FAMILY PLANNING AND CHILD MORTALITY RATE DECLINE IN SUB-SAHARAN AFRICA: AN ECOLOGICAL LONGITUDINAL STUDY AT THE SUB-NATIONAL LEVEL

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Abstract

In this paper we drawn the data from 51 surveys on 103 provinces (or governorate, region or larger geopolitical zone within a country) in 17 sub-Saharan African countries which have conducted three or more comparable Demographic and Health Surveys between 1991 and 2009 to determine the extent to which family planning prevalence at the sub-national level affect under-five mortality rates (U5MR). A multivariate regression analysis of panel data was carried out with a random effects specification to correct for serial correlation of repeated measures and to control for time invariant unobserved or unobservable province characteristics. From 1991 to 2009 U5MR declined from 171.5 to 130.8 per 1000 live births. During the same period average modern contraceptive prevalence rate increased from 12.8% to 23.3%. The analysis also shows that a 1% increase in province's contraceptive prevalence rate was associated with about 6‰ decrease in U5MR, net of other factors.

Keywords: Family planning; Modern contraceptive use; sub-Saharan Africa; Demographic and Health Surveys; Under-five mortality.

INTRODUCTION

Family planning (FP) methods are important for reproductive health and well-being and they remain one of the most cost-effective public health interventions available in developing countries to lower rates of infant mortality (IMR) and promote economic growth (Cleland et al. 2006; Smith et al. 2009; Tsui et al. 2010). FP also helps to reduce the number of high-risk pregnancies, thereby reducing the high levels of maternal and infant mortality associated with risky pregnancies (Smith et al. 2009). The documented health benefits of family planning have become an important consideration in the adoption of national population policies, especially in African countries (Cleland et al. 2011; Seltzer 2002). It is now recognized that family planning is essential link to achieving all eight Millennium Development Goals (Cates Jr 2010; Ezeh et al. 2010). The role of family planning on mortality risk of children is, however, still an under-researched question.

As the reduction of infant and child mortality is a major policy goal in developing countries, understanding the relationship between family planning and mortality risk has important policy implications. In this paper, we sought to determine the extent to which family planning use at sub-national level is associated with under-five mortality rates (U5MR) (and whether this differs in different regions of Africa) and show evidence to inform decision-makers about the relationship between levels of practice of family planning and child mortality change in sub-Saharan Africa (sSA). In other words, this paper seeks to improve individuals' understanding of how family planning contributes to

under-five mortality decline at the sub-national levels, and to reposition family planning higher on national and local policy agendas in sub-Saharan Africa (Population Reference Bureau 2011).

Programmes to promote family planning in developing countries began in the 1960s in response to large improvements in child survival, which in turn led to rapid population growth (Cleland et al. 2006: 1810). Family planning programs provide women with information about and access to contraception (Haupt & Kane 2004). Despite its known benefits and strategic role in reducing maternal and infant mortalities, its acceptance and utilization is low especially in developing countries (Population Reference Bureau & African Population and Health Research Center 2008; Singh et al. 2009). Family planning is much more than birth control. Many countries have recently included in these programs priority actions such as promotion, prevention, and care for mothers and children, such as the promotion of breastfeeding, prenatal care, neonatal and under-5 care, immunization and other actions toward prevention, and management of infectious diseases such as diarrhea (Aquino et al. 2009; Cleland et al. 2006; Population Services International (PSI) 2010).

BACKGROUND

Reduction of child mortality (CM) remains a major global health challenge in Sub-Saharan Africa (Lawn 2010). Since the 1990s, declines in child mortality have reversed

in many countries in the region, while in others they have either slowed or stalled, making it improbable that the target of reducing child mortality by two thirds by 2015 will be reached by the majority of the countries in the region (Fotso et al. 2007; Lawn 2010).

