Effects of Reproductive Health on Poverty in Malawi

1. Introduction

In this research, we will investigate the causal effect of reproductive health on poverty-related indicators primarily using data on randomised interventions that relate specifically to reproductive health. For poverty-related indicators, we will consider not only current variables such as household consumption and female labour supply, but also investment in the health and education of children, which are known to be critical for long term poverty reduction (Bozoli et al. 2007; Schultz, 2005 and 2007; Van der Berg et al. 2006; Strauss and Thomas, 1998; Maluccio et al. 2006).

We use the standard broad definition of reproductive health that includes the reproductive processes, functions and system at all stages of life. Good reproductive health, therefore, implies that people are able to have a responsible, satisfying and safe sex life and that they have the right to decide on when to reproduce. This implies that individuals have access to methods of fertility regulation and appropriate health care services, which allow couples to conceive without risks for their own health, and enable women to have healthy pregnancies and safe deliveries.

Our research will focus on Malawi, a highly policy-relevant context for understanding the relationship between reproductive health and poverty in Sub-Saharan Africa (SSA). Both poverty and poor reproductive health are widespread in Malawi, where maternal mortality is one of the highest in the world, at 984 per 100,000; infant mortality is very high, at 76 per 1,000 live births (DHS, 2004); and where around 30% of births do not occur at health facilities. Poverty is widespread, as reflected in the estimate of the 2005 per capita gross national income of only $160, as compared with $580 for all low-income countries and $745 for all SSA (www.worldbank.org, Atlas method). However, poverty might affect reproductive health, and vice versa. The challenge is to disentangle the causal effect of one on the other, on which there is little empirical evidence. In this research, we will consider the causal effects of reproductive health on poverty.

In what follows, we describe in more detail the research questions that we will address, the data that we will use, and our research methods.

2. Research Hypotheses

H1 Pregnancy related mortality and morbidity reduce investment in children’s human capital: Maternal mortality and pregnancy-related morbidity are frequent in Africa. The latter in particular is perceived to be almost unavoidable (Zabin and Kiragu, 1998). Pregnancy-related morbidity can involve complications that lead to long-term disabilities (Menken and Rahman, 2001). The 1998 National Research Council workshop on the consequences of maternal mortality and morbidity found little information on the effects of maternal deaths on investment in children’s human capital. Some associations between maternal/parental deaths and child stunting and schooling levels in Tanzania were documented (Ainsworth and Semali, 1998), though it is difficult to establish causation from these associations. This is because unobserved factors may simultaneously affect maternal mortality and morbidity, and investments in children’s human capital (see Gertler et al 2004).

Given the data we will use (section 3), we will be able to establish causation in analysing whether pregnancy-related mortality and morbidity have an impact on schooling and labour supply of children in the household, as well as on their nutrition levels. Apart from affecting immediate poverty levels, such early investments have been shown to be critical factors in long-term outcomes of children (see citations above). We will analyse the channels through which such effects might occur, including how pregnancy-related morbidity affects the economic activities of mothers and

1 Note that this remains the case in the more recent review by Greene and Merrick (2005).
private expenditures on health care, which potentially lead to decumulation of assets and/or decreased consumption; and how pregnancy mortality and morbidity increase the demand for care from children.

**H2 Breastfeeding improves infant health but may reduce female labour supply and either increase or decrease household consumption:** There is evidence that increased duration and exclusivity of breastfeeding is associated with better infant health (Morrow, 1996; Morrow et al. 1999). The implications of breastfeeding for poverty levels are less widely understood. This is important, particularly as the World Health Organisation guidelines are currently being changed to reinforce exclusive breastfeeding in poor settings. Below we set out various economic implications of breastfeeding that we will investigate in this research:

1. Breastfeeding, due to its labour-intensive and time-consuming nature, may prevent mothers from working full-time or from working far from home. It may also shift mothers’ work activity from market work to home production, even if the latter activity is less profitable.

2. Breastfeeding may also have implications for the activities of other household members. For example, a child may be used to substitute for the labour of the mother during the breastfeeding period, with potentially adverse consequences for schooling, with possible long-term consequences for poverty reduction.

