Essays in Maternal Health and Human Rights: Evidence from sub-Saharan Africa

Amber Peterman

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Approved by:

Sudhanshu Handa, Ph.D.

Krista Perreira, Ph.D.

Kavita Singh Ongechi, Ph.D.

Gustavo Angeles, Ph.D.

Christine Piette Durrance, Ph.D.

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ABSTRACT

AMBER PETERMAN: Essays in Maternal Health and Human Rights:
Evidence from sub-Saharan Africa
(Under the direction of Sudhanshu Handa)

This compilation of essays focuses on programs, policies and emerging issues which center on gender equity and women's empowerment as broad themes within the larger realm of maternal health and human rights. The first essay explores effects of women's property and inheritance rights on women's long term economic welfare using a thirteen year panel from the Kagera region of Tanzania. The second essay examines contraceptive use and provision of family planning services and their effect on women's economic welfare, again using data from Tanzania. The third essay is a cross-country study (Malawi, Ethiopia, Rwanda and Uganda) examining contributions of trauma due to sexual violence and female genital cutting to the burden of gynecological fistula. The geographic focus of all three essays is sub-Saharan Africa, because women in this region are some of the most impoverished in the world, both in terms of classic measures of poverty and on dimensions of human rights. Motivation for examination of these topics is in part due to a lack of empirical evidence from an economic development perspective. The majority of previous analyses have been framed in a legal or human rights perspective, or limited in geographic and methodological application because of data constraints. It is my hope that this research will indirectly benefit women and their families in sub-Saharan Africa through increased knowledge, awareness and policy change.

To my grandmother Masuye Urata,
an incredible source of strength, love and inspiration;
You have always encouraged me to work for the underserved around the world.

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CHAPTER I: INTRODUCTION

Introduction

This dissertation focuses on programs, policies and emerging issues which center around two broad themes within maternal health and human rights: 1) gender equity and 2) women's empowerment. Although there is some overlap between these two concepts, they both relate to and have motivated distinctive components of my work. The dissertation is divided into three essays. The first explores effects of women's property and inheritance rights (WPIR), the second contraceptive use and provision of family planning (FP) services, and the third traumatic gynecological fistula due to sexual violence (SV) and female genital cutting (FGC). The geographic focus of all three essays is sub-Saharan Africa, because women in this region are some of the most impoverished in the world, both in terms of classic measures of poverty and on dimensions of human rights. Motivation for examination of these three topics is in part due to a lack of empirical evidence surrounding these issues from an economic development perspective. Previous analyses have been framed in a legal or human rights perspective, or limited in geographic and methodological application because of data constraints. It is my hope that this research will indirectly benefit women and their families in sub-Saharan Africa through increased knowledge, awareness and policy change surrounding what I feel are very important and inspiring issues. What follows is a brief explanation of the underlying themes identified above and a discussion of how they relate to each specific essay.

The first underlying goal of my dissertation is to consider programs and policies which have the potential to improve gender equity. Gender discrimination directly inhibits economic growth by making inefficient use of individual ability and limiting meaningful contributions of women. Broadly, gender discrimination can be defined as "any distinction, exclusion or restriction made on the basis of sex which has the effect or purpose of impairing or nullifying the recognition, enjoyment

or exercise by women…of human rights and fundamental freedoms in the political, economic, social, cultural or any other field (UN, 1976)." In recognition of the importance of gender aspects in development, programs and policies are increasingly incorporating gender-specific components as a means to improve overall human capital outcomes and reduce poverty. A more recent challenge is the vulnerability of women to the HIV/AIDS pandemic, reflected not only in terms of higher infection rates, but also in their role as primary care givers.[1] This complication further justifies the need for gender specific development policies to be considered and evaluated. WPIR considers a discriminatory dimension in which women are given unequal rights in comparison to men. Access to contraceptives gives women an equal say in childbearing, reproductive and human capital investment decisions, which increases power dimensions both within marriage and society overall. Finally, women bear an unequal burden of SV and FGC worldwide and in turn suffer unequal adverse consequences including the possibility of traumatic gynecological fistula. To the extent that examination and amelioration of the topics in my dissertation interact with gender equity, my research will promote decision making to facilitate women's wellbeing and poverty reduction.

The second underlying goal of my dissertation is to consider programs and policies which have the potential to enhance women's empowerment. Although women's empowerment has been conceptualized and measured in a variety of ways, it is often thought of as the ability of individual women to make life choices (Kabeer, 1999; Malhorta, Schuler & Boender, 2002). Empowerment as a process occurs when individuals who were previously disempowered or denied the ability to make choices subsequently acquire the ability to make life choices. Studies examining women's empowerment have been built around predictions that women with greater decision making ability and access to resources can seek and procure more favorable outcomes for themselves independent of other factors. The theme of improving choices for women is directly connected to each of my three

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[1] Women constitute nearly 60 percent of the more than 25 million people estimated to be living with HIV/AIDS in sub-Saharan Africa. In many places, HIV prevalence among girls and young women aged fifteen to nineteen is four to seven times higher than among boys their age (Walsh, 2005). In addition to low socio-economic status which fuels transmission, evidence suggests that women are biologically more likely to be infected than men (see Loewenson & Whiteside, 1997; WB, 1998:33-34).

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essays. For example, women who acquire property rights gain the ability to make choices to sell or transfer property, increase credit or decrease cash constraints, to control welfare and labor force outcomes. Similarly, women who have the ability to control their fertility through contraceptive use are able to strategically plan their education and work trajectories as well as other social and economic aspects of family life. Women who receive attention to medically and psychologically treat trauma gynecological fistula are better able to move forward to build a social and financial future for themselves. To the extent examination and research of these three issues will enhance women's empowerment, my dissertation research has the potential to increase knowledge around key issues for the welfare of women.

Benefits of women's empowerment and gender equity are not necessarily limited to women alone. A growing body of research has specifically examined outcomes among second generations and how transfers in human capital are made from mother to child. Improvements in health and human capital for women have been linked with favorable outcomes for children in a number of settings (see e.g. Duflo, 2000; Handa, 1999; Hoddinott & Haddad, 1995; Quisumbing & Maluccio, 2000; Thomas, 1997; Thomas, Strauss & Henriques, 1991). Therefore, the implications of my research do not pertain only to women, but will extend welfare outcomes to children and society in general.

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CHAPTER II: WOMEN'S PROPERTY RIGHTS AND GENDERED POLICIES:
IMPLICATIONS FOR WOMEN'S LONG-TERM WELFARE IN RURAL TANZANIA

> *"Women don't need property of their own.*
> *We take care of them…like we take care of our cows."*

(Male elder in Bagamoyo, Tanzania (Tenga & Peter, 1996))

Introduction

Programs and policies for economic development are increasingly incorporating gender-specific components as a means to improve overall human capital outcomes. The World Bank recently identified gender equality as both an objective in itself, as well as a key means to promote growth, better governance and reduce poverty (WB, 2001; WB, 2001a). The goal of gender equity is both significant and complex for public policy. In addition to marginalization due to socioeconomic status, women face a distinct and unique set of challenges, including reproductive heath and childcare concerns, discrimination and gender-based violence (Malhotra, Schuler & Boender, 2002). A more recent challenge is the vulnerability of women to the HIV/AIDS pandemic, reflected not only in terms of higher infection rates, but also in their role as primary care givers.[2] These complications further justify the need for development policies to be considered and evaluated as containing gender-specific elements.

Property and inheritance rights are one such realm in which women lag behind men. In sub-Saharan Africa and other regions where gender discrimination is widespread, claims have been made that restrictive customs and policies concerning property rights have hampered the economic

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[2] Women constitute nearly 60 percent of the more than 25 million people estimated to be living with HIV/AIDS in sub-Saharan Africa. In many places, HIV prevalence among girls and young women aged fifteen to nineteen is four to seven times higher than among boys of the same age group (Walsh, 2005). In addition to low socio-economic status which fuels transmission, evidence suggests that women are biologically more likely to be infected than men (Loewenson & Whiteside, 1997; WB, 1998).

advancement of women. However, despite an abundance of qualitative evidence, there is almost no quantitative evidence surrounding women's property and inheritance rights (WPIR) and their relationship to human development indicators in sub-Saharan Africa. As with many claims which appeal to human rights arguments, critics may argue that adverse effects of restrictive WPIR are built on the exhibition of the worst case scenarios and that these effects are not relevant or significant for women as a group. This paper seeks to provide preliminary empirical evidence exploring claims concerning WPIR and economic outcomes for women using the Kagera Health and Development Survey (KHDS), a longitudinal panel from rural northern Tanzania collected over 13 years from 1991 to 2004. The panel nature of the data offers a unique opportunity to examine long-term effects of WPIR, which are commonly excluded from micro-level quantitative examination in developing countries due to data constraints. Using a baseline cross-section, results indicate that women who live in communities with high WPIR are more likely to engage in non-agricultural, self-employed work and have higher savings, individual and household-level expenditures. When extended to an individual-level fixed effects model using panel data controls for individual-level time invariant endowments as well as attrition using the inverse probability weighting method (IPW), results indicate that women who live in communities with high WPIR are more likely to be employed outside the home and have higher earnings. Overall, these effects are not sub-group specific to women who are less educated, poorer, or who have experienced widowhood or divorce. In addition to individual outcomes, household-level outcomes for total expenditures and savings are examined to ascertain if individual gains for women result in fewer gains for other household members or are indicative of greater overall welfare within households. Results show that although WPIR is associated with higher household expenditure using a cross-sectional model, this finding does not carry over to individual fixed-effects models that control for women's time invariant heterogeneity. These findings suggest that WPIR restrictions placed on women in Kagera significantly hinder the economic advancement of women and that similar situations are likely in other sub-Saharan African countries.

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Background and significance

Gendered development and WPIR in sub-Saharan Africa

There is significant evidence of gender-based discrimination concerning land and property rights across sub-Saharan Africa. The majority of this literature takes the form of qualitative research, case studies, institutional analysis, anecdotal evidence and popular press and is framed using a human rights or legal perspective (e.g. COHRE, 2003; LaFraniere, 2005; Manji, 2000; Sossou, 2002; Walsh, 2005; HRW, 2003). Documentation in these frameworks typically highlights the social and psychological suffering women are forced to endure due to cultural and ritual practices surrounding WPIR, especially in the context of widowhood. In general, legal examination of WPIR invokes an equity argument and references the many international conventions and declarations which uphold women's rights to property and equal treatment by law.[3]

More recently, property rights have been examined using an economic development framework. One of the most visible supporters of property rights for economic development is Peruvian economist Hernando de Soto. In his 2000 book, *The Mystery of Capital*, he claims that poverty is created and maintained by the way in which poor people are excluded from the legal system, including rights to property created by Western capitalism (de Soto, 2000).[4] Evidence of how lack of property rights harms the general poor can easily be extended to women as an alternative sub-group. In fact, a growing sub-field of development economics examines how women's lack of access to inputs and resources like land, as well as their disadvantaged bargaining position results in negative economic and health outcomes (Agarwal, 2002 and Chadha, 1992 in India; Zwarteveen & Meinzen-Dick, 2001 in South-East Asia). For example, in her influential book, *A Field of One's Own*,

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[3] See for example the 1966 'International Covenant on Economic, Social and Cultural Rights,' the 1979 'Convention on the Elimination of All Forms of Discrimination against Women,' and more recently the 'Women's Declaration on Population Policies,' the 1995 'Beijing Platform for Action,' and the 2003 'Commission on Human Rights Resolution 2003/22 on Women's equal ownership, access to and control over land and the equal rights to own property and to adequate housing.')

[4] De Soto's solution is to formalize all informal use of land, giving poor the ability to use property as collateral to obtain loans and to further invest funds.

Agarwal (1995) uses India as a case-study to argue that land rights for women are good for economic efficiency, welfare, equity and empowerment. As a basic argument, access to, ownership of and control of property are fundamental determinants of secure livelihoods. These 'privileges' provide a place to live, a site for economic and social activity as well as collateral for credit, other resources and services. However, in developing countries, women's rights to land and tenure are often thought of in the context of their relation to men: as wives, daughters, mothers or sisters (Gray & Kavene, 1999). Even if women have rights to use land, they are typically limited in their ability to transfer, sell, designate an heir for and loan land to other parties. Although WPIR have been examined from an economic development perspective, there is a lack of empirical work, both on the determinants and the effects of restrictive WPIR. Part of this difficulty stems from the fact that WPIR in rural areas are often outside the reach of traditional legal structures and therefore necessitate data collection of customary law at the community level in addition to individual-level outcome measures.

Ironically, economic development in and of itself cannot guarantee improvements in property rights for women, especially in rural regions. Using case studies, Gray and Kavene (1999) claim that in many regions of sub-Saharan Africa, women's land rights have actually eroded with the introduction of new crops, improved transportation and agricultural development including irrigation projects and new farming techniques. This view is supported by Tripp (2004) who asserts that individual men and corporations (dominated by men) have increasingly challenged women's rights because they are better situated to take advantage of the economic gains from increased land value due to technological improvements. Women are disadvantaged in the market systems of property ownership, either because opportunities to buy land are very limited or because local level authorities discriminate against women, preventing them from claiming land which in theory should be upheld by law (Lastarria-Cornhiel, 1997; Whitehead & Tsikata, 2003). The same instability is often exhibited when legal titling schemes are introduced. This evidence reinforces the need for gender sensitive development policies, without which there exists the potential to adversely affect marginalized groups such as women.

Despite the link between WPIR and women's welfare in popular press and qualitative

literature, there is limited empirical work supporting this claim. However, several studies have

examined women's actual ownership of property rather than WPIR. For example, Allendorf (2007)

uses population-level data from Nepal to show that women who own land are more likely to have

high decision-making power and less likely to have underweight children. Similarly, Mason (1998)

finds that women who own land in Thailand and India are more likely to have high economic

decision-making power in a study of five Asian countries. Deere and colleagues (2005) examine

rural households in Paraguay and Peru and conclude that households in which females have land

ownership have higher total household income in Peru and higher non-farm income in both countries.

Using data from Chandigarh, India, Datta (2006) finds that joint titling of housing increases, among

other things, bargaining power of women as well as respect they receive from their spouses. Also in

India, Panda and Agarwal (2005) find women with immovable property (land or house) are less likely

to experience physical or psychological marital violence. However, none of these studies deal with

potential endogeneity issues surrounding individual-level asset ownership and welfare outcome

measures, which are likely to be jointly determined. This paper addresses endogeneity by examining

community-level outcomes and changes over time which are less likely to suffer from the same biases

with respect to individual-level outcome measures.

WPIR in the context of HIV/AIDS

The examination of WPIR is especially crucial in the context of HIV/AIDS. Strickland

argues that when women are barred from owning property, they are unable to secure resources that

would allow them to improve their chances of preventing infection, even before the dissolution of a

marriage or death of her spouse (a conceptual diagram from Strickland, 2004 traces out pathways

between WPIR and household level consequences of HIV/AIDS and is included as Figure A2 in the

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Appendix).[5] For example, lack of rights within a marriage may increase women's vulnerability to

domestic violence, unsafe sex, and other HIV related risk factors. It is believed that HIV/AIDS has

exacerbated the issue of woman's rights for two reasons: 1) the epidemic is placing more women and

children in the situation of widowhood at a younger age than before; and 2) the specific manner in

which HIV/AIDS impoverishes a household means that upon finding herself a widow, a woman has

few resources left with which to resist outside pressures exerted by the clan or members of the

extended family regarding inheritances (Drimie, 2002).[6] In addition, widows may face several

customary practices such as widow inheritance or cleansing in which sexual activity is often

unprotected and coerced (Walsh, 2005).[7] Widow inheritance refers to the practice when a male

relative of the dead husband takes over the widow as a wife, often in a polygamous marriage.

Although variants of the practice exist within tribes, cleansing usually involves sex with a social

outcast, supposedly to cleanse the woman of her dead husband's evil spirits. In this practice, sex is

often forced and protection is rarely used, as the cleansing is not thought to be valid unless semen

enters the woman (Walsh, 2005). Consequences for the spread of HIV/AIDS are especially relevant

if the male regularly engages in cleanses with many widows, as is often the case in small

communities. Given the associations between property rights and women's ability to make

economically motivated choices, it is not surprising that lack of WPIR has been cited as fueling the

HIV/AIDS epidemic and as a major issue surrounding rural economic development and poverty

(Krishnan et al., 2008; Walsh, 2005).

The Setting: Republic of Tanzania

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[5] Despite population-level poverty being viewed as a risk factor for HIV/AIDS, there is considerable debate as to the relationship between resources, wealth and HIV within a given resource poor country. See e.g. Piot, Greener & Russell, 2007, Mishra et al., 2007 or Bingenheimer, 2007 for overviews and evidence.

[6] For example, AIDS related losses can reduce African household incomes by up to 80 percent, food consumption by 15 to 30 percent and primary school enrollment by 20 to 40 percent (Whiteside, 2002).

[7] However, it should be noted this practice is increasingly being abandoned where the death of the husband is thought to be caused by AIDS (UNAIDS, 1999).

Formed in 1964, the United Republic of Tanzania occupies the largest land area of any country in East Africa and is home to over 38 million inhabitants (WB, 2006). The country borders with eight countries, Kenya and Uganda to the north, Burundi, Rwanda and the Democratic Republic of Congo to the west and Malawi, Zambia and Mozambique to the south. Although enjoying relative political stability, Tanzania ranks among the poorest countries in the world. The per capita GNI was 340 USD [8] in 2005 and over 35 percent of the population on mainland Tanzania was below the national poverty line at the most recent measurement in 2000 (WB, 2006).[9,10] In 2001, Tanzania ranked 160 out of 175 on the Human Development Index collected by the United Nations Development Programme (UNDP) at a value of 0.4, below the average value for sub-Saharan Africa (UNDP, 2003).[11] In addition to overall measures of poverty within the population, women as a social group in Tanzania face particular hardship. Tanzania ranked 130 out of 144 countries on the UNDP Gender-Related Development Index, at a value of 0.396.[12] This inequity is further seen in Tanzanian outcomes for proxy indicators of women's status such as the maternal mortality ratio and women's labor force participation. According to estimates by the WHO, UNICEF and UNFPA, Tanzania had the world's sixth highest number of maternal deaths during 2000 (at an estimated 21,000 maternal deaths), putting a woman's lifetime risk of maternal death at approximately one out of 10 women (UNDP, 2003). The majority of working women (approximately 72 percent) are involved in

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[8] The per capita GNI (Gross National Income) are converted into USD using the Atlas method. This takes into account GDP plus the net flows from other factors (rents, profits, and labor income) from abroad. The Atlas method smoothes exchange rate fluctuations by using a three year moving average, price-adjusted conversion factor (WB, 2006).

[9] The poverty measures were calculated using the Household Budget Survey 2000-01 and the Integrated Labor Force Survey 2000-01, the poverty line refers to the national basic needs poverty line (United Republic of Tanzania, 2003).

[10] Poverty levels differ between urban and rural residence. The proportion of poor living in urban areas is 13 percent, while the proportion poor living in rural areas is 87 percent (United Republic of Tanzania, 2003.)

[11] The Human Development Index is made up of the average achievements in life expectancy at birth, adult literacy, combined primary, secondary and tertiary enrollment ages and gross national income.

[12] The UNDP measures gender inequality by using the unweighted average of three component indices: 1) life expectancy, education and income. Its gender-related development index (GDI) ranges from 0 (lowest gender equality) to 1 (highest gender equality).

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agriculture, primarily working family owned land (TNBS, 2000). The remaining working women are employed in unskilled labor and manual jobs (20 percent). Only two percent of working women hold professional, managerial or technical jobs. According to the ILO, structural adjustment during the late 1980's and early 1990's are thought to have worsened gender inequality in access to employment and economic activities, especially in the formal sector (ILO, 1997). With respect to welfare outcomes, evidence suggests that overall indicators lag relative to neighboring countries and also the relative position of women in Tanzania has not been improving.