Several studies have sought to explain why progress in maternal and child health has apparently stumbled so badly in many countries. In The World Health Report 2005, the World Health Organization shows in detail how stagnations, reversals and slow progress in some countries are clearly related to poverty, HIV/AIDS, and humanitarian crises, leading to exclusion from access to health care (WHO 2005 Chapter two). The recent changes in infant and child mortality are always influenced by a combination of several factors, including the resurgence of malaria and lower levels of vaccination coverage and health care utilization; the deteriorating living standards and purchasing power, the dismantling of public health systems, the universal rise in health costs, inefficiencies in the health services leading to failures in basic services, and a poor economic climate (Fotso et al. 2007; Houweling & Kunst 2010; Pison 2007; Rutstein 2000).

A large body of empirical studies that focus on identifying the determinants of health outcomes in sub-Saharan Africa are based either on single country analyses, or on cross-country comparisons for several sub-Saharan African countries, but little research has been done to look at changes in child mortality using a large set of local or regional (sub-national) level residences within African countries (Root 1999).

The use a sub-national level perspective, rather than cross-country comparisons, for the study of change in child mortality levels has several advantages, including the significant increase of the number of units of analyses (Boco 2005; Kravdal & Kodzi 2011; Root 1999; Tabutin & Schoumaker 2001). Tabutin and Schoumaker (2001), in their study on a regional analysis of fertility in Africa, started that the diversity of levels and trends is much greater in a regional approach than in cross-country comparisons. Finally, the sub-national level approach is particular relevance for the identification of explanatory variables that transcend state boundaries (e.g. cultural factors) and for the study of diffusion processes (Boco 2005; Root 1999; Tabutin & Schoumaker 2001).

This paper seeks to determine whether family planning were important in contributing to the recent change in the child mortality at a sub-national level in sub-Saharan Africa and aim to provide the extent to which the prevalence of modern contraceptive use relates to infant mortality at province level in sub-Saharan Africa. There is evidence that comprehensive primary health care services can have a significant impact on improving child health, but most of this evidence does not assess longitudinal trends at the sub-national level. In this study, we estimate the independent effect of the levels of family planning use in the province (or governorate, region or larger geopolitical zone within a country), using DHS data in 103 provinces in 17 countries with at least three such surveys. The data design allows inclusion of lagged province variables and province fixed effects.

DATA, VARIABLES AND METHODS

Countries and regions included in the analysis: The data for this analysis were drawn from 51 surveys on 103 provinces in 17 sub-Saharan African countries which have conducted three or more comparable Demographic and Health Surveys (DHSs), namely: Benin (1996, 2001, 2006), Burkina Faso (1993, 1998/9, 2003), Cameroon (1991, 1998, 2004), Ghana (1993, 2003, 2008), Kenya (1993, 2003, 2008/9), Madagascar (1992, 1997, 2008/9), Malawi (1992, 2000, 2004), Mali (1995/6, 2001, 2006), Namibia (1992, 2000, 2006/7), Niger (1992, 1998, 2006), Nigeria (1999, 2003, 2008),Rwanda (1992, 2000, 2007/8), Senegal (1992/3, 1997, 2005), Tanzania (1991/2, 1999, 2004/5), Uganda (1995, 2000/1. 2006), Zambia (1996, 2001/2, 2007) and Zimbabwe (1994, 1999, 2005/6). Selection of countries with three and more surveys enabled us to assess *child mortality* trends for about three decades as well as to mitigate the vulnerability to errors which would occur more often when using only two surveys.

The DHSs use the same methodology to estimate health and other socioeconomic indicators and are comparable across countries and over time. DHS contains full birth histories, i.e. birth and death information for all children ever born to the respondent, as well as information on socio-economic and geographic stratifiers including household ownership of assets, maternal education and rural/urban residence. It also includes direct mortality determinants, such mother's fertility history, water and sanitation facilities, housing characteristics, health care use and childhood malnutrition. Although information

on births and deaths is reported retrospectively by the mother, estimates of levels and trends in under-five mortality are generally accurate (Byass et al. 2007). In addition, the surveys collected information on eight modern methods of contraception (the pill, intrauterine device (IUD), injectables, implants, vaginal methods—foam, jelly, sponge, or diaphragm—the condom, female sterilization, and male sterilization) as well as three traditional methods (periodic abstinence, withdrawal, and prolonged breastfeeding) from women respondents age 15-49 (Gebreselassie & Mishra 2007:6). Surveys are typically repeated every three to five years, allowing analysis of trends in key indicators for many countries. The DHS data are representative at the national level, for urban and rural residence, and for the highest-level aggregate units that were defined (typically governorates, provinces or larger geopolitical zones within a country, but referred to as provinces in this paper) were comparable over at three surveys selected. A list of countries and provinces included in the analysis is shown in the Appendix Table 1.