3. Breastfeeding may also affect household consumption: On the one hand, available resources for other uses may increase as expenditure on formula milk and food decrease, and expenditure on infant health care is also likely to decrease if infant health improves due to breastfeeding; on the other hand, mother’s demand for food consumption may increase as required by exclusive breastfeeding. Also, through these different channels, intra-household allocation of resources may be affected, which, in turn, is likely to affect all child-related investments.

**H3 Parental HIV-infections reduce child schooling but may reduce or increase child work. As a consequence, Volunteer Counselling and Testing (VCT) might also increase schooling and affect child work:** HIV infection and other aspects of reproductive health are closely related, particularly in Sub-Saharan Africa where HIV is mainly transmitted through heterosexual intercourse: if one member of a couple is HIV infected, the couple will not be able to reproduce without risking the other member’s health. For such reasons, VCT is an investment in reproductive health.

The associations between (a) the increased mortality due to HIV and (b) child schooling (e.g., Bicego et al. 2003; Case et al. 2004; Case and Ardington, 2006; Evans and Miguel, 2007) and health (Sarker et al. 2005) have been analysed, though it should be noted that estimates of the effects that are based on cross-sectional data are more likely to find negative impacts of AIDS than do fixed-effect analyses that use panel data. There is less research, however, on the links between the morbidity associated with HIV and child outcomes. Important links may exist, however, as pointed out in recent work by Zivin et al. (2006). These include the fact that poor health of parents implies an increased demand for care from other household members, including children; moreover reductions in parental income may drive children to work.

Our research will advance understanding of the consequences of HIV infection for human capital investments (schooling and nutritional status) in children, by considering not only mortality but also morbidity, at the same time making causal inference possible by addressing issues relating to the endogeneity of HIV infection. We will address whether VCT uptake affects child human capital accumulation and adult labour supply. This is important because VCT has more than doubled since 2002 when the Global Fund started to fund such activities in Malawi. The existing empirical studies on the effects of VCT are not convincing because they use select samples such as those who choose
to attend ante-natal clinics, or who are enrolled in VCT or ART clinics. They also abstract from dynamic multi-period life-cycle considerations with persistent fixed characteristics, such as genetic endowments related to health and tastes for taking risks.

**H4 Collectively-generated information about reproductive health increases contraceptive use and reduces HIV infection of women:** We will consider how information generated through group discussions affects contraceptive use and HIV prevalence, both of which are likely to be related to poverty. The use of community participatory approaches to improve mother and child health in Africa has so far been limited. Simply providing people with information about health risks may not be enough to change behaviour, and behavioural change is often contingent on reinforcement by social interaction. Interactions in social networks have been shown to influence HIV risk perceptions, the adoption of family planning, and spousal communication about HIV/AIDS (e.g., Kohler et al. 2001, 2007a; Behrman et al. 2002). The way in which information reaches people is also likely to matter. Experience in Nepal of providing basic information to individuals on infant care and family planning showed that this did not result in significant changes in behaviour (Bolam, Manandhar et al. 1998); on the other hand, an intervention that generated information through women’s group discussions was found to reduce neonatal mortality and maternal mortality in a district of Nepal (Manandhar et al. 2004).

### 3. Data

To address our hypotheses, this research will draw on two unique data sources. Both contain features that allow us to address issues relating to the endogeneity of reproductive health variables. One source of data (MaiMwana Project, MMP) comes from a cluster randomised controlled trial (RCT) that aims at improving maternal and newborn infant health outcomes. The second source of data (Malawi Diffusion and Ideational Change Project, MDICP) is longitudinal and spans an eleven-year period; it also includes a randomised experiment that may exogenously decrease the rate of HIV infection.