WPIR in Tanzania

Tanzania is in a unique position to evaluate the effects of changing WPIR. In 1999, Tanzania passed one of the most radical land laws in Africa.[13] The law shifted land administration to the village level, where each community is in charge of registration, adjudication, titling and land disputes (Tripp, 2004). This was done primarily to prevent outside appropriation of land and keep all disputes in communities internal and secondarily to promote the operation of a market in land rights. In addition, the reforms stipulated that women are to be represented in the land administration bodies and protects women's rights to co-ownership of land as well as the individual right to acquire, hold, sell and use land.[14] These concessions were the result of much advocacy and public debate lead by the Gender Land Task Force (GLTF), a coalition of women's rights NGOs and associations coordinated by the Tanzania Women Lawyers Association (TWLA) (for full discussion of advocacy and public hearings concerning the Acts of 1999 see Tsikata, 2003).

Historically, the Tanzanian government did not give rural populations and women full access to land and property. Originally Tanzania's administration and law governing bodies reflected proprietary laws established during British colonization, similar to East African neighbors Kenya and

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[13] The reforms begin with the appointment of the Presidential commission on Land Matters in 1991 and resulted in the passage of the Land Act and the Village Land Act in 1999. The commission made recommendations in three broad areas: 1) policy and questions of law; 2) administration and adjudication of disputes and 3) gender equity. For detailed description of the reform process see Tsikata (2003).

[14] The Village Land Act specifies that the Village Council govern land related issues, of which at least one third of its total of 25 members should be women (Walker, 2002).

Uganda (Walker, 2002). Independence resulted in the forced resettling of people into *ujamaa* villages in the late 1960's and early 1970's, set up around collective agriculture (Ikdahl et al., 2005). In theory, the equity ideology rooted in collective farming included all community members, however, in practice did little for women's property rights. In the late 1970's, this policy was abandoned and through the 1980's land laws were in a constant state of confusion due to ambiguous and contradictory laws, poor administration, dual allocation of land rights and the historical villagization process (Ikdahl et al., 2005). The current Land Acts are a result of both internal and external pressure for land reform due to insecurity and the desire to facilitate a market for land rights.

In addition to laws governing land rights, women are concerned with general marriage laws and rules regarding the transfer of assets in the case of marriage dissolution through divorce or death. Despite the existence of a colonial 'rule of law,' prior to 1971 family law in Tanzania was essentially governed by custom or religious beliefs of various communities. In 1971, Tanzania enacted The Law of Marriage Act, aimed at providing uniformity in marriage and divorce and recognizing equity between husbands and wives (Mtengeti-Migiro, 1997). The Law of Marriage Act also allowed women to hold and sell property, and to be sued in their own name (Tenga & Peter, 1996). Although the act was seen as advancement for Tanzanian women, it did not make clear exactly what a woman would receive upon divorce or death of her husband.[15] For example, woman's rights were retained for any property she may have brought to the marriage; however, there is ambiguity as to whether unpaid labor including improvements to land, subsistence farming, housekeeping, or childcare constitutes contributions to marital assets or are simply 'wifely duties' (Mbilinyi, 1972). Although on paper, women have strong rights to land and possessions, it is widely agreed that considerable resistance and interpretation of the law occurs, especially in rural areas where customary law is strong or where populations lack knowledge about their rights concerning land and property.

Impact of WPIR on women's welfare: A conceptual framework

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[15] For example, the Law of Marriage Act set a minimum legal age of marriage of 15 for women and 18 for men. In addition, it required registration of marriage and provided legal terms for divorce for the protection of the family members. See Tenga & Peter, 1996 or Mtengeti-Migiro, 1997 for further discussion of terms included.

Economic models of household production exploring determinants of labor force participation, time use and expenditure behavior have been widely utilized to guide empirical work in developing countries (see Strauss & Thomas, 1995; 1998; Behrman & Deolalikar, 1988; Juster & Stafford, 1991 for reviews). These models are rooted in Becker's household production framework in which households allocate time and goods to produce a range of market and non-market commodities (Becker, 1965). Household utility is maximized subject to a variety of constraints (time and technology) to recover reduced-form demand equations for all inputs in the production function. These reduced form equations map demand for employment, time allocation or certain commodities to exogenous inputs at the individual, household and community level.

For example, following Beegle (2005), time demand for individual woman i in activity j (for example, working her own land) can be modeled as the following reduced form demand equation:

$$(1)\ T_{ij} = T_{ij}\ (T_t,\ p_m,\ p_h,\ w_i,\ A_i,\ v_i,\ v_{ij}\ |\ Z);$$

where T_{ij} is total time or hours spent working on her own land, T_t is total time available, p_m and p_h are vectors of prices for market and home-produced commodities, w_i is the wage rate, A_i are assets or unearned income, v_i are unobservable individual-level characteristics, v_{ij} are exogenous environmental characteristics, conditional on Z, a set of individual level tastes and preferences. As previously mentioned, similar reduced-form demand equations may be constructed for other outcomes.

Before extending the model to incorporate WPIR, it is first important to distinguish between potential interpretations of the indicator. The natural interpretation of the indicator is a direct representation of inheritance and property rights. Under this interpretation WPIR have the potential to *indirectly* affect all women though current and future expectations surrounding accumulation and ownership of assets. Further, restrictive WPIR would be expected to *directly* affect a subset of women who are widowed, divorced or separated through actual reduction in assets. However, it is also possible the indicator of WPIR may also represent general gender discrimination in a given community, in addition to or inclusive of inheritance and property rights issues. Under this

interpretation, WPIR may be a proxy measure for, among other things, community-level tastes and preferences for gender equity, women's decision-making power and autonomy, or other gender-specific policies. In this scenario, WPIR would be expected to broadly affect women and girls of all ages though a number of pathways discussed below. This more broad interpretation has the advantage of including alternative dimensions of gender discrimination which we may want to capture, while the first definition is more specific and amenable to policy recommendations.

Under these two interpretations, there are a number of pathways through which WPIR may enter into individual reduced-form demand equations. If we consider the second interpretation, WPIR could affect time use through exogenous environmental characteristics v_{ii}, the wage rate w_i, or unobservable individual level characteristics v_i. For example, due to gender discrimination, women may have received less education and thus be unable to perform certain jobs such as professional occupations, thus diminishing v_i or individual endowments. Alternatively women could receive a lower wage on average than men working in similar occupations because their time is less valued in comparison to male counterparts, thus WPIR would enter through v_{ij}. However, if we consider the first interpretation, it would be expected that the main and dominating effect would be through A_i or unearned income. Because assets in this case represent large and meaningful contributions to the woman's income source (for example, land) and security (for example, housing) the effect is expected to be large and significant. In addition to income effects, lack of property rights and widow inheritance specifically are expected to enter into the reduced form equations as they have the potential to increase vulnerability to domestic violence, unsafe sex, and other HIV-related risk factors (recall discussion in Section B5).

Data: Kagera Health and Development Survey

Sampling strategy

The KHDS were originally part of a joint research project titled the "Economic Impact of Fatal Adult Illness from AIDS and Other Causes in Sub-Saharan Africa" launched by the Population

and Human Resources and Africa Technical Department of the World Bank (WB-DRG, 2004).[16] The

Kagera region is located to the west of Lake Victoria bordering Rwanda and Burundi to the east and

Uganda to the north. The region is primarily rural and is home to over two million people, divided

into five administrative districts (TNBS, 2002). [17] In Kagera, adult mortality is higher than would be

expected because of the early spread of HIV/AIDS in the area around Lake Victoria. The first case of

AIDS in Tanzania was identified in Kagera in 1983, although experts conjecture that HIV was present

in the area at least a decade earlier (WB, 2004). The area is a hub for long-range commerce between

the East African coast and Central Africa and was heavily affected by the war between Tanzania and

Uganda in the late 1970's. More recently, it has been the site of refugee camps for those fleeing from

conflicts in Rwanda and Burundi.

The KHDS interviewed 816 households in 51 communities over four passages at seven

month intervals between 1991 and 1994 and again in 2004 (WB-DRG, 2004; see Figure A1 in the

Appendix for location of clusters within Kagera). Special concern was given to tracking and re-

interviewing respondents in an attempt to understand economic mobility and changes in living

standards induced by or affecting migration choices. The household sample was randomly selected,

stratified on geography, community adult mortality rates[18] and indicators at the household level that

were thought to be predictive of future adult deaths. In the first stage, 550 primary sampling units

(PSU) in Kagera were classified according to four agronomic zones[19] and either a high or low level of

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[16] The research project is also known as the Economic Impact of Adult Mortality (EIAM) Study. Funding was
provided by the World Bank Research Committee, the United States Agency for International Development
(USAID) and the Danish Agency for Development Assistance (DANIDA) (WB, 2004).

[17] The five districts are Bukoba, Muleba, Karagwe, Biharamulo and Ngara.

[18] Community adult mortality rates were taken from the 1988 census and a subsequent enumeration for the
survey (WB-DRG, 2004).

[19] The four agronomic zones were selected to suggest characteristic agricultural patterns: 1) tree crop zone (low
fertility soils in areas of high rainfall where main crops are bananas, coffee and tea, in the northern part of
Kagera), 2) riverine zone (alluvial and colluvial soils considered high potential, but requiring flood control,
main crops are cereals, sugarcane, rice and legumes, in the middle region of Kagera) 3) annual crop zone (soils
of low to medium fertility with moderate potential and lower rainfall, main crops are groundnuts, cassava,

adult mortality. Clusters of households were randomly drawn from each PSU, stratified on agronomic zone, with a probability of selection proportional to population. In the second stage, households were classified as either 'sick' or 'well.'[20] Approximately sixteen households were selected at random from each cluster, fourteen from the 'sick' and two from the 'well' group (see WB, 2004 or Beegle, DeWeerdt & Dercon, 2006 for further discussion of sampling procedure). The KHDS questionnaires were modeled after the World Bank's Living Standards Measurement Surveys and collected extensive, detailed information on household income, consumption, expenditure, individual economic activities, education and individual health status (including the height and weight of all household members). In addition, matching community modules were administered at local markets to gather price information and at local health and education facilities.

Organization of data

The baseline rounds of the KHDS (1991 to 1994) are divided into four waves, corresponding to the sequence of interviews administered to each household, and four passages, corresponding to the year of the data collection. For example, a woman interviewed for the first time in the last data collection in 1994 corresponds to wave 1, passage 4, whereas a woman interviewed for the fourth time in the last data collection corresponds to wave 4, passage 4. The baseline for this analysis comprises the intersection of the four waves of data. To optimize panel size and length between interviews, data for each woman was taken from the first wave, regardless of when the interview was or how many times she was interviewed. The resulting cross-section is comprised of majority passage 1 interviews (74 percent), an additional ten percent from each passage 2 and 3 and six percent from passage 4 interviews. Note that the sample is limited to women between the ages of 15 and 55 in the baseline. This is done to purposefully limit the sample to adult women who may be responsible

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cotton and cereals, in the southern part of Kagera) and 4) urban zone (town of Bukoba, the capital of Kagera plus additional urban communities) (WB-DRG, 2004).

[20] 'Sick' households were those who either had an adult death (aged 15-50) due to illness in the last year or an adult too sick to work at the time of the survey or both. 'Well' households were all others with no recent deaths or sick members (WB-DRG, 2004).

for economic decisions and produce valid labor force and expenditure indicators. Community characteristics were matched with each woman from contemporaneous passage indicators. The end-line data was collected in one wave starting in early 2004, resulting in a panel length of approximately 13 years.

Attrition

A potential threat in analyzing any longitudinal data is attrition bias. Surveys fielded in developing countries are particularly susceptible to high levels of attrition due to highly mobile populations, incidence of disease and exogenous shocks such as drought or civil conflict. In a review of attrition in longitudinal data from developing countries, Alderman and colleagues find attrition rates between six to 50 percent between survey rounds, or 1.5 to 23.2 percent attrition per year (Alderman et al., 2005). In the KHDS, of the total baseline sample of adult women (N = 1,480), approximately 50.9 percent or 3.9 percent per year are lost to attrition over the panel period. Due to the special attention to tracking and adult mortality built into the survey design, it is possible to assign causes to much of the attrition. Of the total attriters, approximately 15.8 percent were lost to mortality, while 33.4 percent lost to movement out of sample communities (see Beegle, De Weerdt & Dercon, 2006a for detailed description of re-interview rates among the full sample).[21] If attrition occurs randomly, then the estimation strategy does not need to address selection explicitly, however, some efficiency may be lost due to reductions in sample sizes. However, since the KHDS was designed to over-sample households in communities with high levels of mortality and since populations are highly mobile, it is unlikely that attrition in this case is random with respect to the outcomes of interest. For example, it may be expected that women who experience mortality over the sample would have had the worst welfare outcomes had they lived. If restrictive WPIR contribute to mortality, then not accounting for selection may lead to an underestimation of the effect of WPIR. Likewise, if women who would have otherwise had the best welfare outcomes have migrated out of

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[21] Note that many of the women who moved out of sample communities are re-interviewed in KHDS (approximately half), however since they have no community-level variables including WPIR, they cannot be included in the sample and are treated as attriters.

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the sample and having high WPIR helped facilitate the move, the effects of WPIR will be underestimated. However the directions of these associations are unclear. For example, it could also be imagined that in certain cases, poor WPIR could result in a woman being stripped of her possessions and forced to migrate back to her birth family or seek other opportunities. Finally, migration and mortality may be related, for example, households may migrate as a coping or preventative strategy when facing illness or after experiencing mortality. Due to the unclear direction and magnitude of these biases, a careful and explicit treatment of attrition is necessary for the subsequent welfare analysis.

To investigate the extent of non-random attrition, two tests are conducted. First, a comparison using simple t-tests is made on the distributions of individual and community-level observables between the attriters and non-attriters in the baseline. Second, an alternative of the BGLW test is performed in which outcome variables are predicted in the baseline as a function of baseline control variables and an indicator for future attrition (Becketti et al., 1998). The attrition indicator shows whether or not bias exists controlling for observables (in other words, whether or not bias is non-ignorable; see Alderman et al., 2005 for explanation and notation of testing for attrition). The results of these two tests are reported in Tables A1 and A2 in the Appendix. The t-tests in Table A1 show that there is significant correlation on a number of observed variables between attriters and non-attriters, however, the BGLW tests summarized in Table A2 show that attrition may only be an issue for modeling employment outside the home and earnings.

Estimation strategies and variables

The estimation procedure follows four steps described below. First, determinants of WPIR at the community level are explored using the baseline pooled cross-section to identify key characteristics of communities which are initially implementing high levels of WPIR. Second, a re-interview model is estimated to obtain the probability of being interviewed in the 2004 end-line survey. Third, a model predicting economic outcomes at the woman level is developed to examine how community-level WPIR may influence individual welfare. This model is estimated using a

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baseline cross-section of all women, as well as a fixed effects model over the panel period among a reduced sample of women who appear in both rounds. Finally, the fixed effects model examining welfare outcomes is adjusted for non-random attrition using the inverse of probability weighting method (IPW). A number of extensions are explored to assess the robustness of findings.

Trends and community-level determinants of WPIR

Although sample size limits the potential to model complex relationships, understanding trends and correlates of WPIR on a community-level is a useful exercise for several reasons. First, it will indicate if, when and where WPIR are changing. Second, it will aid in making policy prescriptions. For example, if determinants such as economic indicators are associated with WPIR, community development initiatives may aid in liberalizing WPIR through increased presence of legal structures and increased education of the population. In contrast, if WPIR are significantly associated with tribal or ethnic group majorities, this may indicate the important role of custom and require a more structured intervention to promote change. If this is the case, understanding which cultural groups lag behind others is also valuable information for targeting interventions or providing legal services. In addition, it will help in clarification of the exogeniety assumption surrounding WPIR.[22] In this analysis, an assumption is made that WPIR are exogenous to each individual woman and are rather choice variables at the community. Therefore, significance of community-level determinants of WPIR will add evidence to this claim.

The model to examine community-level determinants of WPIR is as follows:

$$(2) \; \Pr (High \; WPIR_c = 1) = f(T, \textbf{Status}_c, \textbf{Custom}_c, \textbf{Economic}_c);$$

High WPIR is a function of time of survey, women's relative status in the community, custom or traditions and economic development. The equation will be estimated using linear probability models (LPMs) among a pooled sample of all five cross-sections containing 51 communities (four baseline

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[22] For example, it could be argued that WPIR is a choice variable on the individual women level. This would occur if specific women or groups of women try to influence or change WPIR. If this is the case, a problem would arise if these women with high WPIR would be expected to have better economic outcomes on average than women in communities with poor WPIR because of correlated unobservables at the individual level.

waves plus 2004 follow-up).[23] Each community-level survey was administered to a group of village

leaders who had the most knowledge about various community administrative, economic, health, or

social issues.[24] To indicate women's status, a variable is constructed indicating the proportion of

community 'experts' who were women. It is expected that communities in which women are given

equal voice and respected as knowledgeable leaders will call upon a higher proportion of women to

respond to survey questions in comparison to communities who assign less importance to women.

The vector of custom variables refers to majority ethnic groups and religious groups in the

community, while the vector of economic variables refers to indicators of general development of the

community (see Table A3 in the Appendix for descriptive statistics of community-level control

variables).

The four WPIR indicators utilized in the analysis are collected in each round of all 51

surveyed communities.[25] The key element is the nature of self report, meant to indicate the actual or

de facto rights of women, as opposed to the legal or political, *de jure* mapping of WPIR (see Kabeer,

2001 for discussion of necessity of including *de facto* rights in empirical studies).[26] Table 2.1 shows

the community-level (top panel) and individual-level (bottom panel) distribution of WPIR over the

survey period. In addition to the baseline (column B) and end-line observations (column C), the 2004

survey asks a retrospective question which asks community leaders to 'recall' what was customary

approximately 20 years earlier (or 10 years prior to the baseline). These indicators are included in

column A for examination of trends only, as they are likely to include substantial recall bias in

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[23] For consistency between cross-sectional and panel specifications, all binary models are estimated using LPMs. Parallel analysis using probit models do not change results.

[24] For example, a minimum of three experts representing the most knowledgeable people in the following areas were called: births, deaths and migration (suggested village secretary/chairman), economic activities (suggested community development officer), education (suggested chairman of education committee), health (suggested chairman of health committee), agriculture and livestock, cultural practices (WB, 2004).

[25] In actuality 49 survey instruments were filled at the community level, two of which represented two clusters each for a total of 51 community clusters (WB, 2004).

[26] The answers to WPIR questions are asked to the group of experts as described above. When there was disagreement among the experts, the majority opinion was honored (WB, 2004).

comparison to contemporaneous responses. All WPIR indicators make significant improvements over the two decades. For example, the percentage of women living in communities where it was customary for a woman to inherit land after a husband's death increased from zero in the pre-panel period, to 45 percent in the baseline to 88 percent in the follow-up. The practice of widow inheritance decreases with 33 percent of women exempt from inheritance in the pre-panel period, 63 percent exempt in the baseline to 94 percent in the follow-up.[27] Similar trends are found for the remaining indicators and individual-level distributions closely map those found at the community level. The key policy variable termed 'high WPIR' is reported at the bottom of each panel and equals one if all four policies are also equal to one (thus the wife can inherit land, house, and assets and is not subject to inheritance herself). The percentage of women living in communities with high WPIR is 22 in the baseline and increases to 81 percent in the end-line.

In addition to the main trends reported in Table 2.1, it is also interesting to fill in some auxiliary descriptive variables concerning WPIR. Overwhelmingly, in 90 percent of end-line communities, respondents report that 'clans' typically settle inheritance matters, while other responses include family members (six percent), the community (two percent) and other sources (two percent). Over half of communities report inheritance disputes in the past year and the average number of disputes among this group is approximately 3.6 with a maximum of 15 reported disputes. It is interesting to note that in communities with high WPIR as defined above, the reported number of disputes are fewer (approximately 1.7) versus those with low WPIR (approximately three). This indicates that situations in which women are potential victims of property rights abuses, challenges and disputes are more likely to arise, than in cases in which women are given property and challenges arise from other family seeking to recover inheritance.

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[27] Passages 1 and 2 in the baseline did not ask this question in the community questionnaire. Therefore indicators of exemption from widow inheritance for women in these passages were replaced with the value for Passage 3. In either case, this represents a value collected approximately six months to 12 months after individual level outcomes. Although it is unlikely for the indicator to have changed for a significant portion of the sample, it would result in an underestimation of the change over the panel period and would tend to bias results toward zero or no significant affect of WPIR as a whole.

