Individual- and community-level effects on child mortality: An analysis of 27 Demographic and Health Surveys in sub-Saharan Africa

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Introduction

Disparities in child health between and within countries persisted and widened considerably during the last few decades (Gakidou and King, 2002; Population Reference Bureau, 2004; WHO, 2007; Population Reference Bureau and African Population and Health Research Center, 2008). The reduction of these disparities is a key goal of most developing countries' public health policies, as outlined in the Millennium Development Goal 2015 (Black et al., 2003; Jones et al., 2003; Lee, 2003; WHO, 2005; UNDP, 2007; Bryce and Requejo, 2008).

It is well recognized that disparities in child health outcomes may arise not only from differences in the characteristics of the families that children are born into but also in the socio-economic attributes of the community where they live (Frankenberg, 1995; Duncan et al., 1998; Robert, 1999; Huie, 2001; Balk et al., 2004; Griffiths et al., 2004; Kravdal, 2004; Angeles et al., 2005; Montgomery and Hewett, 2005). Indeed the incorporation of community-level factors in the analysis of child mortality provides an opportunity to identify the health risks associated with particular social structures and community ecologies, which is a key policy tool for the development of public health interventions (Pickett and Pearl, 2001; Stephenson et al., 2006). Nonetheless, while researchers have devoted considerable attention to the impact of individual-level factors on child mortality, less is known about how community characteristics affect health outcomes for children, even though they have a prominent role in theoretical models (most notably Mosley and Chen, 1984; Schultz, 1984). Existing studies generally have a limited focus (a single country or region within a country), and are quite heterogeneous in the data, definitions and methods adopted.

The main aim of this study is thus to systematically examine the relative importance of individual- and community-level effects on child mortality by using data from the latest round of Demographic Health Surveys for all countries in sub-Saharan Africa. Specifically, this study will

use multivariate and multilevel discrete-time event history analysis to evaluate the impact of contextual factors on the risk of dying before age 5 net of the effect of individual factors.

Data and methods

Data sources

The study will use data from all most recent Demographic and Health Surveys (DHS) available (as of June 2009) for sub-Saharan Africa: Benin (2006), Burkina Faso (2003), Cameroon (2004), Chad (2004), Congo Brazzaville (2005), Congo Democratic Republic (2007), Ethiopia (2005), Ghana (2003), Guinea (2005), Kenya (2003), Lesotho (2004), Liberia (2007), Madagascar (2003/2004), Malawi (2004), Mali (2006), Mauritania (2000/2001), Mozambique (2003), Namibia (2006), Niger (2006), Nigeria (2003), Rwanda (2005), Senegal (2005), Swaziland (2006), Tanzania (2004), Uganda (2006) Zambia (2007) and Zimbabwe (2005/06).

For all 27 countries, information on child mortality is derived from full birth histories collected from women of reproductive ages. The analysis is restricted to children born in the 5-year period before the survey because of the availability of information on maternal and child health.

Analytical strategy

The outcome variable of interest for the study is the risk of death in childhood (0-59 months) measured as the duration from birth to the age at death, or censored. Using multivariate and multilevel event history models (to account for right-censoring in the estimation of exposure time), this study will attempt to separate individual- and household-level factors from contextual factors associated with child survival.

Specifically, the analytical strategy for the study relies on estimating three sets of models for each country. First, I will estimate "naïve" logistic regression models predicting children's probability of dying by their fifth birthday, accounting for within-cluster correlation by using the Huber-White (1967) procedure. These models will provide a baseline against which to compare the results of more complex models. Then, I will estimate cluster-level fixed-effect models, which include a linear effect of unobserved individual- or community-level factors on the risk of dying before age 5. Fixed-effects models permit taking into account only unobserved community-level factors. Yet, by using DHS data, it is possible to construct appropriate community-level measures

and, in some cases, the surveys even directly collected information on community-level characteristics. On the basis of these measures (described in detail in the next section) I will thus finally apply three-level (community, mother, child) random intercept logistic regression models to correctly account for the hierarchy in the DHS data and thus properly assess the impact of community-level factors on child mortality net of individual-level factors.

Fixed effect models will be fitted using Stata 10.0. Multilevel logistic regression models will be fitted using MLwiN v2.16.

Individual- and community-level control variables

Individual- and household-level factors considered in this study are a set of standard covariates that have been identified by previous studies as important determinants of child mortality, and which are available for all countries considered. They include: the age of the child (in months); the child's sex; the duration of the preceding birth interval; the mother's age at the child's birth; the mother's education; whether the mother received antenatal care; the place of delivery and the assistance at delivery; and household wealth.

Community-level characteristics are not directly available for most surveys included in the analysis. They are thus constructed by aggregating individual- and household-level characteristics at the cluster level, and they include: the type of place of residence (urban/rural); the cluster's level of economic development (defined as the proportion poorest in the cluster); the proportion of women in the cluster who are literate; the cluster's level of ethnic fractionalization (defined as the probability that two individuals selected at random from a cluster will be from different ethnic groups); the cluster's under-five mortality rate; and the proportion of the population in the cluster that is employed in the non-agricultural sector.

For a selected number of surveys that directly collected information on community characteristics (Benin, Chad, Gabon, Guinea, Mali, Mauritania and Niger), I will include in the models an additional control variable: the distance to the nearest hospital, which measures the level of access to health care services.

Preliminary findings

A preliminary analysis of data from the eight surveys that directly collected information on community-level characteristics (Benin, Chad, Gabon, Guinea, Mali, Mauritania and Niger) confirms the importance of contextual effects for child mortality net of individual factors (Boco and Bignami, 2008).

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