#### 3.1 MaiMwana Project (MMP), 2006-2009

These data are collected in the Mchinji district of Malawi, under the MaiMwana Project.² The MMP study is a cluster randomised controlled trial of two community interventions that are designed to improve the health of women during and after pregnancy, as well as the health of their newborn infants. It covers 48 clusters.³ The first intervention is a women’s group participatory intervention (WGPI) that has been found to reduce maternal and neonatal mortality in Makwanpur district, Nepal (Manandhar et al. 2004). In brief, this involves women meeting in groups to discuss issues relating to pregnancy, childbirth and newborn health. A facilitator plays a key role in the groups, ensuring that each group moves through a participatory cycle of assessment, experience-sharing, planning, action and reassessment, with the ultimate aim of improving essential maternal and newborn care. The second intervention focuses on infant feeding counselling (IFC). It involves counsellors making home visits to pregnant mothers - once before the birth and four times after the birth - to discuss the importance of exclusive breastfeeding, and to provide support and advice to

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²The Principal Investigators of the MaiMwana Project are Dr. Peter Kazembe and Dr. Charles Mwansambo (Lilongwe Central Hospital, Malawi), Dr. Joseph de Graft Johnson (Save The Children Federation, Malawi), and Prof. Anthony Costello, Prof. Marie-Louise Newell, and Dr. David Osrin (Institute of Child Health, University College London). Information about this Project has been obtained through documents supplied by the team of investigators of the MaiMwana Project. Sonia Lewycka is part of the research team of the MaiMwana project and also of this proposal. We keep a close collaboration with Prof. Anthony Costello and Michelle Rosato.

³The district was divided into 48 zones using Enumeration Areas generated during the 1998 census. Each zone contained a population of approximately 8,000 in total, and from this, a population of around 3,000 was selected from the centre of the zone, leaving a buffer area around it.
new mothers on mother and child health. The counsellor also helps to identify any breastfeeding problems and, if necessary, refers women to a health facility.

The interventions started in 36 clusters in April 2006, and will continue until around April 2009. For this 3 year period, 12 clusters receive the women’s group intervention, 12 receive the infant feeding counselling intervention, 12 receive both interventions, and 12 are randomised out. Data collection is taking place during the first 2 years of the MMP (April 2006 to April 2008). Women who give birth are interviewed, one month after the delivery, and then again 5 months later (only if these fall within this data collection period), in all 48 clusters. The information obtained from them includes the demographics of both parents, birth history, antenatal care, delivery details, infant and maternal illnesses (during pregnancy, delivery and postpartum), health-seeking behaviours, family planning and relationship history, newborn care practices, feeding history including details of weaning, infant weight and height, details of prevention of mother-to-child transmission of HIV, uptake of insecticide treated nets, and mother and infant HIV status (through a blood spot collected from a heel prick). Also, if a maternal, perinatal/neonatal or infant death occurs, a verbal autopsy is conducted with next-of-kin.

However, as can be seen from the above, this data collection does not include any direct information on poverty. This is because the effect of the intervention on poverty is not a primary objective of the MMP. In order to obtain poverty indicators, we will carry out new fieldwork in all 48 clusters. We will commence this fieldwork in April 2008, and we expect it to last until July 2008. We will collect current and, in some cases, retrospective information on the following poverty indicators: infants’ nutritional status and morbidity; days of school lost due to illness; time use (school, labour supply, different domestic activities) of children of school-going age; time use of adults; the desired number of future pregnancies; contraceptive use; household consumption, household income and assets. We will survey all households in which there has been a pregnancy since the project started (approximately 10,000 households, based on the estimation of the MMP research team). A special effort will be made to collect data on children whose mothers have died since the project’s start, to attenuate any selection problems. The randomised design of the MMP and this complementary data collection will offer an excellent opportunity to examine some of our research questions, as developed in section 4.

3.2 Malawi Diffusion and Ideational Change Project (MDICP), 1998-2008

These data come from five rounds of a longitudinal household survey (1998, 2001, 2004, 2006 already collected, 2008 scheduled). The initial MDICP survey in 1998 included approximately 1,500 ever-married women and 1,100 spouses of these women. Subsequent waves were augmented to include new spouses (2001), adolescents (2004), and the spouses of married adolescents (2006).