Re-interview model

As discussed in the previous section, it is likely that the data suffer from non-random attrition over the panel period. The IPW method is implemented to overcome the selection bias using a fixed effects model and parallel normal fixed effects models are run for comparison (see Wooldridge, 2002 for overview; Wooldridge, 2001 for in-depth examination of assumptions; Jayne & Yamano, 2005 for application in economic framework). In the first stage, the IPW method uses a set of excluded variables, for example, denoted 'Z' to predict re-interview (or non-attrition) in addition to control variables in each time period (in this case only the follow-up, 2004). In the second stage, the inverse of this probability is used to weight all observations in the end-line. The IPW method makes the assumption that observed variables 'Z' exist which are strong enough predictors of re-interview that the relationship between controls and outcomes in subsequent periods are independent of attrition selection. In other words, the IPW method assumes that Z variables soak up any significant unobservables which may predict attrition selection and be correlated with outcomes of interest. Under these conditions, Wooldridge shows that the IPW method is a consistent estimator of population parameters and can be applied to cases with binary outcomes (Wooldridge, 2001).

To predict re-interview, several Z variables are used at the household and community-level which are theoretically and statistically valid predictors of attrition due to mortality and/or mobility: 1) indicator of presence in all four rounds of the baseline (1991-1994), 2) indicator of daughter of household head, 3) lagged community-level proportion of adult deaths due to illness and 4) community-level price per tablet of pharmaceuticals.[28] It is expected that variable 1 will be positive predictor of re-interview, households which have a stable residence will be more likely to stay in the

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[28] The pharmaceutical in name is paracetamol, an aspirin substitute. Other pharmaceuticals were tested in the model but were dropped because of their low correlation with re-interview. In addition, following Beegle, De Weerdt & Dercon (2006), alternative relationships to the household head and indicator of child living elsewhere were also tested as potential predictors of attrition and found to have no correlation with re-interview. Note that Beegle and colleagues are only instrumenting mobility and therefore these mentioned variables have increased validity for their analysis versus this analysis. Additionally mortality related enumeration rates connected with sample selection as well as shock variables at the community level (drought, flood, etc.) were tested and also found to lack statistical power with the inclusion of other Z variables and controls and were therefore are not utilized.

same area, rather than out-migrate. It is expected that variables 2, 3 and 4 will be negative predictors of re-interview. Daughters of household heads who are still living at home are subject to future marriage and movement out of the household. In addition, women in communities with higher adult death rates due to illness or with higher costs of treatment are more likely to experience mortality over the panel period in comparison to those with comparably low incidence of illness and costs of treatment. The re-interview model can be written as follows:

$$(3) \ \Pr(R_{i, \, 2004} = 1) = f(\mathbf{Z}_{i, \, 1991}, \mathbf{X}_{i, \, 1991}, \mathbf{X}_{c, \, 1991});$$

where the probability of re-interview (woman has not died or moved out of the sample) is a function of the Z variables listed above and vectors X of individual and community-level characteristics including WPIR. All control variables at the individual and community level which are used in the subsequent analysis estimating determinants of women's welfare are included in the re-interview model. Not only should all determinants be good predictors of re-interview (as measured by the R^2 value) but in addition the Z variables should be jointly significant (rule of thumb, Wald test value above 10). The model above is estimated using a LPM specification and the recovered predicted probability is applied as an inverse weight to the models estimating women's welfare discussed below. Descriptive statistics of the $\mathbf{Z}$ variables are given in Table A4 in the Appendix.

 Estimating determinants of women's welfare

Predictions of women's welfare are guided by the reduced-form demand equations described in section C and can be written as follows:

$$(4) \ \Pr(Employed_{i, \, 2004\text{-}1991} = 1) = f(High \ WPIR_{c, \, 2004\text{-}1991}, \mathbf{X}_{i, \, 2004\text{-}1991}, \mathbf{X}_{c, \, 2004\text{-}1991});$$

In the above specification, the probability of being employed is a function of community-level WPIR, individual characteristics and other community-level controls. The model is estimated for each welfare outcome first using OLS and LPMs among the working sample baseline cross-section. Subsequent analyses extends the model to include the 2004 round using individual-level fixed effects and fixed effects adjusted for attrition using the IPW method as discussed above. Individual-level fixed effects have the advantage of controlling for heterogeneity due to fixed factors such as initial

endowments (for example, cognitive ability) or time invariant behaviors (for example, work ethic or preference for savings) which may affect outcomes.[29] Due to sample size, binary outcomes cannot be estimated using non-linear models as all observations which do not change over time are dropped.[30] The vector of individual-level variables includes age, education, religion, tribe/ethnicity and an indicator for lower quintile of wealth index. The wealth index is measured as household per capita created through factor analysis using land, dwelling and livestock values and a range of assets (mean values and principal contributions are reported for baseline and follow-up in Table A7). The vector of community-level variables includes proxy measures of infrastructure and labor force opportunities such as indicators of urban, population, presence of bank, public transport, any households have electricity, piped water and an indicator of residing in the district containing Kagera's regional capital. In addition, month indicators are included to control for fluctuations in labor demand due to seasonalities and baseline passage indicators are included to control for time trend differences in the baseline survey round. Descriptive statistics for all control variables at the individual level are included in Table A6.

Table 2.2 displays descriptive statistics for individual-level welfare outcome indicators in the baseline and the follow-up periods. Outcomes are grouped into three categories: 1) labor force participation and earnings 2) expenditures and 3) savings (see Table A5 in Appendix for details on construction of all outcome variables). Although not comprehensive, these measures are meant to capture aspects of economic status for individual women and for general household welfare.[31] It would be expected that women who fare better economically will have higher rates of labor force participation, particularly working outside the home, as well as higher earnings, savings and

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[29] Fixed effects models are used as an alternative to random effects models. The Hausman test rejects the random effects model in favor of fixed effects in all cases but self employment.

[30] As an alternative, conditional logit models are run on panel specifications to estimate working outside the home, working self employed and indicator of savings account, however, the sample size drops to 220 and thus is not utilized.

[31] Although many of these variables are subject to recall bias, documentation indicates that individual members were interviewed separately in private for individual level outcomes such as mentioned above, improving accuracy and confidentiality of responses.

individual expenditures. It is also hypothesized that high WPIR will be a significant determinant or enabler of high welfare for women and overall for households.

Generally, the welfare of women is improving over the panel period. For example, earnings and labor force opportunities are increasing: a larger percentage of women report working outside the home (seven versus 11 percent) and working self employed (seven versus thirteen percent). These changes may be a result of economic development which has taken place over the period including advances in technology or simply the result of aging of women over the sample period. Overall, the category in which improvements are not seen is for individual and household expenditures which decrease slightly over the panel.[32] Approximately five percent of women have a formal savings account. Unfortunately, savings indicators are not collected in the end-line and thus more sophisticated estimations over time are not possible.

Results

Community-level determinants of WPIR

Table 2.3 shows the results for the determination of WPIR at the community-level. Covariates are added step-wise: column one contains only the time trend and women's status indicators, while column 2 adds custom indicators and column 3 adds economic indicators. A significant predictor of high WPIR in all models is the time trend variable, as would be expected. The proportion of female 'experts' in the community is associated with higher WPIR, although the effect is muted when economic controls are introduced. This indicates communities with a larger number of women leaders are not necessarily those which have the best WPIR norms.[33] Communities with an ethnic majority Hangaza and those with a religious majority Muslim are significantly less likely to have high WPIR than other ethnic groups. Although presence of piped water and a bank in

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[32] All expenditure and savings indicators were deflated to the baseline (1991) value of the Tanzanian shilling on a yearly basis using the CPI obtained from the Tanzanian Bureau of Statistics on July 18, 2007.

[33] Note other community-level indicators of high women's status were tested and also found to be insignificant including proportion of women with higher education and proportion of women with higher education in comparison to men in the same community.

the community are statistically significant, economic indicators taken together are not jointly

significant. This indicates that cultural variables and women's status within communities matter over

and independent of relative economic development.

Re-interview model

Table 2.4 shows results of the re-interview model. In the first and second columns, the

estimation is conducted using only the **Z** variables, resulting in statistical significance separately and

jointly of all four variables. As expected, if women enter into all four baseline rounds, they are

significantly more likely to be re-interviewed in the follow-up. If they are a daughter of the

household head, they are significantly less likely to be re-interviewed. In addition, the community-

level adult death rate due to illness and price of pharmaceuticals contribute negatively to the

probability of re-interview. In the third and fourth columns, control variables are added to the model,

resulting in the insignificance of the relationship to the household head variable. However, since all

four variables as a group are still highly statistically significant, all four are retained in the final

model. F-tests of joint significance and R^2 values are reported at the bottom of the table.

Determinants of women's welfare

Table 2.5 is a summary of results from all three specifications of models predicting women's

welfare. Coefficient estimates are for the indicator of high WPIR and the dependent variables are

listed on the first column. In the baseline cross-sections (Column A), high WPIR is significantly

associated with working self-employed, higher individual and household expenditures and total

individual savings. Column B indicates that when controlling for unobserved heterogeneity (for

example, initial endowments), high WPIR retains significance only for working self-employed.

Finally, in column C when controlling for attrition, high WPIR is significantly associated with

employment outside the home and log earnings. These results are consistent with the theory that first

a cross-sectional analysis not controlling for individual-level heterogeneity will overestimate the

effects of WPIR, and second that there is a downward attrition bias due to losing women which would

have otherwise had better economic outcomes. The differences between the columns B and C are

consistent with the story that women who leave the panel either due to mortality or mobility may be the ones particularly affected by WPIR. For example, it is feasible women who lose assets or are constrained by restrictive WPIR are forced to migrate out of the sample, perhaps return to their natal villages. Likewise, women who have suffered property rights violations may be at a greater risk for HIV or lack personal security due to loss of housing or sources of economic support and be more likely to experience mortality. Although neither of these hypotheses are testable, they are consistent with results in which coefficients become more statistically significant when controlling for attrition bias. Given the difference in results over the three methods, the preferred model specification is the IPW fixed effects regressions (column C) which control for both individual heterogeneity and attrition bias. Full regressions are reported in Tables A8, A9 and A10 in the Appendix.

Extensions

Two additional explorations are conducted based on the results above. First, interactions are explored between high WPIR and potential inhibitors of welfare outcomes under the hypotheses that lack of property rights effects marginalized groups in a different manner than the general population of women. Three groups are explored: 1) widowed and divorced women,[34] 2) poor women (as measured by lowest wealth quintile) and 3) women with no formal education. Even if WPIR do not significantly affect all women, it is possible that they adversely affect sub-sets that are particularly marginalized due to their family structures, class structures, lack of resources or lack of knowledge to uphold and claim property or assets (Lastarria-Cornhiel, 1997). Secondly, to test the relative importance of each of the four policy variables influencing WPIR, the indicator is disaggregated and each component is tested separately in the models for women's welfare outcomes.

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[34] Although these women are distinctly different, they share common hardships. While widowed women may be subject to abuse by in-laws, divorced or separated women may be denied property by her husband and forced to return to her natal family. In many cases returning home results in forced re-payment of bride price by the woman to her family, and is not necessarily accompanied by welfare improvements (Manji, 2000). To test differences empirically, the groups were separated and coefficients from the cross-sectional models were tested against each-other. Results indicate that the groups do not differ significantly with respect to the outcomes of interest and are therefore retained as one indicator.

Summary results of the first extension are reported in Table 2.6 for outcomes which may be modeled in the panel specification. The coefficients for interaction terms are found in column A for the baseline and column B for the fixed effects model and column C for the IPW fixed effects model. It would be expected that if high WPIR are especially crucial for the marginalized groups listed above, the interaction term will be positive and significant. In other words, property rights matter significantly more for poor or uneducated women (are substitutes for poverty or educational status) in achieving higher welfare outcomes. Although several interaction terms are significant in column A, these do not carry over to the panel specifications. For example, on average, having high WPIR matters more in determining probability of individual expenditures for women of the lowest wealth quintile in comparison to other women. Uneducated women benefit from high WPIR in comparison to other women when it comes to employment outside the home, total individual and household-level expenditures. However, only for individual expenditures for low income women does the significance carry over to a fixed effects or IPW fixed effects specification. These results show that while high WPIR aids marginalized women in achieving certain outcomes, generally no sub-group examined can be seen as particularly affected by WPIR as compared to all women.

Results of the second extension (not displayed) show that no one of the single policy variables is as strong a predictor as the combined indicator of high WPIR. Of the four, the indicator of land inheritance is the strongest in delivering positive and statistically significant results while the indicator of widow inheritance is the weakest. This may be because of the relative similarities between the inheritance of land, house and assets, which are likely to be correlated. As predicted by the conceptual framework, widow inheritance may be more influential for welfare outcome in its effect through health, which is not explicitly modeled in these specifications. As an alternative policy variable, a principal component score is developed and tested using all four variables, however, results remain largely unchanged.[35]

Discussion and policy implications

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[35] The alpha scale reliability associated with the indicies are 0.70 for the baseline and 0.59 for the end-line.

Three points of discussion emerge from the results above as warranting further attention. First, how large are the improvements in women's welfare and what do they mean in practical terms? Second, how defendable are they and finally, what can be said to generalize this study to other regions and cultures? Each of these points will be addressed in turn below.

As an example of the magnitude of improvements, take women's employment outside the home. According to simulations using the results reported from the IPW fixed effects model (Table 2.5, panel C), the predicted average rate of employment outside the home is approximately 16.77 percent. If we consider a scenario in which there were no improvements in WPIR, the predicted average rate of employment outside the home is 8.83 percent, as compared to a predicted average rate of 24.18 under a scenario in which all communities moved from low to high WPIR. The rate of self employment under improvements in WPIR is 2.1 times the rate under no improvements in the fixed effects specification and the gross earnings with improvements are 3.80 times the level without improvements. In the baseline cross-section, a similar simulation shows that in communities with high WPIR, women's predicted average individual savings are 1.35 times the predicted average amount in communities with low WPIR. Clearly these are large and meaningful contributions. In fact, the magnitude of WPIR coefficients are on par or larger than those found for education in other developing countries. For example, Mammon and Paxton (2000) estimate that women with post-secondary schooling are 23 percent (India) and 25 percent (Thailand) more likely to be in the labor force using data from the 1980's and 1990's than women with less than secondary education. Likewise, using data from South Africa in the mid-1990's, Winter (1999) shows that women who had completed secondary schooling had a 23 percent higher likelihood of labor force participation in comparison to those who had completed primary school. However, not all indicators show significant associations. One area in which no significant improvements are seen when controlling for individual-level fixed effects are expenditures. First, the categories of individual expenditures may not be the appropriate measures. For example, women may have increased expenditures, however they may be spending on their children, on household expenses or on their businesses rather than

spending on an individual-level. Since the effect of WPIR on household-level expenditures are also

insignificant, this indicates that potential increased expenditures may be offset by decrease in

expenditures by other household members. Alternatively, women could be saving more as predicted

in the baseline cross-section rather than spending. Unfortunately these measures are not collected in

the end-line and therefore cannot be tested in more sophisticated models.

There are several threats to the validity of the results discussed above. One question

proposed in the presentation of the conceptual framework is: what is really being measured by the

WPIR indicator? Recall that the *direct* interpretation is that WPIR represent only the customs relating

to ownership and inheritance of land, house, assets and the widow herself, while the *indirect*

interpretation is that WPIR is actually picks up more general gender-related status and empowerment

norms and policies within each community. Results of the interactions between widows/separated

women and high WPIR show that these women are not necessarily more advantaged than other

women when it comes to property rights issues. This may suggest WPIR is actually a proxy measure

since all women are affected equally (except in the case of savings for the cross-section). However,

the indicators of women's status in the community-level exploration is insignificant, suggesting that

on average communities in which women are regarded as leaders have no higher WPIR as compared

to those which have fewer or no women identified as leaders. It is not infeasible that WPIR as they

appear in this paper do in fact effect *all* women through expectations and current ownership of

property even if they are still in a marriage or are not yet married. In fact, women may use ownership

of assets and property to leverage bargaining power both within marriages and in the process to

arrange a suitable partner. In addition, inheritances from father to daughters may mirror those

specifically asked for wives as is the case in this analysis. In order to effectively test if the measure is

picking up actual inheritance, it would require household and individual gender-disaggregated data on

asset ownership and inheritance over time, which is not available in the KHDS. Another limitation of

the current study is the inability to determine when WPIR changed over the 13 year period. This

inability may lead to an underestimation of the effects of WPIR if changes occurred in the early

2000's, thus having little time to effect meaningful and significant changes in women's welfare. A more precise measure would have been able to evaluate a before and after change instead of treating the time between panels as a black box.

Finally, what can be said about generalizability? Clearly Kagera is a somewhat unique region in Tanzania and the sampling process further distinguishes the data as representing a select sub-set of the population. The situation in Kagera implies that WPIR have been much improved over the late 1990's and early 2000's, however there is still significant discrimination with over 1/5 of the sample still restricting certain aspects of women's rights and nearly half of those communities restricting rights in more than one realm. It could be argued that results are not necessarily generalizable to other regions, especially given the importance of culture in determining property rights and the selective sampling which may drive outcome measures.[36] Although it is difficult to draw conclusions over dozens of sub-Saharan African countries in different stages of development, institutional structures and cultures, there are several similarities to be mentioned. In a global review of WPIR, UN-HABITAT (2006) identify only nine countries in sub-Saharan Africa which specifically give women equal property rights (Tanzania included), two with gender neutral laws and three currently revising or appealing restrictive laws.[37] Throughout the literature it is cited that even in countries where legal rights exist are not always honored in traditional settings (Drimie, 2002; Tekle, 2001; Khadiagala, 2001). In addition, the limited data on titling which is available suggests that a very small fraction of all titled land is owned by women (Deere & Doss, 2006). For example, in Cameroon less than ten percent of title deeds are held by women, in Kenya only five percent and in Uganda only seven percent of women own land in their names (ICRW, 2005; Rugadva et al., 2005).

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[36] Results from Beegle, De Weerdt & Dercon (2006a) show that there are few differences between the Kagera Rural CWIQ, fielded one month before the start of the 2004 KHDS round and the rural sample from the 2004 KHDS. However, the differences increase if the sample is increased to include the urban sector of the KHDS or those individuals tracked outside Kagera. For more details see Beegle, De Weerdt and Dercon (2006a: Appendix C).

[37] Countries with equal WPIR include Burkina Faso, Malawi, Mozambique, Niger, Rwanda, South Africa, Tanzania, Uganda and Zimbabwe. Ethiopia and Eritrea have gender-neutral laws and Botswana, Kenya and Namibia are in process of reform (UN-HABITAT, 2006).

Further, findings suggest that on average women's land is not only smaller in size (Benin, Morocco, Tanzania and Zimbabwe) but also in value relative to men's (Ghana) (FAO, 1997; Doss 2006). However there are some broad distinctions which can be drawn based on priorities within land reform and within cultural inheritance systems. For example, Walker (2002) separates those countries where land redistribution is a major issue (Namibia, South Africa, Zimbabwe) from those in which tenure security and agrarian reform are priorities (Botswana, Lesotho, Malawi, Mozambique, Swaziland and Zambia) and makes policy prescriptions for each grouping. In addition, case studies may serve to highlight unique attributes of each country. For example, case studies from Lesotho indicate that while widows are often given rights to their husbands land, it is revoked if they re-marry, therefore incentivising many widows to stay single (Drimie, 2002). In this setting, honoring the right of women to land often is correlated with how educated village leaders are concerning HIV/AIDS and the level of discrimination towards widows whose husband's deaths were attributed to HIV. In Kagera the Haya tribe makes up the majority in the KHDS data (62 percent of the baseline sample), a patrilineal ethnic group in which inheritance runs from father to son (Manji, 2000). Upon marriage, brideprice is paid from the bride's family to the groom's family and women are expected to leave their kin and reside in the village of their husband's household. Therefore, in certain matrilineal groups, these same patterns should not be expected (e.g. the Chewa in Malawi or the Kaguru in Tanzania). In short, it is reasonable to assume that many sub-Saharan African countries are in similar situations as Tanzania which has seen relative liberalization of WPIR relative to men, while other countries lag behind.

