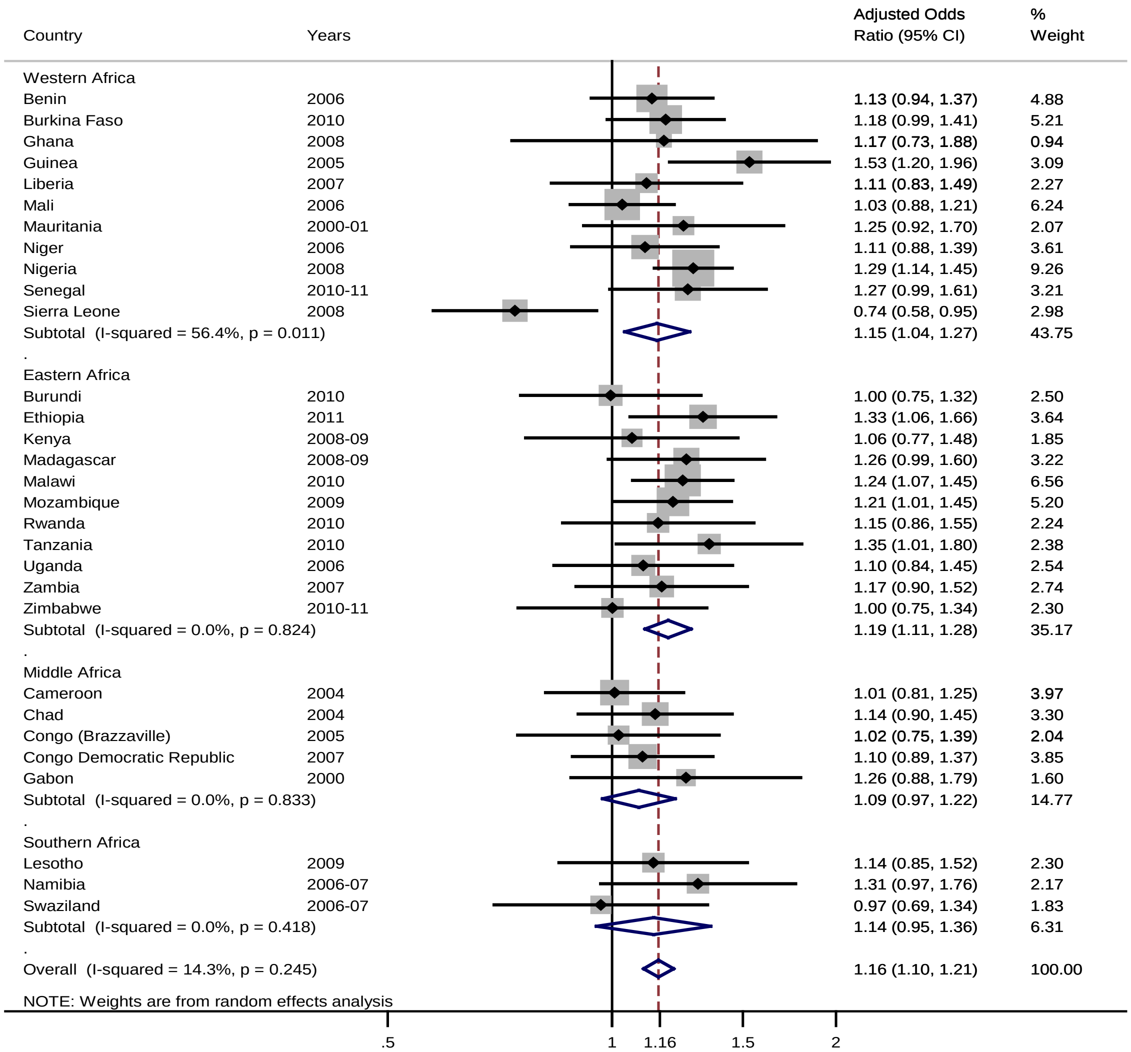
The basic questions addressed in this research are: 1) what are factors that explain the sex differentials in child mortality?; 2) to what extent and by what mechanisms are the effects of biology and environment on risk of mortality of children younger than 5 years dependent on sex? I define sex differential risk of mortality as the differences in the probability or risk of death between male and female children. This study focuses on the under-five mortality rate (the probability of dying between birth and age five, also denoted in the literature as U5MR and 5q0 (Hill et al. 2012:1). In this paper the main purpose is to estimate and interpret adjusted effects on under-five mortality of children by sex, adjusting for the matrices of social, economic, demographic, and biological factors. I conducted a country-by-country multivariable analysis to assess sex differentials in under-five mortality using a multivariate multilevel discrete-time hazard model. I used meta-analysis techniques to combine and summarize results from multiple countries.