The MDICP data are expansive, and space considerations permit just a summary of key features that are particularly relevant for our proposed research. The data contain basic demographic information on all members residing in the sample households; intergenerational and intra-familial transfers of money and help; cash income and labour market participation of the household

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4 The relationship between the project leaders and the community leaders, as well as extensive local involvement in this project, is critical in identifying all pregnant women in the areas, irrespective of their use of health care.
5 We are aware of no other RCT of a community-based participatory intervention in perinatal health in a rural African setting, and although there have been RCTs of behaviour change interventions for the promotion of exclusive breastfeeding in Mexico, Bangladesh and India, no published studies report similar interventions in rural Africa.
6 Detailed descriptions of the MDICP sample selection, data collection and data quality are provided on the project website at http://www.malawi.pop.upenn.edu, in a Special Collection of the online journal Demographic Research that is devoted to the MDICP (Watkins et al. 2003), and in a recent working paper that incorporates the 2004 and 2006 MDICP data (Anglewicz et al. 2006). Several studies on data quality and attrition conclude that the quality of MDICP data appears to be high (Bignami-Van Assche, 2003; Bignami-Van Assche et al. 2003).
members, schooling/time uses of children; indicators of household wealth, capital accumulation and savings; attitudes and behaviours in relation to HIV/AIDS and other STIs, qualitative data and semi-structured interviews on reproductive health, HIV/AIDS status; village-level data on infrastructure and the availability of various services; time series of regional market prices and weather conditions and spatial GPS coordinates of respondents’ households along with distances to health care facilities or other services to provide instruments for endogenous variables in our econometric models.

Central to our proposed research, HIV testing was offered to all respondents in the 2004 and 2006 surveys (and will be offered in 2008). The take-up rates of the HIV tests were high, at 91% and 93% in 2004 and 2006 respectively. HIV prevalence rates were 6.9% and 7.2% in 2004 and 2006 respectively. During the 2004 MDICP fieldwork an experimental design was implemented to examine the impact of monetary incentives on respondents’ willingness to return for their results. After collecting the biomarkers for the HIV test, respondents were randomly assigned a voucher for a small monetary reward (<1% of annual income), redeemable upon return to mobile VCT centres established in sample villages. The results of this VCT experimental design indicate that important AIDS-related behaviors, such as the uptake of VCT and the obtaining of information about one’s own serostatus, as well as HIV incidence, are strongly responsive to financial incentives (for details, see Thornton 2005). These findings point to potentially important causal effects of learning one’s HIV status on subsequent AIDS-related behaviors (see Dinkelman et al. 2006), and recent work by Kohler et al. 2007b finds using Instrumental Variable techniques, that VCT reduces HIV infection probability by about 5 percentage points, around three times more than estimates suggested by standard analyses. Interventions that improve access to VCT are, therefore, a potentially important and effective way to reduce HIV infection. These findings are important for our analytic strategy developed below since they demonstrate that randomised monetary incentives can provide suitable instruments for endogenous VCT participation and other AIDS-related behaviours.

4. Methodology

The hypotheses outlined in section 2 can be investigated by specifying the following relationship

$$y_{ith} = \alpha X_{ith} + \beta M_{ith} + f_{ith} + \epsilon_{ith} \quad (1)$$

where $y_{ith}$ represents the poverty-related outcome of individual $i$ in household $h$ in period $t$. The variables that affect $y_{ith}$ include observed individual/household characteristics, $X_{ith}$; reproductive health indicators of household $h$, $M_{ith}$; time-invariant unobserved individual and/or household characteristics, $f_{ith}$; and time-varying unobserved characteristics, $\epsilon_{ith}$. The parameter of interest in equation (1) is $\beta$, which summarises the relationship between reproductive health, $M$, and the outcome variable, $y$ (subscripts on observed variables are suppressed for ease of notation). In general, estimates of $\beta$ will be biased when observational data are used, and thus cannot be given a causal interpretation. This is because even conditional on $X$, $M$ may also depend on the unobserved factors $f_{ith}$ (e.g. attitudes to risk, discount factors) and $\epsilon_{ith}$ (e.g. income shocks, price shocks, disruption to health care facilities, information about reproductive health). This is the problem of endogeneity, alluded to already.