Conclusion

Women's struggles for equal property and inheritance rights in sub-Saharan Africa are not new; they have been documented for decades. Research shows it is not only the liberalization of laws that matters, but how such also how laws are implemented, enforced and protected. In addition, legal rights often have little effect if they are not accompanied by promotion of change in customary law and how communities view the citizenship of their women. This paper adds to the institutional, legal

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and anthropological evidence by examining the problem from an economic perspective and attempts to quantify some economic effects of granting property rights to women. Findings suggest that WPIR are significant in promoting individual economic advancement for all women, especially in the realms of employment and earnings. These findings are based on changes in community-level variation of customs over time after a change in constitutional arrangements in land administration and are not a result of strictly exogenous policy change. However, because of the nature of property rights, it is virtually impossible to implement a randomized field experiment varying levels of WPIR without introducing ethical considerations. There is clearly a lack of suitable and population-level WPIR data, collected on several levels (community, household and individual) with which to make clear policy recommendations. Therefore, a primary consideration of researchers interested in advocating for increased WPIR should be to more clearly and cleanly collect and analyze data, both to examine impacts, trends and gaps between *de jure* and *de facto* WPIR. If countries want to support human development and economic growth, they should not discount the potential of equitable policies to promote the advancement of women.

Tables

Table 2.1: Time trends in WPIR measured at the community and individual level

| | (A) | (B) | (C) |
| | 10 Years | Baseline | Follow-up |
If her husband dies, is it customary for the...	Prior	(1991-94)[1]	(2004)
Panel A: Community-level distribution:	(N = 51)	(N = 51)	(N = 51)
(1) Wife to inherit land (=1)	0.00	0.49	0.86
(2) Wife to inherit house (=1)	0.04	0.53	0.90
(3) Wife to inherit other assets (=1)	0.08	0.88	0.98
(4) Wife not to be inherited (=1)	0.39	0.61	0.94
High WPIR (all four policies =1)	0.00	0.24	0.80
Panel B: Individual-level distribution: [2]	(N = 755)	(N = 1,480)	(N = 755)
(1) Wife to inherit land (=1)	0.00	0.45	0.88
(2) Wife to inherit house (=1)	0.06	0.50	0.93
(3) Wife to inherit other assets (=1)	0.08	0.87	0.97
(4) Wife not to be inherited (=1)	0.33	0.63	0.94
High WPIR (all four policies = 1)	0.00	0.22	0.81

Note: Variables used for column A are collected through recall in the 2004 survey round.
[1] For simplicity, community baseline distribution is calculated from passage 1 in 1991.
[2] The sample for individual-level distributions include women who appear in the baseline
(column B) and those who appear in the panel (columns A and C).

Table 2.2: Distribution of economic welfare outcomes in baseline and follow-up

	Baseline (1991-94)		Follow-up (2004)	
	(N = 1,480)		(N = 755)	
Labor force participation and earnings	Mean	SD	Mean	SD
Employed outside the home (last week = 1)	0.07	0.26	0.11	0.31
Working self employed (last week = 1)	0.07	0.25	0.13	0.34
Earnings (log shillings)	0.63	2.18	0.92	2.60
Expenditures [1]				
Total individual expenditures (log shillings)	7.56	2.50	7.16	2.24
Total household expenditures (log shillings)	9.47	1.55	9.03	2.77
Savings				
Savings account (=1)	0.05	0.23	---	---
Total individual savings (log shillings)	2.95	3.48	---	---
Total household savings (log shillings)	6.58	4.50	---	---

[1] Expenditures categories are clothing, medical and food consumed outside the home.
Clothing and medical expenses are recalled for 12 months, food expenses on two weeks.

Table 2.3: Community-level determinants of WPIR (N = 254)

Indicator:	High WPIR (all four policies = 1; otherwise = 0)		
2004 survey round (=1)	0.528	0.537	0.557
	(0.063)***	(0.065)***	(0.066)***
Proportion female "experts"	0.356	0.336	0.323
	(0.203)*	(0.201)*	(0.219)
Majority ethnic/religious groups: [1]			
Ethnic group Nyambo (=1)		0.128	0.155
		(0.096)	(0.103)
Ethnic group Hangaza (=1)		-0.113	-0.155
		(0.075)	(0.077)**
Ethnic group Sukuma (=1)		-0.119	0.018
		(0.071)*	(0.102)
Religion Muslim (=1)		-0.186	-0.201
		(0.099)*	(0.099)**
Religion Christian (=1)		0.109	0.092
		(0.180)	(0.183)
Economic indicators:			
Urban (=1)			-0.006
			(0.093)
HHs have electricity (=1)			-0.102
			(0.069)
HHs have piped water (=1)			0.170
			(0.099)*
Population (in 1,000's)			-0.005
			(0.016)
Bank (=1)			-0.168
			(0.096)*
Constant	0.221	0.229	0.255
	(0.043)***	(0.048)***	(0.057)***
Joint significance of ethnic indicators:[2]		0.053	0.023
Joint significance of economic indicators:			0.182
R²	0.2021	0.2224	0.2394

Note: LPM is used to predict high WPIR using a pooled cross-section
(four baseline passages in addition to the 2004 round). Robust standard
errors are reported in parenthesis.
* indicates significant at 10%; ** significant at 5%; *** significant at 1%
[1] The excluded majority ethnic group is Haya, the excluded majority religious
group is Catholic.
[2] Joint significance is reported using a the p-value from a χ² test.

Table 2.4: Estimating re-interview among full baseline sample

Determinants (N = 1,480)	Re-interview (=1 if yes, 0 if no)			
	Coeff	SE	Coeff	SE
Enters all four baseline rounds (=1)	0.319	(0.017)***	0.317	(0.024)***
Community-level illness related adult death rate	-0.345	(0.116)***	-0.245	(0.095)**
Price per tablet of paracet (=1)	-0.008	(0.004)**	-0.007	(0.004)*
Daughter of HH head (=1)	-0.099	(0.034)***	-0.005	(0.042)
Age splines:				
Age 20 to 29 (=1)			-0.01	(0.041)
Age 30 to 39 (=1)			-0.004	(0.048)
Age 40 to 49 (=1)			0.083	(0.054)
Age 50 and over (=1)			0.099	(0.053)*
Education:				
No formal education (=1)			0.028	(0.029)
Secondary or above (=1)			-0.206	(0.056)***
Marital status:				
Never married (=1)			-0.123	(0.042)***
Widowed or separated (=1)			-0.143	(0.031)***
Religion of HH head:				
Muslim (=1)			-0.054	(0.046)
Other Christian denominations (=1)			-0.037	(0.031)
Ethnicity/Tribe of HH head:				
Nyambo (=1)			0.119	(0.037)***
Hangaza (=1)			0.000	(0.049)
Other tribe (=1)			-0.062	(0.037)*
Bottom quintile of wealth distribution (=1)			-0.054	(0.030)*
Community-level variables:				
High WPIR (=1)			-0.066	(0.034)*
Urban (=1)			0.009	(0.048)
Population (in 1,000's)			0.001	(0.006)
Bank (=1)			-0.001	(0.037)
HHs have electricity (=1)			-0.083	(0.056)
HHs have piped water (=1)			0.034	(0.058)
Public transport (=1)			0.019	(0.035)
District is regional capital (=1)			-0.021	(0.048)
Constant	0.700	(0.087)***	0.745	(0.090)***
R²	0.1251		0.1855	
Wald test for joint significance of Z variables:[1]	0.000	119.96	0.000	47.93

Note: LPM is used to estimate re-interview, standard errors clustered at the community level are reported in parenthesis. Also included but not reported are seasonal and passage indicators.
* indicates significant at 10%; ** significant at 5%; *** significant at 1%
[1] Joint significance is reported using the p-value from a χ^2 test.

Table 2.5: Summary of coefficients on high WPIR for economic welfare outcomes (left column)

	(A) Baseline Cross-section		(B) Fixed effects		(C) Fixed effects with IPW	
	(N = 1,480)		(N = 755)		(N = 755)	
Labor force participation and earnings	Coeff	SE	Coeff	SE	Coeff	SE
Employed outside the home (last week = 1)	0.002	(0.034)	-0.004	(0.035)	0.153	(0.065)**
Working self employed (last week = 1)	0.075	(0.025)***	0.067	(0.035)*	-0.144	(0.099)
Earnings (log shillings)	0.054	(0.237)	0.029	(0.258)	1.336	(0.576)**
Expenditures [1]						
Total individual expenditures (log shillings)	0.461	(0.203)**	0.048	(0.240)	-0.323	(0.490)
Total household expenditures (log shillings)	0.230	(0.156)*	0.219	(0.286)	-0.468	(0.527)
Savings						
Savings account (=1)	0.018	(0.017)	---	---	---	---
Total individual savings (log shillings)	0.691	(0.295)**	---	---	---	---
Total household savings (log shillings)	0.420	(0.457)	---	---	---	---

Note: All models are estimated using OLS and LPMs. Standard errors clustered at the community level are reported in parentheses; See Tables A8, A9 and A10 in the appendix for full models.
* indicates significant at 10%; ** significant at 5%; *** significant at 1%.

Table 2.6: Summary of interactions (lowest wealth quintile, no schooling and widowhood) and WPIR coefficients

	(A) Baseline cross-section (N = 1,480)				(B) Fixed-effects (N = 755)				(B) Fixed-effects with IPW (N = 755)			
	High WPIR		Interaction term		High WPIR		Interaction term		High WPIR		Interaction term	
	Coeff	SE	Coeff	SE	Coeff	SE	Coeff	SE	Coeff	SE	Coeff	SE
A. Lowest wealth quintile:												
Employed outside the home (last week = 1)	0.005	(0.029)	-0.021	(0.069)	-0.006	(0.357)	0.013	(0.075)	0.154	(0.070)**	-0.003	(0.117)
Self employed (last week = 1)	0.082	(0.026)***	-0.042	(0.044)	0.076	(0.039)*	-0.056	(0.064)	-0.157	(0.104)	0.098	(0.013)
Earnings (log shillings)	0.106	(0.227)	-0.318	(0.504)	0.047	(0.255)	-0.997	(0.581)	1.390	(0.608)**	-0.412	(0.914)
Total individual expenditure (log shillings)	0.358	(0.234)	0.630	(0.341)*	-0.147	(0.236)	1.083	(0.581)*	-0.559	(0.846)	1.784	(0.953)*
Total household expenditure (log shillings)	0.270	(0.187)	0.183	(0.334)	0.215	(0.306)	0.023	(0.456)	-0.612	(0.585)	1.091	(1.132)
B. No schooling:												
Employed outside the home (last week = 1)	0.016	(0.030)	-0.073	(0.038)*	-0.020	(0.037)	0.059	(0.057)	0.163	(0.070)**	-0.059	(0.102)
Self employed (last week = 1)	0.071	(0.029)**	0.023	(0.046)	0.082	(0.041)**	-0.057	(0.042)	-0.169	(0.108)	0.153	(0.110)
Earnings (log shillings)	0.185	(0.211)	-0.656	(0.414)	-0.066	(0.273)	0.343	(0.429)	1.451	(0.612)**	-0.705	(0.800)
Total individual expenditure (log shillings)	0.325	(0.199)	0.682	(0.301)**	-0.014	(0.239)	0.223	(0.473)	-0.508	(0.483)	1.132	(0.696)
Total household expenditure (log shillings)	0.186	(0.161)	0.570	(0.257)**	0.274	(0.300)	-0.195	(0.527)	-0.636	(0.542)	1.027	(0.732)
C. Widow or separated:												
Employed outside the home (last week = 1)	-0.004	(0.034)	0.021	(0.021)	-0.024	(0.045)	0.071	(0.069)	0.105	(0.080)	0.184	(0.172)
Self employed (last week = 1)	0.058	(0.026)**	0.053	(0.024)**	0.075	(0.040)*	-0.030	(0.055)	-0.112	(0.103)	-0.121	(0.154)
Earnings (log shillings)	0.083	(0.252)	-0.140	(0.368)	-0.084	(0.310)	0.394	(0.048)	1.029	(0.725)	1.170	(1.327)
Total individual expenditure (log shillings)	0.409	(0.220)*	0.253	(0.399)	-0.150	(0.270)	0.688	(0.546)	-0.332	(0.570)	0.035	(0.722)
Total household expenditure (log shillings)	0.298	(0.149)**	0.007	(0.215)	0.258	(0.297)	-0.134	(0.499)	-0.342	(0.532)	-0.481	(1.027)

Note: All models are estimated using OLS and LPMs. Standard errors clustered at the community level are reported in parentheses. Models are estimated with same specifications as in Table 2.5; * indicates significance at 10%; ** significant at 5%; *** significant at 1%.

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CHAPTER III: CONTRACEPTIVE USE AND WOMEN'S WELL-BEING:
SPILLOVER EFFECTS OF FAMILY PLANNING SERVICES IN RURAL TANZANIA

Introduction

Giving women the ability to safely plan and space their fertility has profound consequences for the

individual and society as a whole. The contraceptive pill was cited by the *Economist* (1999) as the

greatest science and technology advancement of the twentieth century and has been linked to

decreases in total fertility and improvements in reproductive health outcomes worldwide.[38] Further

evidence suggests the 'power of the pill' may go beyond reproductive health to include positive

externalities in social and economic realms. For example in the US, diffusion of modern

contraceptives has been linked to various dimensions of women's welfare including delayed age at

first marriage, higher labor force participation and increased earnings (Bailey, 2006; Goldin & Katz,

2000; 2002). Although little evidence exists of this spillover effect in developing countries largely

due to data constraints, common belief suggests that women who are able to avoid unwanted or mis-

timed pregnancies, will in turn be able to invest more in their human capital, improving not only their

own economic status, but also that of their children. Understanding the linkage between family

planning (FP) and development outcomes is especially important for resource poor countries where

access to contraceptives is still restricted and funding for FP services is low. Advocates of

reproductive choice claim FP services should be offered as part of the essential development package

because of their potential to empower women and improve overall societal well-being. However,

there is little evidence to support this claim.

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[38] The US Food and Drug Administration first approved the use of a synthetic progesterone norethynodrel called Enovid as an oral contraceptive in 1960.

This paper seeks to contribute to the gap in empirical evidence linking contraceptive use and women's economic welfare outcomes using data from rural Tanzania. The data span four waves of the Kagera Health and Development Survey (KHDS) collected from 1991 to 1994. The KHDS were originally commissioned by the World Bank to identify the long-term impacts and determinants of adult working age mortality due to HIV/AIDS and thus contains a rich set of economic outcomes measured at the individual level. A range of economic welfare outcomes are examined to provide a more robust understanding of the relationship with contraceptive use and are divided into three main groups: 1) labor force participation and earnings, 2) savings and 3) expenditures. The main empirical challenge is the potential endogeneity of contraceptive use which is addressed through instrumentation using two-stage least squares (2SLS) and individual fixed effects longitudinal modeling. Results indicate measures of contraceptive use are statistically significantly associated with nearly all measures of economic welfare in cross-sectional models, and many of these relationships hold when applied to models accounting for the endogeneity of contraceptive use. In addition, several extensions to the main analysis are conducted which indicate the type of contraceptives used matter and women who have higher education are better situated to take advantage of the benefits of contraceptive use, however this relationship is not observed for older or wealthier women. This study reinforces program implications from US based studies which indicate strong spillover effects of FP services to a broader range of economic and social benefits.

Background and significance

Contraceptive use, reproductive health and development outcomes

Informed access to safe, affordable, effective and acceptable contraceptive methods are an integral component of reproductive heath, affecting quality of overall health and everyday life (USAID, 2005). Research aimed at identifying the direct effects of contraceptive use on fertility, child spacing, birth outcomes and overall reproductive health has grown since the 1960's and 70's. Contraceptive use has been found to be correlated with lower fertility in a number of international settings using a variety of analytic techniques (see e.g., Adamchak & Mbizvo, 1990; Edwards, 1996

in Zimbabwe; Hinde & Mturi, 2000 in Tanzania). Although questions remain regarding effectiveness of specific components, the direct effect of contraceptive use on fertility outcomes through reduction in total fertility or through birth spacing has been shown in select resource poor settings. A closely related body of literature examines the linkages between access to FP services on the community-level and actual individual use of contraceptive methods or fertility (see e.g., Angeles, Guilkey & Mroz, 1998; Beegle, 1995, both in Tanzania; Degraff, Bilsborrow & Guilkey, 1997 in the Philippines; Entwisle et al., 1996 in Thailand; Guilkey & Jayne, 1997 in Zimbabwe; Pörtner, Beegle & Christiaensen, 2006 in Ethiopia; Tsui et al., 1981 in Korea, Mexico and Bangladesh; Magnani et. al., 1999 in Morocco).[39] In general, these and other studies find that community-level availability of FP services are directly associated with the probability of current contraceptive use, although the magnitude of these associations vary within subgroups and among settings. Results on the effect of community-level FP service availability on fertility is mixed, although lack of association has been attributed to endogenous placement of and lack of variation in services (e.g., Molyneaux & Gertler, 2000; Pitt, Rosenzwieg & Gibbons, 1993 both from Indonesia find no effect; Sinha, 2005; Foster & Roy, 1997 both from Bangladesh find significant effects). Findings from the literature examining direct FP service impacts is heavily contingent on assumptions regarding whether placement is demand or need driven rather than an exogenous positive shock.

A less developed body of literature examines the *indirect* effects of contraceptive use on economic outcomes such as age at first marriage, labor force participation and earnings. Using cross-state quasi-experimental data from the US, Goldin and Katz (2002) find that access to oral contraception early in life leads to a later age at first marriage and a larger proportion of women in professional occupations. Using a similar framework and domestic data from the late 1970's through the mid 90's, Bailey (2006) shows that legal access to the contraceptive pill is significantly associated with an increased number of women in the paid labor force as well as an increased number of annual

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[39] Cross program effects have also been found between access to FP and other birth outcomes such as abortion, child mortality and maternal mortality (Marston & Cleland, 2003; Rahman, DaVanzo & Razzaque, 2001; Rosenzweig & Wolpin, 1982; Winikoff & Sullivan, 1987).

hours worked. The author proposes access to FP services affect women's lifecycle labor supply through a reduction in the costs and increase in the returns to pursuing a career. The intuition is that providing an accessible means to delay childbearing allows women to continue formal education, pursue careers and work additional hours which would have been spent caring for children. Moreover, this effect is independent of changes in total completed fertility. Bailey (2006) argues the ability to strategically space births and the delay early unintended pregnancies may be among the contraceptive pill's most important contributions, and thus studies which only examine completed or total fertility effects of FP services necessarily omit an important and significant part of the story.

Research examining the effect of contraceptive use on indirect economic welfare outcomes in developing countries is more uncommon due to data constraints. Using data from Indonesia, Angeles, Guilkey and Mroz (2005) model women's schooling, marriage and fertility decisions using a maximum likelihood framework and find that FP services at early ages significantly contribute to higher educational attainment and lower fertility among women. Miller (2005) evaluates the Columbian *Profamilia* FP program and finds positive effects on education and labor force participation on young women exposed to the program as teenagers. In addition to reducing women's overall fertility, Foster and Roy (1997) show that FP programs have a significant effect on increasing their children's schooling using data from the Matlab experiment in Bangladesh.[40] Also using Matlab data, Sinha (2005) shows that access to FP services significantly reduces women's fertility and labor force participation for their male children ages 10 to 16, although has no effect on female children's labor force participation or school enrollment of either sex. More recently also using the Matlab data, Joshi and Schultz (2007) find women and their children in villages with FP services have significantly higher measures of health using a twenty-year panel, however, economic benefits are found primarily among better educated women. This study and the Indonesian study are initial evidence that the

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[40] The Matlab family planning, maternal and child health experiment was started in 1977 by the International Center for Diarrhoeal Disease Research, Bangladesh and provided intensive health service delivery including FP outreach through community health workers. Approximately half of the 149 sample villages received the intensive treatment while the remainder continued to be served by existing government FP services (Joshi & Shultz, 2007).

social returns to reproductive health programs may have lasting indirect effects for women.

However, it is possible that findings from Bangladesh are site specific due to the intensive nature of

the experimental Matlab program design. Although the theoretical and motivational basis for

extending contraceptive use to economic outcomes in developing countries is promising, there is a

lack of geographically diverse evidence to support this hypothesis.