Data and Methods

Data included in our analysis come from 30 Demographic and Health Surveys (DHS) conducted in sub-Saharan Africa countries for which a recent (2000 or later) standard DHS containing all necessary variables is available (as of October 2012) (http://www.measuredhs.com). The analytic sample consists of 176,710 children (89,729 boys and 86,981 girls) born between 2001 and 2011. The number of children by country included ranges from 2091 in Ghana to 17596 in Nigeria The dependent variable used in this study is the risk of death in childhood (0–59 months), measured as duration from birth to the age at death (in months) or censored. The focal independent variable in the regression models is simply the sex of the child, defined as a binary variable that equals 1 if male and 0 if female. To estimate an adjusted sex difference in under-five mortality I include in the estimation models a set of control variables known to be associated with the risk of under-five mortality. Control variables consist of the individual- and community-level characteristics, which include 1) biologic covariates (child size at birth, birth order and preceding birth interval, and mother's age at child birth) and 2) environmental characteristics measured at the individual and community level (type of gender preference, mother's education, household wealth Index, skilled attendant at delivery, place of residence, community-level socio-economic status, community-level education, community level of hospital delivery, and prevalence of women who have a son preference). I modeled child mortality using multilevel discrete-time hazard models (Allison 1982; Sear et al. 2002). I started with an analysis of the simple association between sex of the child and risk of dying before 59 months, adjusted for the child's age (exposure time). Then, the control variables were entered sequentially in groups. The focus of the analysis was the change in the child's sex coefficients with the introduction of the subsequent factor groups (i.e., biological and environmental factors as predictors). After obtaining country-level parameter estimates (individual country's odds ratios (OR) and 95 percent confidence intervals), I used meta-analysis techniques to combine and summarize results from multiple countries (Harris et al. 2008).

Findings: The results show a systematically higher mortality for male children compared to females in all countries except Burundi, Sierra Leone, Swaziland, and Zimbabwe; and the relationship is significant in 10 of 30 countries (Figure 1). On average males have 22% (range from 17% to 52%) higher odds than females of dying before age five in the countries where the association is significant. These patterns withstood controls for the individual-and community level factors as well as unobserved heterogeneity.

Figure 1. Meta-analysis of the regression model results of under-five mortality on child's sex, last births during the five years before the survey (singleton births): 30 Sub-Saharan Africa countries.



Note: Forest plot displaying a weighted random-effect meta-analysis: adjusted odds ratios (95 percent confidence intervals (95% CIs)) of under-five mortality by sex. Comparing male to female. Parameter estimates from the multilevel discrete-time hazard models after adjusting for the individual- and community-level characteristics, which include 1) biologic covariates (child size at birth, birth order and preceding birth interval, and mother's age at child birth) and 2) environmental characteristics measured at the individual and community level **(**type of gender preference, mother's education, household wealth Index, skilled attendant at delivery, place of residence, community-level socio-economic status, community-level education, community level of hospital delivery, and prevalence of women who have a son preference). The grey square indicates the actual study results (size); the horizontal line represents the 95% confidence interval. Combined odds ratios are indicated by the diamond-shaped figures at the bottom of the chart. The solid vertical line represents an odds ratio (OR) of one, i.e. no difference in risk of under-five mortality between males and females.

Discussion and Conclusions: The issue of sex differentials in childhood mortality in developing countries has recently generated considerable interest. In this article I pursue the question of how much biological and environmental factors explains the sex effects on under-five mortality across countries in SSA, a world's region with highest levels of under-five death. The findings also seem to confirm the theory of male biological disadvantage in early life in sub-Saharan Africa.

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