Our general approach to tackling this endogeneity issue is to use Instrumental Variable (IV) techniques with both the MMP and MDICP estimates, as well as Fixed Effects (FE) and FE-IV estimates with the longitudinal MDICP. IV techniques require observing variables, known as instruments, that affect $M$, and that can be excluded from $X$; in other words variables that only affect $y$ through $M$. This implies that the instruments are uncorrelated with $f_{ith}$ and $\epsilon_{ith}$. Finding such variables is not always straightforward. The most convincing candidates generally arise from interventions or other events that are randomised. This is because randomness implies that these events are uncorrelated with $f_{ith}$ and $\epsilon_{ith}$. At the same time, if they are effective, they change $M$. 
The MMP and MDICP data described in section 3 provide us with random experiments that exogenously induce variation in reproductive health indicators and that thus provide credible instruments for $M$ in equation (1). Apart from the benefits of randomisation, an important strength of these data lies in the fact that the experiments are specifically related to reproductive health. This is important because if they also affected poverty through channels other than reproductive health, we would not be able to isolate the effects of reproductive health on poverty. The MDICP data include, in addition, other candidates for instruments pertaining to weather fluctuations, market price fluctuations and distances from health clinics and other services. These will be explored to see if they give additional power beyond the experiments, with overidentification tests to assure that these additional candidate instruments are independent of the unobserved variables in equation (1).

In what follows, we relate each of our hypotheses, H1 through H4, to the above framework and to the data that we will use in this research.

H1 & H2: $M$ is a 3x1 vector comprising an indicator of reproductive health, an indicator of breastfeeding practice, and an interaction between the two. The outcome variables, $y$, will include, successively, school enrolment, child labour supply and child nutrition; economic activities of the mother; household assets; consumption. The set of instruments are the randomised interventions of the MMP (women’s group participatory and infant feeding counselling). The sample includes the 48 clusters of the MMP. We will have three endogenous terms, which we can instrument thanks to the design of the MMP. We can think of the approach as making two way comparisons between the four randomisation clusters, each comparison estimating the causal impact of the relevant intervention or combination thereof. By controlling for other observed characteristics we improve the precision of estimation and by using all comparisons we can estimate the interaction effects between the interventions.

H3: $M$ denotes the HIV-infection status of the parent. The outcome variables, $y$, include child schooling, child nutritional status and child labour supplies. The instrument is the randomly assigned incentive provided to individuals to participate in VCT. This changes the uptake of VCT for reasons that are exogenous to the outcomes, providing the required variation to uncover the causal impact of VCT and of variables such as HIV that are affected by VCT. The sample includes the 2004-2006-2008 waves of data from the MDICP. The multiple rounds also permit using fixed effects to control for $f_{ih}$, as well additional instruments beyond the experimental variations such as weather variations for FE-IV estimates as noted above.

H4: $M$ denotes measures of information about reproductive health. The outcome variables, $y$, include contraceptive use and the HIV infection status of women. The instrument is the randomised women’s group intervention implemented in the MMP. The sample includes the 24 clusters in which women’s groups are implemented, whether alone or in conjunction with the infant-breastfeeding intervention, as well as the 12 clusters that were randomised out.

5. Other Issues. We need to collect new data to address research hypotheses H1, H2 and H4 because first, widely available datasets such as the Demographic and Health Survey, do not contain data on randomised interventions that influence reproductive health, and second, the original MMP data collection contains no information on household income, consumption and assets, and time use/economic activities of household members, which are critical for our research.

We will disseminate our research findings to academics through seminars and papers. We expect to publish academic papers in top-ranked economics- and health-oriented peer-reviewed journals. We will also write policy reports and will organise conferences to inform policymakers on the impact of reproductive health on poverty in SSA. By examining interventions designed to improve reproductive health, we will also shed light on their relative effectiveness.