Contraceptive use in Tanzania

Evidence suggests that contraceptive use in Tanzania has steadily increased during the

1990's. According to the Ministry of Health, the contraceptive prevalence rate among currently

married women of reproductive age in the late 1980's ranged between five and seven percent (MoH,

1989). The 1991/92 Tanzanian Demographic and Health Survey (TDHS) estimated the same number

at 10.4 percent and by 1996, the prevalence rate had risen to approximately 18.4 percent (Ngallaba et

al. 1993; BoS & Macro International, 1997). These trends show some of the largest gains in Eastern

Africa in the decade and coincide with a series of general health sector reforms initiated in the early

1990's. Reforms were aimed at addressing capacity and quality problems including shortage of

trained personnel, low morale of current workers, poor management and heavy political influence in

health sector appointments. To specifically address the demand for FP services, the Ministry of

Health established a Family Planning Unit in 1990 to coordinate and implement the countries first

National Population Policy. The policy was formally enacted in 1992, with the primary goal of

strengthening FP services, promoting the health and welfare of families and eventually reducing

population growth (Shutt, 1994). In addition, these reforms coincided with the Family Planning

Services Support Project, a $20 million, seven year USAID funded project. The expected outputs of

the project not only included expansion of quality clinical FP services, but also incorporated building

institutional capacity in reproductive health and development of monitoring and evaluation of

activities. Despite the roll out of services and rapid increase in contraceptive uptake during the

1990's, the Tanzanian FP program lost momentum in the 2000's (Pike & Simbakalia, 2006). The

total fertility rate (TFR) in Tanzania showed no statistical decline from 1996 to 2004 and the annual

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change in contraceptive prevalence decreased from 2.1 percent (1992 through 1999) to 0.20 percent

(1999 through 2004).[41] However, unmet need has continued to increase. Estimates from the TDHS

2004 show that 1.1 million married women have an unmet need for contraception, a larger number

than those currently using a modern method, or 880,000 women (BoS & Macro International, 2005).

Although FP programs and diffusion of modern contraceptives were given resources and attention

over a decade ago, this momentum has slowed and now lacks support from both in country and

international organizations.

Development in Tanzania

Formed in 1964, the United Republic of Tanzania occupies the largest land area of any

country in East Africa and is home to over 38 million inhabitants (WB, 2006). The country borders

eight countries, Kenya and Uganda to the north, Burundi, Rwanda and the Democratic Republic of

Congo to the west and Malawi, Zambia and Mozambique to the south. Although enjoying relative

political stability, Tanzania ranks among the poorest countries in the world. The per-capita GNI was

340 USD[42] in 2005 and over 35 percent of the population on mainland Tanzania was below the

national poverty line in at the most recent measurement in 2000 (WB, 2006).[43] In 2001, Tanzania

ranked 160 out of 175 on the Human Development Index collected by the United Nations

Development Programme (UNDP) at a value of 0.40, below the average value for sub-Saharan Africa

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[41] The annual change in prevalence in the Lake Zone (Kagera, Kigoma, Mara, Mwanza, Tabora and Shinyanga regions) is estimated at 1.3 (1992 to 1999) and is estimated to have decreased to -0.46 (1999 to 2004) (Pike & Simbakalia, 2006).

[42] The per capita GNI (Gross National Income) are converted into USD using the Atlas method. This takes into account GDP plus the net flows from other factors (rents, profits, and labor income) from abroad. The Atlas method smoothes exchange rate fluctuations by using a three year moving average, price-adjusted conversion factor (WB, 2006).

[43] The poverty measures were calculated using the Household Budget Survey 2000/01 and the Integrated Labor Force Survey 2000-01, the poverty line refers to the national basic needs poverty line. Poverty levels differ between urban and rural residence. The proportion total poor living in urban areas is 13 percent, while the proportion of poor living in rural areas is 87 percent (United Republic of Tanzania, 2003).

(UNDP, 2003).[44] In addition to the overall measure of poverty within the population, women as a

social group in Tanzania face particular hardship. Tanzania ranked 130 out of 144 countries on the

UNDP Gender-Related Development Index, at a value of 0.396.[45] This inequity is further seen in

Tanzanian outcomes for proxy indicators of women's status such as the maternal mortality ratio

(MMR) and women's labor force participation. According to estimates by WHO, UNICEF and

UNFPA, Tanzania had the world's sixth highest number of maternal deaths during 2000 (at an

estimated 21,000 maternal deaths), putting a woman's lifetime risk of maternal death at

approximately 1 out of 10 women (UNDP, 2003). The majority of working women (72 percent) are

involved in agriculture, primarily working family-owned land (TNBS, 2000). The remaining working

women are employed in unskilled labor and manual jobs (20 percent). Only two percent of working

women hold professional, managerial or technical jobs. According to the ILO (1997), structural

adjustment during the late 1980's and early 1990's are thought to have worsened gender inequality in

access to employment and economic activities, especially in the formal sector. With respect to health

and welfare outcomes, evidence not only suggests that overall indicators lag relative to neighboring

countries and that the relative position of women in Tanzania has not been improving.

Theoretical model

Economic models of household production exploring determinants of time use, expenditures and

nutrition have been widely utilized to guide empirical work using data from developing countries (see

Strauss & Thomas, 1995; 1998; Behrman & Deolalikar, 1988; Juster & Stafford, 1991 for reviews).

These models are rooted in Becker's household production framework in which households allocate

time and goods to produce a range of market and non-market commodities (Becker, 1965). This

model has been specifically applied to reproductive decisions through the mapping of total lifetime

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[44] The Human Development Index is made up of the average achievements in life expectancy at birth, adult literacy, combined primary, secondary and tertiary enrollment rages and gross national income.

[45] The UNDP measures gender inequality by using the unweighted average of three component indices: (1) life expectancy, education and income. Its gender-related development index (GDI) ranges from 0 (lowest gender equality) to 1 (highest gender equality).

fertility to the total psychic reward (utility) of consumption (see e.g., Becker, 1960; Robinson, 1997; Turchi, 1975). In general, economic models of human capital outcomes specify the following: among other things, household utility is a function of number and quality of children, consumption of leisure and other non-market and market goods. Utility is maximized subject to a variety of constraints (time and technology) to recover reduced form-demand equations for all inputs in the production function. These reduced-form equations map demand for children, nutrition, time allocation, or certain commodities to exogenous inputs at the individual, household and community level.

For example, following Beegle (2005), time demand for individual woman i in activity j (for example working her own land) can be modeled as the following reduced demand equation:

$$(1) \; T_{ij} = T_{ij} \, (T_t, \, p_m, \, p_h, \, w_{ij}, \, A_i, \, v_i, \, v_{ij} \mid \mathbf{Z});$$

where T_{ij} is total time or hours spent working on her own land, T_t is total time available, p_m and p_h are vectors of prices for market and home-produced commodities including contraceptives, w_{ij} is the wage rate, A_i are assets or unearned income, v_i are unobservable individual level characteristics, v_{ij} are exogenous environmental characteristics, conditional on $\mathbf{Z}$, a set of individual level tastes and preferences, including preferences for family size and/or regarding acceptability of contraceptive use. As previously mentioned, similar reduced-form demand equations may be constructed for other outcomes.

Contraceptive use affects economic outcomes through a number of different channels. The option to use contraceptive methods may influence a woman's current or future decisions about schooling, marriage, or labor force participation through expectations of w_{ij} (wage rate for activity j) or though a shift in $\mathbf{Z}$ (tastes and preferences regarding family size). In addition, women who are currently using contraceptive methods to space, limit, or delay fertility may be affected through an increase in T_t, total time which they would have otherwise spend caring for and raising children. As previously discussed, many direct effects on fertility decisions (spacing or delaying) may only be identifiable after any individual woman's fertility is completed. It is important therefore, to examine

these cross effects without explicitly considering the effect through current fertility (Bailey, 2006; Miller, 2005).

Data: Kagera Health and Development Survey

The KHDS were originally part of a joint World Bank research project the "Economic Impact of Fatal Adult Illness from AIDS and Other Causes in Sub-Saharan Africa" (WB-DRG, 2004).[46] The Kagera region is located to the west of Lake Victoria bordering Rwanda and Burundi to the east and Uganda to the north. The region is primarily rural and is home to over two million people, divided into five administrative districts (TNBS, 2002). The KHDS interviewed approximately 832 households in 50 communities over four waves at seven month intervals between 1991 and 1994 (see Appendix Figure A1 for location of clusters within Kagera). The household sample was random, stratified on geography, community adult mortality rates[47] and indicators at the household level that were thought to be predictive of future adult deaths. In the first stage, 550 primary sampling units (PSU) in Kagera were classified according to four agronomic zones and either a high or low level of adult mortality. Clusters of households were randomly drawn from each PSU, stratified on agronomic zone, with a probability of selection proportional to population. In the second stage, households were classified as either 'sick' or 'well.'[48] Approximately sixteen households were selected at random from each cluster, fourteen from the 'sick' and two from the 'well' group (see WB-DRG, 2004 or Beegle, DeWeerdt & Dercon, 2006 for further discussion of sampling procedure). The KHDS questionnaires were modeled after the World Bank's Living Standards Measurement Surveys and collected extensive, detailed information on household income, consumption expenditure, individual economic activities, education and individual health status, including the height and weight of all household

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[46] The research project is also known as the Economic Impact of Adult Mortality Study. Funding was provided by the World Bank Research Committee, the United States Agency for International Development (USAID) and the Danish Agency for Development Assistance (WB-DRG, 2004).

[47] Community adult mortality rates were taken from the 1988 census and a subsequent enumeration for the survey (WB-DRG, 2004).

[48] 'Sick' households were those who either had an adult death (aged 15 to 50) due to illness in the last year or an adult too sick to work at the time of the survey or both. 'Well' households were all others with no recent deaths or sick members (WB-DRG, 2004).

members. In addition, matching community modules were administered on local markets and price information, health facilities and education facilities.

The analysis will utilize the first four waves of KHDS which started in 1991 and took place approximately every six to seven months afterward until 1994.[49] The sample is limited to women between the ages of 15 and 49 who enter at least two of the four waves, corresponding to the age range of women who were asked the fertility modules.[50] The panel is made up of approximately 3,781 woman years over four passages (1,159 individual women). The sample is restricted to women entering at least two rounds of the panel to eliminate inconsistencies in comparison between pooled cross-sectional and longitudinal models.

Empirical models and variables

The main empirical challenge in estimating the effect of contraceptive use on economic welfare is the endogeneity of contraceptive use. It is likely there are a set of preferences regarding contraceptive use which are unobserved to the researcher (vector Z in equation 1). These preferences or individual heterogeneities are of concern if they also affect economic outcomes and thus result in biased estimates, which are likely to overestimate the relationship between contraceptive use and welfare outcomes. More specifically, it may be expected that women who are more likely to choose to use contraceptives are those who are more likely to work outside the home in the absence of contraceptive use. Thus women who are empowered have a higher likelihood of both using FP services and having better economic welfare outcomes. To illustrate the endogeneity problem and to provide a more robust understanding of the relationship between contraceptive use and women's economic welfare outcomes, three different models are compared: 1) pooled cross-sectional models among all four waves, 2) two-stage least squares (2SLS) models instrumenting contraceptive use, and

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[49] The data was collected over four waves, corresponding with the questionnaire sequence and four passages, corresponding with the year the questionnaire was given. Therefore, a woman who is interviewed for the first time in 1993 is assigned wave 1, passage 3. For this analysis, each individual was assigned contemporaneous passage indicators and arranged according to survey year (for details see WB-DRG, 2004).

[50] In wave 1, all women are asked. In the remaining waves, the module is asked to only 15 to 50 year olds and married 14 year olds.

3) a longitudinal individual-level fixed effects models. The first model, does not account for endogeneity and uses a pooled cross-section where the illustrative unit of analysis is the individual woman *(i)* in community *(j)* can be written as follows:

$$(2)\ \text{Pr}\ (Y_i = 1) = \beta_0 + \beta_1(C_i) + \beta_2(X_i) + \beta_3(X_h) + \beta_4(X_j) + \varepsilon_i$$

Economic welfare outcome (Y_i) of any given woman is a function of contraceptive use (C_i), individual woman-level characteristics (X_i), household-level (X_h) and community-level indicators (X_j). Contraceptive use is measured by asking each woman the following question: "*Some couples use contraceptive methods to avoid pregnancy or to space births, are you currently using a method of contraception? (for example, the pill, IUD [inter-uterine device], condoms, withdrawal, rhythm, abstinence).*" This question is asked for both primary and secondary birth control methods for each woman. Because this measure is a broad definition of contraceptive use, alternative indicators representing only modern contraceptive use (pill, IUD, condoms and injectibles) and only dual contraceptive use (any method in addition to condoms) are explored as alternatives to the comprehensive measure described above.[51] Individual-level control variables include age and age squared, education levels, marital status, religion, ethnicity and wave indicators. Household-level characteristics included in all models are the bottom 40 percent of the wealth index and community-level controls include indicator of bank, daily market, households in the community have electricity and piped water and seasonal indicators. Seasonal indicators are month variables at the time of interview to control for fluctuations in work, earnings and expenditures inherit in agriculturally driven economies. Binary outcomes are estimated using linear probability models (LPM) and continuous outcomes using OLS regression. Standard errors are clustered at the community level to account for unobserved cluster-level variation.

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[51] Note several of the methods in this comprehensive measure do not require a medical intervention and can be behaviorally based (but require FP knowledge such as the rhythm method which must be taught at a clinic). Due to the low percentage using strictly modern methods, this more comprehensive measure is used to capture a greater percentage of women who are currently intending to limit or prevent pregnancy in the main analysis, while alternatives are examined in extensions.

As previously mentioned, a simple cross-sectional model such as (2) does not take into account unobserved heterogeneous preferences or fixed traits influencing individual-level contraceptive use. Under this scenario, the error term ε_i takes the following form:

$$(3)\ \varepsilon_i = \lambda_i + u_{it}$$

where λ_i is constant across individuals and u_{it} is assumed to be $\sim N(0, \sigma^2_u)$. To address this potential bias, two different models are contrasted. To correct for bias from time invariant sources, an individual-level panel fixed effects model is estimated and following specification:[52]

$$(4)\ \Pr\left(\Delta Y_{it} = 1\right) = \beta_0 + \beta_1(\Delta C_{i,t}) + \beta_2(\Delta X_{i,t}) + \beta_3(\Delta X_{h,t}) + \beta_4(\Delta X_{j,t}) + \Delta\varepsilon_t$$

Equation (4) maps the change in welfare (ΔY_i) of each woman over the four waves as a function of the change in contraceptive use (ΔC_i), the change in individual woman-level (ΔX_i), household-level (ΔX_h) and community-level indicators (ΔX_j). In this specification the constant term (λ_i) is eliminated through differencing and equation (4) is left with a random error component, thus accounting for individual and community-level fixed sources of bias. Note this approach relies on the assumption the main source of endogeneity is from time-invariant factors influencing contraceptive choice. As an alterative to control for the endogeneity of contraceptive use, three variations of 2SLS are conducted instrumenting contraceptive use with a variety of health service availability including FP indicators at the community-level.[53] This method involves predicting contraceptive use in a first stage equation, using the following specification:

$$(5)\ \Pr\left(\boldsymbol{Contraceptive\ Use}_i = 1\right) = \beta_0 + \beta_1(\boldsymbol{FP}_j) + \beta_2(\boldsymbol{X}_i) + \beta_3(\boldsymbol{X}_h) + \beta_4(\boldsymbol{X}_j) + \varepsilon_i$$

In equation (5), the probability of using contraceptives is a function of community-level health and FP services ($\boldsymbol{FP}_j$ instruments), a vector of individual-level ($\boldsymbol{X}_i$), household-level ($\boldsymbol{X}_h$) and community-level characteristics ($\boldsymbol{X}_j$). The value of the predicted contraceptive use from equation (5)

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[52] Note that the choice of a fixed effects model can be tested against the alternative random effects estimator using the modified Breush-Pagan test for unbalanced panels adopted by Baltagi and Li (1990). These statistics are reported in the bottom of Appendix Table B8.

[53] Note two stage residual inclusion models are an alternative to 2SLS models, and comparatively found to be more consistent (Terza, Basu & Rathouz, 2008). However, for this analysis, results do not change substantially and therefore are not reported.

is then placed in equation (2) in the second stage to predict economic welfare outcomes. To account

for use of a predicted value, standard errors in the second stage are bootstrapped with 1,000

repetitions. Equation (5) is estimated using a LPM to avoid misspecification bias likely in use of logit

or probit models (Angrist & Krueger, 2001). The viability of the instrumental variables approach

depends critically on the strength of the instruments in predicting the endogenous variable. If

equation (5) poorly predicts contraceptive use, then replacing the actual value with the predicted

value only replaces the indicator with a noisy, poor measure. The R^2 of the first stage (equation 5) is

a good approximation of the strength of the instruments, where an R^2 under 0.10 is a poor predictor

(Bollen, Guilkey & Mroz, 1995). In addition, joint F-test's on the instruments in the first stage

should be statistically significant and strong, where the rule of thumb is an F-statistic of 10 or over.

Finally the instruments should theoretically and statistically be excluded from equation (2) as shown

by an insignificant or less powerful joint F-statistic when included in equation (2). The basic set of

indicators used to instrument contraceptive use are: 1) distance in kilometers to the nearest health

facility, 2) nearest health facility stocks the contraceptive pill, 3) nearest health facility offers HIV test

and 4) nearest health facility offers pregnancy test. In addition, to increase the explanatory power of

the instrument set, interactions between indicators service availability (instruments 2, 3 and 4) and

education levels of individual women (primary and secondary education and above) are included. It

is assumed higher educated women are more able to take advantage of FP and other health services

due to increased health knowledge and information as well as economic accessibility. This set of four

instruments in addition to the six education interactions will be referred to as the 'basic instrument

set.' The KHDS collects a variety of other quality of care indicators including availability of various

FP methods, number of days offering FP services, if payments are required for methods and other

specific complimentary services (for example cesarean sections). However, none of these services

are significantly associated with contraceptive use and are thus not utilized.[54] Further discussion of

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[54] In addition to testing straight indicators, indices using factor analysis and Cronbach's alpha are constructed
representing FP method availability and specific complimentary services at the community level. However

the lack of significance of many FP service indicators is highlighted in the discussion section. Although the basic instrument set are theoretically valid exclusions and expected to explain contraceptive use rather than economic outcomes, the conditions for valid 2SLS modeling are stringent and there are many potential pitfalls (Angrist & Krueger, 2001). In implementation of this approach, it is apparent this set of instruments has low predictive power of contraceptive use (as shown by the first stage R^2 and F-test of instruments) and therefore two alternative instrumentation variations are explored. The first (variation 1) includes the four basic instrument set (including interactions with education indicators) as well as the community-level non-self clustered mean of contraceptive use. The second (variation 2) includes the basic instrument set as well as cluster-level fixed effects in an effort to identify some of the spatial differences in service provision.[55] These two variations are discussed further in subsequent sections.

Results

Descriptive results

Descriptive statistics for contraceptive use and economic outcome indicators are presented in Table 3.1. In addition to the pooled sample, descriptive statistics are given for the first and fourth waves to help identify trends over the three year period. Average contraceptive use is 12 percent among the pooled sample, moving from 15 percent in wave one to 11 percent in wave four. A lower percentage of women practice modern and dual contraceptive use (six and two percent of the pooled sample, respectively). The economic welfare indicators fall into three main categories: 1) labor force participation and earnings, 2) savings and 3) expenditures (see Appendix Table B1 for detailed information on construction of economic outcome variables). Approximately eight and 10 percent of the pooled sample work outside the home and are self employed. The percentage over the three year panel working outside the home decreases slightly, while the percentage working self employed

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these indices are not significantly associated with individual-level contraceptive use and thus not utilized.

[55] Note in the models which employ cluster-level fixed effects, second stage models include district-level fixed effects to account for some of the higher level spatial factors influencing contraceptive use.

increases slightly. Approximately five percent of the sample has a formal savings account, 45 percent

of the sample has any kind of savings and 22 percent of the sample participates in an informal credit

group. Trends in earnings, expenditures and savings are mixed; earnings and expenditures decrease

slightly while savings increase slightly over the panel period.

Descriptive statistics for the key instruments used to predict the contraceptive use in 2SLS

models are presented in Table 3.2 for the pooled cross-section as well as the first and fourth waves.

The average distance to the closest health facility is 3.6 km and approximately 62 percent of the

nearest facilities stocked the contraceptive pill at the time of the data collection visit. Lower

percentages of the closest facilities offer HIV tests (12 percent) and pregnancy tests (13 percent).