Published data drawn from STATcompiler and DHS final reports provided trend data for sub-national level estimates of indicators related to the main determinants of infant and child mortality. All variables used in this analysis were drawn from STATcompiler http://www.statcompiler.com[1].

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[1] The DHS STATcompiler allows users to draw data from the demographic and health surveys. Virtually all of the population and health indicators published in the DHS final reports can be viewed online. STATcompiler enables one to create customized tables, drawing on more than 600 indicators from approximately 100 countries covering more than 200 surveys. Topics include Characteristics of Households, Fertility, Family Planning, Other Proximate Determinants of Fertility, Fertility Preferences, Early Childhood Mortality, Maternal and Child Health, Maternal and Child Nutrition, and AIDS and other STDs (MEASURE DHS+ 2002:8).

Measures: The dependent variable is direct estimates of under-five mortality rate (i.e., mortality among children under five years of age) at the provincial level in each country covering the period ten years prior to the date of each survey (Rutstein & Rojas 2003). Estimates of childhood mortality are based on information from the birth history section of the questionnaire administered to individual women (Rutstein & Rojas 2003). U5MR is widely recognized as the most appropriate indicator of the cumulative exposure to the risk of death during the first five years of life (UNICEF et al. 2007). It has a number of advantages over the IMR as a composite measure of health risks at young ages (Ahmad et al. 2000:1176). The key independent variable is the prevalence of the use of modern family planning methods among women of reproductive age at the sub-national level (the percentage of women aged 15-49 who are currently using any modern methods of contraception). We could have used an alternative indicator of the FP program including the family planning effort index (FPEI) score proposed in the early 1970s, which is meant to provide an indication of the performance of national family planning programs (Ross & Smith 2010). However, the FPEI has been critiqued for its subjective nature, given that it relies on a limited number of key informants within the national government to provide an assessment of performance (Bertrand & Escudero 2002). In addition, unfortunately, to our knowledge there is no the FPEI available at the sub-national level for all countries included in the analysis.

Based on an extensive literature review (Amouzou & Hill 2004; Aquino et al. 2009; Boco 2005; Houweling & Kunst 2010; Root 1999; Rutstein 2000; Schell et al. 2007), we

selected a set of covariates as determinants of child mortality given their potential to confound the effect of the principal independent variable. These include the sub-national level measures of access to sanitation and electricity, possession of the goods, women's literacy and the total fertility rate, vaccination coverage, and ethnic fractionalisation. The definitions of the covariates used in the analysis are reported in Table 1.

Methods: The unit of analysis is the province (or governorate, region or larger geopolitical zone within a country) level. A multivariate regression analysis of panel data was carried out with a random effects specification to correct for serial correlation of repeated measures and to control for time invariant unobserved or unobservable province level characteristics (Wooldridge 2002). The main advantage of using panel data is the ability to minimize (or eliminate) omitted variable bias (Baltagi 1995: chapters 2 and 4). The equation of the panel model could be expressed as follows:

$$\text{U5MR}_{it} = \alpha \times planning + X_{it}\beta + u_i + e_{it}$$

where U5MR_{it} is the under-five mortality rate in province *i* at time *t* (survey year); *planning* a province's modern contraceptive prevalence rate; X_{it} is the vector of the observed demographic, social, and economic covariates at time t and a constant; α and β are the coefficients to be estimated; u_i is the unobserved province-specific effect; e_{it} is the residual. In the fixed-effect model u_i is treated as a fixed term. A multivariate model is fitted to determine the direct effect of each of the independent variables adjusting for the others. We used a natural logarithm of the under-five mortality estimates to satisfy the

normality assumption of the outcome variable. A similar log transformation of infant and child mortality rates are found in Baldacci et al. (2003)(2003) and Filmer and Pritchett (1999). It is also allow for the individual regression coefficients can be interpreted as elasticity.

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