Similar to individual-level contraceptive use indicators, FP and other health service provision

decreases slightly over the panel period. For example in wave 1, 61 percent of nearest health

facilities stock the contraceptive pill, while this percentage decreases to 58 percent in wave 4.

Descriptive statistics for all control variables in the pooled sample as well as the first and

forth waves are presented in Table B2 in the Appendix. The average age among the pooled sample is

27 years and the majority category for education is partial or completed primary (77 percent). The

largest proportion of women are in a marital union (47 percent) followed by never married (35

percent) and the fewest women have been widowed or separated (19 percent). The majority

household heads identify as Christian or Catholic (87 percent) and belong to the Haya ethnic group

(63 percent). Household wealth is computed through construction of a household per capita index

created through factor analysis using land, dwelling, livestock values and a range of assets (mean

values and principal contributions are reported for wave 1 in Table B3). Approximately 21 percent of

the sample resides in urban areas, 29 percent of the communities have electricity and 23 percent have

piped water. The average cluster population size is approximately 3,440 inhabitants.

First stage results: FP availability and contraceptive use

Table 3.3 displays first stage results predicting contraceptive use using a pooled-cross section. The

first two columns present coefficients and bootstrapped standard errors using the basic set of

instruments, the middle two columns present results of variation 1 (adding the non-self clustered mean of contraceptive use), while the last two columns present results of variation 2 (adding cluster fixed effects). Columns A, A1 and A2 are results using only instruments to predict contraceptive use, while columns B, B1 and B2 are results adding all control variables to models. Note columns A, A1 and A2 are displayed to illustrate the unmediated relationship between the instruments and contraceptive use, however predicted values are not used in subsequent analysis. R^2 values and F-tests of instrument strength are reported at the bottom of the table. In models using the basic instrument set, increasing distance to the nearest health facility decreases the probability that a woman will be using contraceptives. This effect is significant with and without additional control variables (moving from column A to B). Indicators of stocking contraceptive pill and offering pregnancy tests contribute negatively to the probability a woman uses contraceptives, however, this effect is offset by positive interaction terms with primary and secondary education. The direct effect of the provision of HIV testing is associated with higher contraceptive use, while interaction terms with education indicators are negatively associated with contraceptive use, which may indicate purposeful or endogenous placement of HIV testing services. The primary concern with the basic set of instruments is low predictive power of contraceptive use. The overall F-test of instrument strength is highly significant (1 percent level), however the F-statistic (6.05) fails to achieve the rule of thumb cut off of 10 or higher. The R^2 value is also relatively low, only explaining just over seven percent of the variation in contraceptive use. As previously noted, two alternative instrumentation strategies are explored, both of which boost the explanatory power of the model, however still do not achieve the rule of thumb tests for instrument strength. The weak instrument problem is further explored in the discussion section and evidence suggests purposeful program placement may play a role in lack of explanatory power of the indicators utilized for instrumentation. Other significant determinants of contraceptive use are age (U-shaped relationship), secondary education (positively associated with contraceptive use), being widowed or separated and low household wealth (both lower the probability of contraceptive use).

Contraceptive use and economic outcomes

Table 3.4 displays a summary of the coefficients and bootstrapped standard errors for the effects of contraceptive use on a variety of economic welfare outcomes listed in the left column. Column A displays results from the pooled cross-sectional models, columns B, B1 and B2 from the 2SLS models and column C from the individual-level fixed effects models. Note that each coefficient on contraceptive use is taken from separate regressions predicting economic welfare outcome measures. Full regression results are found in Tables B4 through B8 in the Appendix. F-statistics for tests of exclusion restrictions of instruments using 2SLS models are found in the bottom of Tables B5, B6 and B7. It should be noted nearly all exclusions are statistically significant at some level in economic outcome models, which is in part expected because of interaction terms. However, with the exception of prediction of having a savings account, none of these levels are higher as compared to the first stage strength of instruments. P-values from Hausman tests of contrasting fixed effects and random effects models for panel data models are found in the bottom of Table B8. All Hausman tests reject random effects models in favor of the fixed effects specifications. In models using the pooled cross-section (column A), contraceptive use is positively associated with all economic welfare outcomes except working self employed. For example, women who use contraceptives are five percentage points more likely to be employed outside the home in the last week and 10.5 percentage points more likely to have any individual savings. However, when the endogeneity of contraceptive use is accounted for (columns B, B1 and B2), only savings indicators remain significantly associated with contraceptive use. Note that many of the coefficients in the 2SLS models have magnitudes higher relative to the columns A or C and it is probable the estimates are unstable because of relatively weak explanatory power of instruments. In column C, where individual time invariant fixed effects are employed, contraceptive use is positively correlated with holding a savings account, any savings, total individual savings, any expenditure and total individual expenditure. The magnitudes of the fixed effects coefficients are lower than the cross-sectional analysis, but generally comparable.

Extensions

Two extensions are explored to gain a more robust understanding of the linkages between contraceptive use and development outcomes. First, interaction terms are explored between contraceptive use, age, secondary education or above and highest wealth quintile to explore heterogeneous treatment effects of contraceptive use. Second, two alternative measures for contraceptive use are explored: 1) modern use and 2) dual use (with condoms). Previous literature has shown that women with higher status as signaled by age, higher education, or household wealth are better situated to take advantages of and benefit from contraceptive use (Foster & Roy, 1997; Sinha, 2005; Rosenzweig & Schultz, 1982). Therefore it is expected that interaction terms between contraceptive use, education and age will be positive and significant (complements), while the interaction term with low household wealth will be negative and significant (substitutes). The alternative contraceptive use measures are interesting for a number of reasons. Modern use represents a more restrictive definition of contraceptive use, specifically one which must be provided by a FP facility as opposed to a knowledge based or behavioral intervention such as the rhythm method or withdrawal. Dual use is particularly noteworthy in the setting with high HIV prevalence to explore if women choosing to use condoms only or condoms alongside another birth control method show stronger associations with welfare outcomes through the added benefit of HIV protection. It is expected both modern and dual contraceptive use will show stronger statistical significance or magnitude with welfare outcomes in comparison to the inclusive measure of contraceptive use as implemented in the main analysis.

A summary of results of the first extension are displayed in Table 3.5. The top panel (A) shows the coefficients on contraceptive use and the interaction terms with age, the middle panel (B) replicates this model for interactions with secondary education and above and the bottom panel (C) with the bottom 40 percent of the wealth index. Dependent variables are listed in the first column and each set of coefficients is taken from a separate regression. The only set of interactions which are consistently significant those in the pooled cross-section analysis (column A) with contraceptive use and secondary education and above. In five outcomes (employment outside the home, earnings,

savings account, any savings and total savings amount), higher education is positive and significant, signifying education and contraceptive use are complements. However, none of these significant interactions carry over into the fixed effects panel specification. One set of interactions with household wealth in predicting participation in informal credit groups move in the expected direction, however, overall there is no pattern signifying wealth or age may act to inhibit or promote the linkage between contraceptive use and welfare outcomes.

Summaries of the second extension examining the effects of modern use and dual use of contraceptives and economic welfare outcomes are reported in Tables B9 and B10 respectively in the Appendix. Results of these extensions are generally as hypothesized, where coefficients for modern and dual contraceptive use are larger as compared to the broader measure of contraceptive use signifying a stronger effect size. For example, modern contraceptive use is associated with an eight percentage point increase in the probability of employment outside the home and a 14 percentage point increase in probability of any individual savings (Table B9, column A). Likewise, dual contraceptive use is associated with a 17 percentage point increase in probability of working outside the home and in having any individual savings (Table B10, column A). Although the trend of increasing effects is generally the case with these alternative measures, dual contraceptive use is never significant in fixed effects models (Table B10, column B). This is likely due to the very low percentage of women using dual protection and low power to achieve significance levels both in cross-sectional and panel models.

Discussion

There are significant challenges in identifying impacts of FP services, which not only contain a large behavioral take-up component, but also are subject to endogenous placement of programs. In implementing a 2SLS approach, data on theoretically valid exclusions for instruments is often lacking. Even when suitable instruments are available, they may not be statistically valid, which is partially the case in this analysis. A number of FP service indicators are natural choices for instruments, however, overall they lack the explanatory power of strong instruments leading to

potentially biased and unstable results. In spite of weaknesses of the 2SLS approach, due to the panel

nature of the data, it is possible to offer a credible alternative approach to this problem through fixed

effects modeling. A factor which may be driving low explanatory power of FP services in

determining contraceptive use is potential placement of FP programs.[56] If FP programs are targeted

or allocated within communities according to a specific funding rule or based on demand for services,

this may bias results if distribution mechanisms are also correlated with outcomes such as health and

fertility (Molyneaux & Gertler, 2000; Pörtner, Beegle, & Christiaensen, 2007; Rosenzweig & Wolpin,

1988). The endogeneity problem of program placement is examined by Angeles, Guilkey and Mroz

(1998) using cross sectional data from Tanzania. Results show that without controlling for program

placement, hospitals are the most important type of facility for providing FP services. However, after

controlling for the potential endogeniety of program placement, health centers are found to have

significant effects on fertility reduction, while hospitals have insignificant effects. To further explore

the potential of endogenous program placement in the KHDS, a community-level analysis is

conducted using demographic, economic, regional and fertility related factors to predict the

probability of stocking contraceptive pills at the nearest health facility. The results of this exploration

are presented in Appendix tables B11 (descriptive statistics) and B12 (determinant analysis).

Although the sample size is relatively small, the results confirm the hypothesis of endogenous

program placement based on average community-level fertility. Two variations are considered,

column A includes average community fertility of women ages 30 to 50 to represent past demand or

perceived need for FP services, while column B includes average community fertility of all women

ages 15 to 50 to represent current demand or need for FP services. Results indicate communities with

an average fertility of one child higher per woman are associated with an eight (past fertility) to 14

(current fertility) percentage point increased probability of the nearest health facility stocking the

contraceptive pill. This could be driven by demand in high fertility areas, or governmental planning

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[56] Program placement has been the hypothesized cause of negative association between FP programs and contraceptive prevalence in several cross sectional studies using Indonesian data (see e.g. Lerman et al., 1989).

which targets areas with the highest potential for program impact of providing services. Regional and economic indicators are in general not significant suggesting distribution factors are not playing a significant role determining FP services (for example urban centers or districts closer to the capital city are not more likely to provide services). The result of this analysis which suggests purposeful placement of services based on demand for services speaks to both a potential underlying factor driving the weak instrument problem found in this analysis and the difficulty in capturing accurate program impacts of FP services.

Other studies focused on identifying effects of contraceptive use or FP services have addressed endogeneity issues with varying levels of success. In domestic studies, Bailey (2005) and Goldin and Katz (2002) use variation in state laws over time on access to contraception as instruments. These laws (for example the requirement of prescription from physician versus pharmacist and access for legal minors) are taken as exogenous to the individual woman's use of contraceptive services. A number of studies from developing countries use geographic variation in introduction of FP service provision, arguing exogeneity of placement, either due to experimental program design (Foster & Roy, 1997; Joshi & Shultz, 2007; Sinha, 2005 all in Bangladesh) or 'haphazard' distribution unrelated to fertility or other socio-economic characteristics of the community (Miller, 2005 in Columbia). In considering factors which influence contraceptive choice, a variety of determinants linked to FP services have been shown to significantly influence individual women's uptake of contraceptives including quality of care, provider attitudes and method availability (Lerman et al., 1989; Magnani et al., 1999; Tsui et al., 1981) and are thus natural instrument choices. From an economic perspective, natural choices for instrumenting health input are prices, either in the form of time or access costs, such as distance to services, time spent waiting or monetary costs of services (Shultz, 2004). It is not plausible to assume these factors are strictly exogenous to economic welfare outcomes, however, it is reasonable to assume they better predict use of contraceptives rather than general development outcomes. In the current study for example, distance to nearest health clinic is used as an exogenous factor to predict contraceptive use. Although

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closer presence of a health facility is indicative of better overall development opportunities, it is likely this measure is a stronger predictor of health services use. Based on the weakness of the indicators used in this analysis (nearest health facility), it is possible they are not comprehensive enough to capture the true array of services available to women in each community whom may be serviced by several health facilities. This data limitation should be clearly acknowledged in discussion of findings and how they can be used to inform FP policy.

An interesting area of further discussion and investigation are the ways in which contraceptive use interacts with HIV. Although the KDHS data were collected to provide evidence of the interactions between HIV and economic status, it is unclear what direct conclusions can be drawn from this investigation. Theoretically, using contraceptives has two main benefits: 1) preventing unplanned pregnancy and 2) protecting against sexually transmitted infections (STIs) including HIV. In practice however, contraceptives with the most effective pregnancy prevention often have little or no protection from STIs (Cates & Stone, 1992; Mati et al., 1995). Research examining the interactions between general contraceptive use and HIV transmission have not given definitive results (Daly et al., 1994), however there is evidence from some settings that condom use has contributed to a decline in HIV/AIDS prevalence rates (Hearst & Chen, 2004). In this analysis, generally larger significant associations are found between dual contraceptive use and economic welfare outcomes among a cross-sectional analysis, however this does not translate to panel models. As previously mentioned, this may in part be due to the low percentage of women using dual methods and since HIV biomarkers are not collected, it is unclear how this relationship may translate to HIV risk or infection. On a service provision level, if FP services are an important source for HIV testing or treatment of STIs, offering services may be a significant inducer of positive behavior change in reducing HIV transmission, especially in the case of vertical transmission from mother to child (King, et al., 1995; Wilkinson et al., 1997). There is some evidence HIV services are part of a larger package of reproductive health provision in the KHDS, however it is unclear through what mechanisms this may be directly or indirectly influencing use and ultimately welfare outcomes. The

interactions, integration and roles of HIV in providing FP services are an active area of research (Berer, 2003; Bradley et al., 2008; Fleischman Foreit, Hardee & Agarwal, 2002). Initial evidence suggests there are important synergies between the two areas, however questions still remain as to how best to implement and design programs in order to best take advantage of synergies.

There are several limitations worth discussing while considering results of this analysis. First, since the panel only covers four years, there may be inadequate potential to identify significant changes regarding certain outcome variables. Second, the issue of attrition is not controlled for explicitly in the empirical estimation. Attrition due to mortality is expected due to the nature of the setting and sampling procedure. However, since the panel is relatively short and excludes very young and old women, the number of women who enter the panel and experience death is a small percentage.[57] Attrition due to mobility and movement of the population is issue if the choice to move or enter the sample is in part determined by labor force opportunities and/or availability of services in the community. Schultz (2004) highlights migration as a source of bias in modeling health related outcomes where movement can be viewed as a sorting mechanism according to health endowments, health stocks, preferences for health and regional prevalence of HIV/AIDS infection. Exploration of differences in FP service availability and contraceptive use controlling for age indicate there are no significant differences in number of years lived in the sample community.[58] There are mean significant differences in availability or use of contraceptives controlling for age between women who enter only two or three times in the panel versus all four, however it is unclear what role selective migration out of communities plays as motivation for out-migration is undocumented. Finally,

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[57] If none of the women appearing in round one had experienced mortality in subsequent survey years, the sample size would be 18 women larger. The percentage of women meeting sample qualifications and experiencing death in between rounds one and two is approximately 0.001. The percentage meeting sample qualifications and experiencing death between rounds two and three and between three and four are 0.009 and 0.01 percent respectively.

[58] Women's average number of years living in communities in which nearest health facility stocks the contraceptive pill is 15.58, while average number of years among communities which nearest health facility dose not stock the contraceptive pill is 16.24 (p-value = 0.326). Among women using contraceptives, average number of years in the community is 16.68, among those not using contraceptives, average number of years in the community is 15.70 (p-value = 0.289).

outcome measures are be subject to a variety of measurement, recall and self-report biases especially inherit in collecting welfare measures in developing countries and should be noted when reporting results.

Conclusion

This paper is a first step in assessing the spillover effects of contraceptive use on women's economic welfare in a sub-Saharan African setting. The empirical challenge of controlling for endogeneity of contraceptive use is addressed through 2SLS and panel fixed effects modeling which take into account unobserved fixed preferences regarding use of FP services. Naïve estimates of the relationship without controlling for the individual choice to use contraceptives indicates a strong and positive link between contraceptive use and all labor force, savings and expenditure outcomes with the exception of working self employed. Many of these relationships hold when applied to fixed effects models, where changes in contraceptive use are significantly associated with holding a savings account, individual savings and expenditures. Unfortunately, instrumental variable approach yields unstable results, due in part to endogenous program placement of FP services and weak ability to sufficiently predict individual contraceptive use. In general, these linkages are stronger and more significant when either modern or dual contraceptive use is considered. In addition, women with secondary education and above have a comparative advantage in benefiting from contraceptive use in respect to economic gains, while this complementary effect is not observed among older or wealthier women.

This analysis speaks directly to the argument by FP advocates that "reproductive health matters" for economic development and mirrors conclusions from similar studies between FP use and women's economic welfare in Indonesia, Bangladesh and Columbia. As data on FP service provision and contraceptives in developing countries improve, a clearer understanding of what mechanisms are directly responsible for this finding will become possible both on a micro and macro level. From a policy perspective this finding does not imply governments should advocate for lower fertility or use of contraceptives across the board, rather it suggests allowing women to make strategic choices

regarding the timing and spacing of childbearing provides them with an opportunity to improve other economic and social realms of their lives. This linkage is of prime importance as funding for FP services is sidelined in favor of higher publicized or less controversial aid packages such as for HIV/AIDS funding. Contraception should be viewed as part of an essential development package because of its potential to empower women and improve individual economic welfare.

Tables

Table 3.1: Descriptive statistics for contraceptive use and economic welfare outcomes

	Pooled (1991-94)		Wave 1 (1991-94)		Wave 4 (1994)	
	(N = 3,781)		(N = 956)		(N = 825)	
Use of family planning	Mean	SD	Mean	SD	Mean	SD
Contraceptive use (=1)	0.12	[0.33]	0.15	[0.36]	0.11	[0.31]
Modern contraceptive use (=1)	0.06	[0.23]	0.07	[0.25]	0.06	[0.23]
Dual contraceptive use (=1)	0.02	[0.12]	0.02	[0.02]	0.01	[0.08]
Labor force participation and earnings						
Employed outside the home (last week = 1)	0.08	[0.27]	0.08	[0.28]	0.07	[0.26]
Working self employed (last week = 1)	0.10	[0.30]	0.07	[0.25]	0.13	[0.34]
Earnings (log shillings last month)	0.65	[2.23]	0.74	[2.35]	0.57	[2.12]
Savings						
Savings account (=1)	0.05	[0.22]	0.06	[0.23]	0.05	[0.22]
Any savings (=1)	0.45	[0.50]	0.45	[0.50]	0.45	[0.50]
Savings amount (log shillings)	3.18	[3.67]	3.06	[3.55]	3.31	[3.85]
Participates in informal credit group (=1)	0.22	[0.41]	0.23	[0.42]	0.22	[0.42]
Expenditures[1]						
Any expenditures (=1)	0.88	[0.32]	0.94	[0.23]	0.84	[0.37]
Total expenditures (log shillings)	7.53	[3.06]	7.74	[2.29]	7.39	[3.51]

Note: All shilling amounts are deflated to the base year 1991.
[1] Expenditures categories are clothing, medical and food consumed outside the home. Clothing and medical expenses are recalled for 12 months, food expenses are recalled for two weeks.

Table 3.2: Descriptive statistics of health services used to instrument contraceptive use

Community-level variables	Pooled (1991-94) (N = 3,781)		Wave 1 (1991-94) (N = 956)		Wave 4 (1994) (N = 825)	
	Mean	SD	Mean	SD	Mean	SD
Distance to health facility (km)	3.609	[4.016]	3.749	[3.937]	2.777	[3.251]
Stocks contraceptive pill (=1)[1]	0.617	[0.486]	0.611	[0.488]	0.579	[0.494]
Stocks contraceptive pill*primary education	0.466	[0.499]	0.454	[0.498]	0.458	[0.499]
Stocks contraceptive pill*secondary education or above	0.036	[0.186]	0.039	[0.193]	0.028	[0.165]
Offers HIV test (=1)	0.122	[0.327]	0.139	[0.346]	0.087	[0.282]
Offers HIV test*primary education	0.103	[0.304]	0.112	[0.315]	0.078	[0.268]
Offers HIV test*secondary education or above	0.002	[0.049]	0.004	[0.065]	0.002	[0.049]
Offers pregnancy test (=1)	0.127	[0.334]	0.142	[0.349]	0.136	[0.343]
Offers pregnancy test*primary education	0.107	[0.309]	0.116	[0.321]	0.119	[0.324]
Offers pregnancy test*secondary education or above	0.008	[0.087]	0.012	[0.107]	0.010	[0.098]

Note: Values reflect services as the nearest health facility to the village, in the case there are two at the same distance to the village, the one with the larger number of services is used.

[1] Stocking of the contraceptive pill is at the time of the data collection visit.

Table 3.3: First stage results predicting contraceptive use (N = 3,781)

| | Contraceptive use (=1) | | | | | |
| Instruments | Basic set of instruments | | Variation 1 with non-self clustered mean | | Variation 2 with cluster fixed effects | |
	(A)	(B)	(A1)	(B1)	(A2)	(B2)
Non-self village clustered mean contraceptive use	---	---	0.575***	0.396***	---	---
	---	---	(0.069)	(0.109)	---	---
Distance to health facility (km)	-0.007***	-0.005**	-0.004***	-0.004**	-0.004	-0.004*
	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)
Stocks contraceptive pill (=1)[1]	-0.061***	-0.027	-0.050***	-0.028	-0.053**	-0.041
	(0.021)	(0.031)	(0.017)	(0.029)	(0.022)	(0.030)
Stocks contraceptive pill*primary education	0.047**	0.031	0.035**	0.025	0.031*	0.02
	(0.018)	(0.032)	(0.017)	(0.031)	(0.019)	(0.031)
Stocks contraceptive pill*secondary education or above	0.203***	0.106*	0.177***	0.108*	0.170***	0.109**
	(0.047)	(0.055)	(0.045)	(0.054)	(0.034)	(0.053)
Offers HIV test (=1)	0.107	0.095	0.113*	0.099*	0.137**	0.097
	(0.067)	(0.059)	(0.062)	(0.056)	(0.065)	(0.065)
Offers HIV test*primary education	-0.092*	-0.057	-0.090*	-0.06	-0.08	-0.053
	(0.052)	(0.050)	(0.052)	(0.048)	(0.061)	(0.061)
Offers HIV test*secondary education or above	-0.217***	-0.141**	-0.215***	-0.144**	-0.192	-0.132
	(0.070)	(0.061)	(0.071)	(0.058)	(0.129)	(0.127)
Offers pregnancy test (=1)	-0.130**	-0.155***	-0.153**	-0.153***	-0.179***	-0.150**
	(0.058)	(0.056)	(0.059)	(0.055)	(0.065)	(0.064)
Offers pregnancy test*primary education	0.111*	0.111*	0.122**	0.115*	0.122*	0.103
	(0.057)	(0.057)	(0.057)	(0.057)	(0.067)	(0.065)
Offers pregnancy test*secondary education or above	0.149**	0.094	0.169**	0.107	0.173*	0.101
	(0.072)	(0.070)	(0.068)	(0.068)	(0.092)	(0.092)
Age (years)		0.036***		0.035***		0.036***
		(0.006)		(0.006)		(0.005)
Age² (years)		-0.001***		-0.001***		-0.001***
		(0.000)		(0.000)		(0.000)
Partial/completed primary (=1)		0.027		0.029		0.035
		(0.027)		(0.026)		(0.027)
Secondary or above (=1)		0.105**		0.095**		0.095**
		(0.045)		(0.043)		(0.046)
Never married (=1)		0.005		0.002		0.001
		(0.019)		(0.018)		(0.017)
Widowed or separated (=1)		0.049**		0.047**		0.050***
		(0.019)		(0.018)		(0.015)
Muslim (=1)		-0.009		-0.011		-0.012
		(0.020)		(0.020)		(0.017)
Nyambo (=1)		-0.020		-0.016		-0.007
		(0.021)		(0.020)		(0.034)
Hangaza (=1)		-0.018		-0.012		-0.089**
		(0.033)		(0.024)		(0.044)
Other tribe (=1)		0.002		-0.008		-0.037
		(0.022)		(0.018)		(0.025)

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Table 3.3 continued

Bottom 40% wealth quintile (=1)		-0.023*		-0.023*		-0.023*
		(0.013)		(0.012)		(0.012)
Urban (=1)		0.043*		0.019		0.003
		(0.023)		(0.018)		(0.042)
Constant	0.157***	-0.406***	0.076***	-0.438***	0.219***	-0.427***
	(0.019)	(0.096)	(0.017)	(0.093)	(0.052)	(0.082)
F-test instruments (F-prob)	0.000	0.000	0.000	0.000	0.000	0.000
F-test instruments (F-stat)	7.52	6.05	31.78	8.53	3.41	2.34
F-test community controls (F-prob)	---	0.001	---	0.144	---	0.098
R²	0.019	0.073	0.031	0.076	0.052	0.098

Note: Outcomes and estimated with LPMs. Standard errors clustered at the community level are reported below in parenthesis ( ). Omitted are married, no schooling, Catholic/Christian religion and Haya ethnic group. Also included as control variables but not reported are community-level indicators (daily market, population, bank, HHs have electricity, HHs have piped water) and wave indicators.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 3.4: Summary of coefficient results of contraceptive use predicting economic welfare outcomes (left column)

	(A) Pooled Cross-section (N = 3,781)		(B) 2SLS (N = 3,781)		(B1) 2SLS Variation 1 (N = 3,781)		(B2) 2SLS Variation 2 (N = 3,781)		(C) Individual panel FE (N = 3,781)	
	Coeff	SE	Coeff	SE	Coeff	SE	Coeff	SE	Coeff	SE
Labor force participation and earnings										
Employed outside the home (last week = 1)	0.050**	(0.025)	0.022	(0.170)	0.061	(0.141)	0.082	(0.077)	0.008	(0.021)
Working self employed (last week = 1)	0.024	(0.019)	0.024	(0.154)	0.091	(0.137)	0.037	(0.084)	0.025	(0.021)
Earnings (log shillings last month)	0.509**	(0.233)	0.778	(1.480)	1.131	(1.164)	0.896	(0.614)	0.031	(0.128)
Savings										
Savings account (=1)	0.046**	(0.018)	-0.211	(0.142)	0.003	(0.110)	0.024	(0.054)	0.020*	(0.010)
Any savings (=1)	0.105***	(0.023)	0.126	(0.290)	0.394*	(0.239)	0.239*	(0.134)	0.074**	(0.034)
Savings amount (log shillings)	0.943***	(0.181)	1.611	(2.092)	4.184**	(1.723)	2.487**	(0.970)	0.571**	(0.240)
Expenditures[1]										
Participates in informal credit group (=1)	0.045*	(0.023)	0.156	(0.241)	0.300	(0.203)	0.191*	(0.113)	0.044	(0.033)
Any expenditures (=1)	0.036**	(0.014)	-1.219	(1.880)	-0.080	(0.167)	0.057	(0.092)	0.051**	(0.023)
Total expenditures (log shillings)	0.650***	(0.145)	-0.216	(0.205)	0.411	(1.561)	1.049	(0.870)	0.637***	(0.226)

Note: All models are estimated using OLS and LPMs. Standard errors clustered at the community level are reported in parentheses ( ).
Standard errors for columns B, B1 and B2 are bootstrapped with 1,000 replications. See Appendix Tables B4 through B8 for full models
All shilling amounts are deflated to the base year 1991.
[1] Expenditures categories are clothing, medical and food consumed outside the home. Clothing and medical expenses are recalled for
12 months, food expenses are recalled for two weeks.
* indicates significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3.5: Summary of coefficients for interactions (age, secondary education and above, bottom 40% wealth quintile and contraceptive use in predicting economic welfare

	(A) Pooled cross-section (N = 3,781)				(B) Individual panel FE (N = 3,781)			
	Contr. use		Interaction term		Contr. use		Interaction term	
A. Interactions (contraceptive use*age)	Coeff	SE	Coeff	SE	Coeff	SE	Coeff	SE
Employed outside the home (last week = 1)	0.074	(0.069)	-0.000	(0.002)	0.114*	(0.069)	-0.003*	(0.002)
Working self employed (last week = 1)	0.034	(0.069)	-0.000	(0.002)	0.066	(0.081)	-0.001	(0.003)
Earnings (log shillings last month)	0.520	(0.677)	-0.000	(0.023)	0.503	(0.527)	-0.016	(0.016)
Savings account (=1)	-0.033	(0.046)	0.002	(0.002)	-0.019	(0.040)	0.001	(0.001)
Any savings (=1)	0.375***	(0.109)	-0.009**	(0.004)	0.318*	(0.176)	-0.008	(0.005)
Savings amount (log shillings)	2.737***	(0.835)	-0.060**	(0.027)	1.969*	(1.149)	-0.046	(0.035)
Participates in informal credit group (=1)	-0.110	(0.078)	0.005*	(0.003)	0.034	(0.101)	0.000	(0.003)
Any expenditures (=1)	0.074*	(0.038)	-0.001	(0.001)	0.158*	(0.089)	-0.004	(0.003)
Total expenditures (log shillings)	1.070**	(0.462)	-0.014	(0.014)	1.040	(0.822)	-0.013	(0.026)
B. Interactions (contraceptive use*secondary education and above)								
Employed outside the home (last week = 1)	0.028	(0.024)	0.213***	(0.079)	0.006	(0.023)	0.209	(0.055)
Working self employed (last week = 1)	0.032	(0.021)	-0.078	(0.056)	0.030	(0.024)	-0.061	(0.083)
Earnings (log shillings last month)	0.267	(0.212)	2.267**	(0.958)	0.027	(0.145)	0.054	(0.373)
Savings account (=1)	0.029*	(0.016)	0.157**	(0.063)	0.022*	(0.012)	-0.023	(0.026)
Any savings (=1)	0.089***	(0.025)	0.156*	(0.083)	0.075**	(0.035)	-0.006	(0.150)
Savings amount (log shillings)	0.800***	(0.188)	1.332*	(0.709)	0.593**	(0.247)	-0.257	(0.997)
Participates in informal credit group (=1)	0.045*	(0.026)	-0.003	(0.060)	0.046	(0.035)	-0.028	(0.090)
Any expenditures (=1)	0.038**	(0.017)	-0.038	(0.017)	0.055**	(0.024)	-0.037	(0.084)
Total expenditures (log shillings)	0.634***	(0.169)	0.144	(0.518)	0.645***	(0.232)	-0.101	(0.844)
C. Interactions (contraceptive use*bottom 40% wealth quintile)								
Employed outside the home (last week = 1)	0.058**	(0.028)	-0.022	(0.042)	0.024	(0.024)	-0.041	(0.038)
Working self employed (last week = 1)	0.030	(0.021)	-0.016	(0.040)	0.038	(0.026)	-0.036	(0.048)
Earnings (log shillings last month)	0.582*	(0.299)	-0.209	(0.403)	0.078	(0.131)	-0.128	(0.250)
Savings account (=1)	0.060**	(0.026)	-0.041	(0.039)	0.018	(0.015)	0.006	(0.027)
Any savings (=1)	0.125***	(0.030)	-0.057	(0.047)	0.094**	(0.043)	-0.054	(0.073)
Savings amount (log shillings)	1.127***	(0.256)	-0.534	(0.378)	0.705**	(0.320)	-0.368	(0.503)
Participates in informal credit group (=1)	0.074**	(0.028)	-0.085*	(0.043)	0.088**	(0.041)	-0.120**	(0.052)
Any expenditures (=1)	0.029*	(0.016)	0.022	(0.030)	0.054*	(0.028)	-0.007	(0.050)
Total expenditures (log shillings)	0.620***	(0.177)	0.086	(0.318)	0.686**	(0.280)	-0.133	(0.457)

Note: All models are estimated using OLS and LPMs using same specifications as in main models, adding interaction terms one by one. Standard errors clustered at the community level are reported in parentheses ( ). All shilling amounts are deflated to the base year 1991.
[1] Expenditures categories are clothing, medical and food consumed outside the home. Clothing and medical expenses are recalled on 12 months, food expenses are recalled for two weeks.
* indicates significant at 10%; ** significant at 5%; *** significant at 1%.

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CHAPTER IV: INCONTINENCE AND TRAUMA: SEXUAL VIOLENCE,
FEMALE GENITAL CUTTING AND PROXY MEASURES OF GYNECOLOGICAL FISTULA

Introduction

Gynecological fistula is an abnormal opening between the vagina and the bladder or rectum,

resulting in uncontrollable leakage of urine and/or feces.[59] Although the condition has been virtually

eliminated in the developed world, cases are still found throughout sub-Saharan Africa, parts of Asia

and the Middle East. The most commonly cited estimates suggest over two million women suffer

from untreated fistula, with 20,000 to 33,000 new cases occurring annually on the African

subcontinent alone, however, figures are largely unknown (AbouZahr 1998; Stanton, Holtz & Ahmed

2007; Vangeenderhuysen, Prual & Ould el Joud, 2001). Fistula imposes lifelong isolation, shame and

stigma, as women are typically rejected by their communities and families, unable to work or

participate in organized social activities (Muleta et al., 2008; Williams 2007). Fistula is primarily

caused by obstructed labor from prolonged pressure on vaginal tissues, however it is also caused by

trauma to the genital area though sexual violence (SV) or cultural practices such as female genital

cutting (FGC).[60] Although *obstetric* fistula has begun to receive attention on the international public

health agenda, less attention has been given to *traumatic* fistula.[61] In fact traumatic fistula is often

treated as a unique occurrence or exception to the more common obstetric injury (Maybeya 2004;

Roy et al., 2002). Women with traumatic fistula may be victims of brutal rape and exposed to a

number of other dangers including unwanted pregnancy, sexually transmitted infections (STIs) and

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[59] These two types of gynecological fistula are referred to as vesicovaginal fistulae (VVF) or rectovaginal
fistulae (RVF); hereafter referred to as simply fistula.

[60] Also called female genital mutilation or female circumcision.

[61] The UNFPA's Campaign to End Fistula was launched in 2003 and is now working in 40 countries
worldwide. Partners include the African Medical and Research Foundation, CDC, EngenderHealth, Family
Care International, Population Council, WHO, the Women's Dignity Project and the Worldwide Fistula Fund
(www.endfistula.org).

psychological hardship. Emerging field reports from medical personnel and relief workers within war

zones indicate that traumatic fistula is a real and relevant problem (Kalume et al. 2004; Longombe,

Claude & Ruminjo 2008; Nordland 2006; Shetty 2007). However, since evidence has been largely

anecdotal, qualitative or based on counts from select facilities, levels and contributions of trauma to

fistula prevalence are virtually unknown.

This analysis is the first to specifically examine the co-occurrence of incontinence, SV and

FGC using population-level data. The study uses recent Demographic and Health Surveys (DHS)

from four African countries (Malawi, Rwanda, Uganda and Ethiopia) to investigate associations

within a sample of reproductive age women 15 to 49. [62] More specifically, the aims of this study are

to: 1) empirically test the associations between women's self reports of incontinence and a variety of

SV and FGC indicators, 2) provide simulations of the magnitude of these associations and 3) to

explore statistical methods to account for sample selection and imperfections in data collection. It is

hypothesized that each measure of trauma will be positively associated with incontinence and that this

measure will increase in magnitude and significance within regions where civil unrest is present and

where particularly severe forms of FGC are practiced. The remaining sections of the paper give

general background and country specific information on traumatic fistula, SV and FGC, describe the

data and methods used in the study, present and discuss the results and finally offer some policy

recommendations based on the findings.

Background and significance

Traumatic gynecological fistula: what do we know?

In September 2005, a group of fistula surgeons, health and social workers, psychologists,

lawyers and policy makers from 12 African countries met in Addis Ababa, Ethiopia for a workshop

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[62] DHS Mali (2006), DHS Pakistan (2006) and DHS Niger (2006) also collect incontinence data, however in Mali and Niger too few women report fistula symptoms and in Pakistan, neither SV nor FGC indicators are collected.

on traumatic fistula.[63] It was the first ever meeting focused on traumatic fistula with the goal of

sharing knowledge regarding magnitude, interventions, key successes, gaps and challenges

surrounding the issue, as well as to develop country-specific recommendations (ACQUIRE, 2006).

For the purpose of the meeting, traumatic fistula was defined as "an abnormal opening between the

reproductive tract of a woman or girl and one or more body cavities or surfaces, caused by sexual

violence, usually but not always in conflict and post-conflict settings." Conflict refers to situations of

civil unrest including war zones and unstable environments where militia or guerrilla forces may be

present. Case studies presented at the workshop included Democratic Republic of the Congo (DRC)

and Burundi where the magnitude of traumatic fistula is thought to be highest, in addition to other

'hot spots' including Chad, Guinea, Rwanda, Liberia, Uganda and Sudan. Discussion also

highlighted FGC, particularly *infibulation* and the *gishiri* cut which are hypothesized to contribute

directly to fistula (primarily in Somalia (*infibulation*) and Nigeria (*gishiri* cutting)).[64, 65] The meeting

was a key step in recognizing traumatic fistula as a distinct issue, creating a forum for exploration,

knowledge sharing and making linkages and is a basis of much of the literature surrounding current

knowledge of trauma and incontinence.

The majority of current information surrounding incontinence and trauma comes from

anecdotal reports and hospital-based studies. Unpublished reports and communications from conflict

situations estimate the percentage of traumatic fistula to be from two percent in Chad, to 35 percent in

---

[63] The event was funded by EngenderHealth/The ACQUIRE Project, the Ethiopian Society of Obstetricians and Gynecologists and Synergie des Femmes pour les Victimes des Violences Sexuelles and took place from the 6th to the 8th (see ACQUIRE, 2005 for more details).

[64] *Infibulation* is the most invasive classification of FGC, practiced primarily in Somalia, Djibouti and parts of Sudan, Egypt and Ethiopia. The procedure involves removal of the clitoris and partial or total removal of the labia minora. In addition, cuts are made in the labia majora and subsequently stitched together, resulting in scar tissue which may cover the urethra and vaginal opening. Because of the narrow opening, intercourse and childbirth may necessitate a 're-opening' or defibulation and in many cases women are re-infibulated or sewn up after childbirth (Masterson & Swanson, 2000).

[65] *Gishiri* means salt in the Hausa language of Niger and Northern Nigeria. The Hausa believe that an imbalance of salty or sweet food can cause a film to grow over the woman's vagina, resulting in among other things, a difficult labor. If during labor, this condition is suspected, a traditional healer or midwife may be summoned and a sharp object (knife, razor blade or piece of broken glass) is used to make a series of random cuts to 'open the way' for the baby to come out (Wall et al., 2001).

Kissidougou, Guinea to between four percent and 35 percent in DRC (ACQUIRE, 2005; 2006).

Other reports in DRC estimate percentages to be much higher, for example, in Goma, DRC, a hospital received 3,550 rape survivors and performed 600 fistula repairs, 68 percent of which were traumatic in nature (ACQUIRE, 2006). Still other studies from DRC find much lower percentages. In a record review from Panzi Hospital in the Eastern region, Onsrud and colleagues (2008) find only one percent of all fistula patients present with the injury directly resulting from SV and four percent indirectly related to SV. A study in the Addis Ababa Fistula Hospital in Ethiopia describes the cases of 91 young girls over six years with fecal incontinence, 78 of which had sustained injuries from forcible sex within marriages (Muleta & Williams, 1999). In Northern Nigeria, a hospital-based study attributes fewer than five percent of 899 fistula cases to *gishiri* cutting and the remaining to obstetric causes (Wall, et al., 2004). Other studies in Nigeria estimate *gishiri* cutting to account for six to thirteen percent of cases (Ampofo, Otu & Uchebo, 1990; Tahzib, 1983; 1985). There is also speculation that forms of FGC in which women develop scar tissue may contribute to fistula through increase risk for obstructed labor, however there is no conclusive evidence on the issue (Maybeya 2004; Wall et al., 2001). Johnson (2007) is the only population-based study I am aware of to analyze the determinants of fistula as well as assess the validity of incontinence as a fistula proxy measure from the 2004 Malawi DHS. Findings from Malawi indicate that women who have experienced SV are approximately 70 percent more likely to report incontinence than their counterparts. Although this study utilizes Malawi DHS data, it is a unique contribution as it includes disaggregated measures of SV, FGC indicators, offers cross-country comparisons, as well as simulations to approximate the contribution of SV to overall incidence of incontinence.

Sexual violence in intimate partner relationships and in conflict situations

SV is a general term to describe any "violence, physical or psychological, carried out through sexual means or by targeting sexuality (UN, 1998)." Although SV can encompass everything from sexual discrimination and attempted rape to sexual slavery, for the purpose of this study, SV refers

specifically to penetrative rape of the genital area by an intimate partner or a stranger.[66] Other studies

examining effects of SV may not use the same definition; however, they are useful to review as they

speak to the broader context and consequences of SV. Intimate partner violence is the most pervasive

form of gender-based violence. Results from 50 population-based studies in 36 countries indicate that

between ten to 60 percent of ever married or partnered women have experienced at least one incident

of intimate partner violence (Heise, Ellsberg & Gottmoeller, 2002). Violence is almost always

accompanied by psychological abuse and in a third to over half of cases, by sexual abuse. Intimate

partner violence has been linked to a host of adverse health outcomes including mental health

instability and depression, injuries, alcohol and drug use, unsafe abortion and suicide (Heise, Ellsberg

& Gottmoeller, 2002; Campbell & Soeken, 1999). In addition, a review of 19 studies worldwide

indicates that anywhere from seven to 36 percent of women report sexual abuse during childhood

(Finkelhor, 1994). This increases the risk of injury as young girls are not fully developed and more

likely to incur physical damage during sexual acts.

Other forms of SV include forced sex or rape by strangers, acquaintances and other non-

partner individuals. Conflict situations are characterized by increased incidence of forced sex and

exacerbated by factors such as militarization, decreased respect for international law, deepening

poverty and diminished state provision of basic services (ACQUIRE, 2006). SV can be used as a tool

for humiliation and genocide and reports indicate that women are often abducted and used as sex

slaves or unpaid labor for military or rebel groups. In the past five years, SV associated with conflict

has been reported in dozens of countries, by refugees or displaced persons (ACQUIRE, 2005).[67]

Although statistics from conflict situations are rarely reliable, post-conflict evidence surrounding the

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[66] Penetrative rape is defined by the International Criminal Tribunal for the former Yugoslavia is the "sexual penetration, however slight: a) of the vagina or anus of the victim by the penis of the perpetrator or any other object used by the perpetrator; or b) [of] the mouth of the victim by the penis of the perpetrator; where such sexual penetration occurs without the consent of the victim. Consent for this purpose must be consent given voluntarily, as a result of the victim's free will, addressed in the context of the surrounding circumstances (Foca case, 2002).

[67] Those mentioned in the corresponding report are Angola, Bosnia and Herzegovina, Chechnya, Haiti, India, Kosovo, Mozambique, Pakistan, Peru, Serbia, Somalia, Uganda, Zimbabwe, DRC, Rwanda, Liberia, Sudan, Guinea and Chad to name a few (ACQUIRE, 2005).

nature of SV provides several insights. First, evidence suggests that perpetration of violence is often

by groups rather than a single individual. In research from 2005 in Eastern DRC, 79 percent of nearly

500 women who had been sexually assaulted had been attacked by between two and twenty men (IA,

2005; UN ORCH/IRIN, 2007). Secondly, the age of victims seems to vary widely from infants to

elderly (HRW, 2002). Finally, the context in which violence occurs is diverse, ranging from open

raids, to prostitution, to kidnapping of women for 'bush wives' of domestic militia or peace keeping

forces. Although sexual assault is a violation of international law, few perpetrators are accused,

convicted or sentenced.[68]

There is evidence from developed countries linking SV to a range of maternal morbidities

including pelvic pain, pelvic inflammatory disease, sexually transmitted infections and other

conditions (Coker et al., 2000; Collet et al., 1998; Koss, Koss & Woodruff, 1991; Schei, 1991).

There is less evidence from developing countries. Adolescent girls in Rakai, Uganda who reported

being forced during their first sexual experience are significantly more likely to report one or more

symptoms of genital tract infection (Koenig et al., 2004). A study among matched couples in

Northern India shows that physical and sexual violence by intimate partners increase the odds of

reporting general symptoms of gynecological morbidity, however they attribute much of the

significance to the contribution of STIs (Stephenson, Koenig & Ahmed, 2006). Significant

associations stem from a combination of many factors including direct trauma, increased risk of

infections, characteristics of partners, and the physiological damage incurred by abused women.

Although none of these studies examines incontinence specifically, there is sufficient evidence to

support linkages across a range of women's health problems.

Female genital cutting: magnitude and consequences

According to the WHO, FGC is "the partial or total removal of the female external genitalia

or other injury to the female genital organs for cultural or other non-therapeutic reasons (WHO,

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[68] Sexual assault violates the 1949 Geneva Convention, the 1948 Genocide Convention, and the 1984 Torture Convention.

UNICEF & UNFPA, 1997)." Classifications of FGC range from minor forms including pricking and piercing to *infibulation*, in which part or all of the external genitalia are removed and the remaining opening is stitched closed.[69] Estimates suggest that over 130 million women and girls have undergone FGC, primarily on the African subcontinent and parts of the Middle East (UNICEF, 2005). FGC has been recognized as a fundamental violation of human rights, a form of gender discrimination used to control woman's sexuality and expose girls and women to health risks (UNICEF, 2005). Further, because women often undergo FGC before the age of 18, it is seen as a violation of the protection of children due to exposure of potential damaging practices. In its least invasive forms, FGC has been linked to post-surgery hemorrhage, infection, and development of abscess and cysts, while more invasive forms of FGC have been linked to prolonged labor, urine retention and death (Jones et al., 1999; Jones, Ehiri & Anyanwu, 2004; Morison et al., 2001). Despite its harmful health consequences, FGC continues to be valued by ethnic groups and linked to social standing, marriagability, fertility and a community's social fabric (Berggren et al., 2006; Chege et al., 2004; Gruenbaum, 2005). Due to the cultural significance of FGC, programs to encourage its abandonment have adopted a holistic approach towards the elimination of the practice (WHO, 1999).

The settings: Malawi, Rwanda, Uganda and Ethiopia

The countries included in this analysis are located in Eastern and Southern Africa, have high levels of poverty, low human capital and poor health. These countries also have high maternal mortality ratios and low life expectancies (see Table C1 in the Appendix for background indicators by country). In addition, measures of gender equity are low, with all four countries ranking in the lowest quintile of the UN's gender related development index. Of the included countries, Uganda and

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[69] The WHO groups FGC into four types: 1) Excision of the prepuce (fold of skin surrounding the clitoris), with or without excision of part or the entire clitoris, 2) Excision of the clitoris with partial or total excision of the labia minora (smaller inner folds of the vulva), 3) Excision of part or all of the external genitalia and stitching or narrowing of the vaginal opening (*infibulation*), 4) Unclassified, which includes pricking, piercing or incising of the clitoris and/or labia; stretching of the clitoris and/or labia; cauterization by burning of the clitoris and surrounding tissue; scraping of tissue surrounding the opening of the vagina (*angurya* cuts) or cutting of the vagina (*gishiri* cuts); introduction of corrosive substances or herbs into the vagina to cause bleeding or to tighten or narrow the vagina; and any other procedure that can be included in the definition of FGC (WHO, UNICEF & UNFPA, 1997).

Rwanda have a history of or are currently engaged in conflict. For the last two decades, Northern Uganda has been in crisis due to an insurgency by the Lords Resistance Army killing more than half a million and displacing more than two million people (ACQUIRE, 2006; see Dolan, 2000 for overview of conflict). In the early 1990's, Rwanda experienced a civil war which culminated with the mass killings of hundreds of thousands of ethnic Tutsis in 1994. Reports of SV have been linked to each of these situations. The UN estimates that between 250,000 and 500,000 girls and women were raped during the Rwandan conflict in the early 1990s. SV continues to be reported as a weapon of war in the Ugandan conflict mirrored in the stories and increasing numbers of young women in rehabilitation centers, however the magnitude remains unknown (Turshen, 2000; UN OCHA/IRIN, 2007).

Theoretical framework

The framework guiding this analysis draws on the path diagram first proposed by the Worldwide Fistula Fund (Wall et al., 2001).[70] The framework includes both 'origins' and 'consequences' of fistula and is included in its original form in Appendix C, Figure C1. Examples of distal determinants (origins) of fistula are malnutrition and early marriage, examples of proximate determinants are lack of emergency services and obstructed labor. Consequences of fistula include medical conditions such as infertility, foot-drop and chronic skin irritation as well as social consequences such as stigmatization, isolation and loss of social support. This analysis will focus on the 'origins' flow and make policy recommendations extrapolating to 'consequences' of fistula. In order to incorporate aspects of trauma into the framework, SV is conceptualized as a proximate determinant and FGC is specified as a 'cultural practice.' The presentation of the framework is for illustrative purposes only and meant to serve as a guide to understanding potential mediating and confounding factors associated with incontinence.

Data: Demographic and Health Surveys

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[70] Formerly called the Worldwide Fund for Mother's Injured in Childbirth.

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Four DHS surveys are included in the analysis: 1) Malawi (2004), 2) Rwanda (2005), 3) Uganda (2006) and 4) Ethiopia (2005). The DHS are cross-nationally comparable population-level surveys collected by host country governments with funding and technical assistance from Macro International and USAID.[71] The DHS are designed to inform the planning, implementation, monitoring and evaluation of population and health programs in and across countries by providing detailed information on a range of issues including fertility, infant, child and adult mortality, nutrition, family planning and HIV/AIDS. All countries except Ethiopia include modules on SV while only Uganda and Ethiopia collect data on FGC. Indicators of incontinence are collected by asking women if they have ever "experienced uncontrollable leakage of urine or feces through the vagina." The question sequence often mentions or adds a probe for the local term for fistula and relates it to condition women may experience after childbirth. In addition to general questions, Malawi asks more specific questions to women who have had a live birth in the last five years. However, it does not approach the gold standard of a pelvic exam (see Appendix C for questionnaire modules by country). Therefore, the fecal and urinary incontinence measure is a proxy and subject to several potential sources of bias. A key issue surrounding the questionnaire design for this analysis are the sub-samples or threshold questions asked in two out of four countries.[72] In Rwanda, incontinence questions are only asked to women who have had a live birth in the last five years, while in Ethiopia women are first asked if they have heard of a condition in which women leak urine or feces and are only asked subsequent questions if they answered affirmatively. This has implications for population-level analysis if it is believed that women who are included in questioning are somehow different with respect to: a) their risk of incontinence, b) their risk of SV or c) their risk of FGC than those women who are not questioned. All these are reasonable assumptions. For example,

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[71] Funding is provided through USAID sponsored MEASURE DHS in addition to other international development agencies. Data is publicly available from www.measuredhs.com.

[72] In this case, a 'threshold question' refers to a question asked to all women which determines a sub-sample of women who are then surveyed on incontinence. Threshold questions may be asked immediately proceeding incontinence questions or may be determined from prior questioning (see Appendix C for modules included in each country.)

the Rwandan sample includes women with recent live births, excluding women who have had only a

stillbirth or women who have been rendered infertile by incontinence. Thus, the sampling framework

may underestimate the prevalence of incontinence when extended to the full population. Likewise, if

women who are more likely to have heard of fistula are those who are better educated, have higher

health knowledge and live in urban centers, the sample in Ethiopia may underestimate the prevalence

of incontinence when extended to the full population.

Empirical model

In Malawi and Uganda, where incontinence questions were asked to all women ages 15 to 49,

the estimating equation is a logit model predicting the probability of incontinence. To account for

differences in sub-samples in Rwanda and Ethiopia, the equation is estimated using a Heckman

selection equation. Below is an example of the model estimated for Rwanda where incontinence

questions are only asked to women who had had a birth in the last five years:

(1) Pr (***Birth in 5 years***$_{ij}$ = 1) = β_0 + β_1(***contraceptive use***$_i$) + β_2(***X***$_i$) + β_3(***X***$_j$) + ε

(2) Pr (***Incontinence***$_{ij}$ |***birth in five years***$_{ij}$ = 1) = β_0 + β_1(***SV***$_i$) + β_2(***FGC***$_i$) + β_3(***X***$_i$) + β_4(***X***$_j$)

$\qquad$ + λ_i ($\Delta\rho\sigma_\varepsilon$) + ε

Equation (1), the participation equation, predicts the probability of having a birth in the last five years

using a probit model, which among other things is a function of an identifying instruments,

contraceptive use and pregnancy termination of individual woman i in community j. Contraceptive

use and pregnancy termination variables are expected to be associated with the probability of having

previous births. However, they have no effect on incontinence except through their influence with

previous births. Equation (2) predicts the probability of reporting incontinence, conditional on having

a previous birth, which is a function of both SV and FGC.[73] Equation 2 contains an added term λ_i, the

predicted inverse Mills ratio, or the non-selection hazard-rate which measures the likelihood that an

individual has had a previous birth at the time of the survey. In both equations, X_i and X_j represent

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[73] Note that FCG was not collected in Rwanda, but is included as a demonstration of how FGC will be modeled in those countries where the indicator is present.

vectors of individual-level and community-level control variables. Individual-level control variables included are: 1) age splines,[74] 2) education attainment indicators, 3) wealth asset quintiles, 4) indicator of ever had a stillbirth and 5) indicator for bottom decile of height distribution. Community-level control variables included are: 1) urban residence and 2) limited access to health care. Johnson (2007) gives a comprehensive explanation of pathways through which these variables may be associated with incontinence and is therefore not repeated here. The error term ε is assumed to be normally distributed. In Ethiopia, the participation equation models knowledge of the fistula condition, equation 1 is instrumented with measures of media exposure and health knowledge. In Malawi and Uganda, equation 2 is estimated without a participation equation.

A variety of questions were asked to assess the prevalence of SV across surveys. Each country collects SV measures in intimate partner relationships by asking a selected sample of women if they have ever been physically forced to have sex against their will by a current or past intimate partner. In addition, two questions are asked concerning forced sexual experiences to assess if the woman has been forced to have sexual intercourse by individuals other than their partner. For example, in Malawi, one woman per household who reports ever having sex are asked if their first sexual experience was forced and if they have been forced by someone other than their partner to have sex in the past year (see Appendix Table C2 for summary of SV questions asked in each country). In order to utilize the full samples in each survey, SV indicators are constructed by imputing missing values for women who were not selected to complete the modules. Imputed values are based on relationship status and report of ever having sex and including an indicator for imputed value as a covariate. The composite indicator is constructed by taking the intersection of woman

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[74] Main results are robust to inclusion of age as a continuous variable, in five year splines or stratifying on age groupings.

reporting either forced sex or intimate partner SV and missing values are imputed identical to the specific measures.[75]

Results

Descriptive statistics

Table 4.1 shows summary statistics for incontinence by country. Reports of incontinence within sub-samples are highest in Malawi (approaching five percent), followed by Ethiopia and Rwanda (both over three percent) and lowest in Uganda (over 2.5 percent). Lifetime prevalence follows the same pattern, with women in Malawi experiencing 16.4 reported cases of incontinence for every 1,000 live births to women in Uganda 5.9 cases for every 1,000 live births. Significant differences by region ($p<0.05$) are found in all countries except Malawi, however are significant at a higher level in Rwanda and Uganda ($p<0.01$) in contrast to Ethiopia ($p<0.05$).

Table 4.2 displays summary statistics of the key independent variables by country. Of the three countries collecting SV information, Uganda has the highest composite value (42 percent) followed closely by Malawi and Rwanda (38 and 36 percent respectively). The same ranking is found for intimate partner SV with 25 percent of Ugandan women, 13 percent of Malawian and 12 percent of Rwandan women ever experiencing SV from intimate partners. Finally, accounts of other forced sex are highest in Malawi (27 percent) followed by Uganda and Rwanda (23 and 17 percent respectively). Of the two countries collecting FGC information, women in Uganda report a very low incidence (less than one percent) of FGC, while the majority of women in Ethiopia report some form (74 percent) and 4.5 percent report the most severe form.

Table 4.3 presents descriptive statistics of control, mediating and excluded variables for the participation equations which will be used based on their association with incontinence and their potential association with SV and/or FGC (use of mediating variables will be explained in detail in section F3). The modal age group in all countries is 20 to 29 and the modal education level is

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[75] Note that because of imputation, the mean values are close but not identical to weighted values among the selected sample.

primary, except in Ethiopia where nearly two thirds of women report having no formal education. Women report very low incidence of still births (approximately two percent) and from 20 to 40 percent of women have never had a live birth. The majority of women live in rural areas and report high levels of limited access to health care (from 40 to 68 percent).

Associations between SV, FGC and incontinence

Summary coefficients for SV and FGC from equations predicting incontinence are shown by country in Table 4.4. In the first two columns (A and B) coefficients on composite indicators are displayed, while the remaining four columns (A1, A2, B1 and B2) break each composite indicator into two specific forms. In Malawi and Rwanda, women who experience any form of SV are significantly more likely (OR = 1.67, 95 percent CI = 1.38 - 2.02; OR = 3.78, 95 percent CI = 2.29 - 6.39) to report incontinence. In Uganda, women who report any form of SV are also more likely to report incontinence (OR = 1.40, 95 percent CI = 0.75 - 2.64), however, the association is not statistically significant. The statistically significant associations in Malawi and Rwanda hold when disaggregated to specific measures of intimate partner SV or other forced sex, however, in Rwanda the odds associated with forced sex are larger than for intimate partner SV (OR = 2.45, 95 percent CI = 1.41 - 4.26, verses OR = 2.37, 95 percent CI = 1.29 - 4.36) while in Malawi they are slightly lower (OR = 1.43, 95 percent CI = 1.16 - 1.76, verses OR = 1.65, 95 percent CI = 1.30 - 2.11). Again in Uganda, no specific indicator is statistically significant. Neither country with information on FGC shows significant associations with incontinence among composite or specific indicator. Although not displayed, as discussed in the previous section, results from Rwanda and Ethiopia include a first stage selection model to account for the differences in sample selection. The results of the first stage regressions are reported in Table C7 in the Appendix, including chi-squared statistics on identifying instruments which are significant and substantial. Inverse Mill's ratios achieve significance for Ethiopia and Rwanda, confirming significant differences in sample selection, however are significant at the 10 percent level only (reported at the bottom of each table).

Table 4.5 shows results of simulations of predicted levels and percent changes in incontinence under different scenarios which eliminate various sources of trauma explored in the multivariate analysis. The changes associated with statistically significant coefficients are in bold. For example, in Rwanda, elimination of all forms of SV is associated with a 40 percent decline in the predicted prevalence of incontinence, while an elimination of only intimate partner SV or only other forced sex are association with 11 percent and 16 percent declines in incontinence prevalence respectively. Elimination of all forms of SV are associated with an 18 percent decline in incontinence in Malawi and a 13 percent decline in incontinence in Uganda, although the later is based on insignificant coefficients. Likewise, simulations of reductions in FGC show variations by country, however are not based on significant coefficients.

Extensions and robustness checks

Three extensions are conducted to check the robustness of findings. First, there may be a concern that the analysis suffers from omitted variable bias, specifically from a measure encompassing women's status or decision-making. For example, it could be argued that women who experience SV are more likely to have lower decision-making power, suffer from low status in general and specifically be less likely to seek delivery care. If this is the case, the coefficient on SV will pick up the partial effect of the mediating variable, low decision-making, if the mediating variable is not included in the regression.[76] To test this hypothesis, a parallel analysis is run adding two mediating variables to proxy women's health seeking at delivery: 1) skilled attendance at delivery and 2) delivery in a health facility for the last birth (descriptive statistics for the mediating variables are found on the bottom panel of Table 4.3). Second, it may be expected that FGC may not

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[76] Note that this hypothesis holds for SV in intimate partnerships where power dynamics may exist which influence decision making, while it is not appropriate for forced sex from other individuals. In addition to the indicators representing delivery care described here, two general decision-making indices are tested. These indices are constructed from questions concerning a woman's 'final say' on various items (own health care, large and small household purchases, visits and food preparation). The first index is a sum of the number of decisions a woman reports having the final say on. The second index is a scale created from factor analysis using the same questions which take a 0, 1 or 2 depending on if the woman has final say, shares the decision or if someone else has the final say. Results are robust to inclusion of both variations of this general decision making index.

have a direct association with incontinence, however may contribute to fistula formation through build up of scar tissue causing obstructed labor. To test this hypothesis, the sample is limited to women who have ever had a birth and a parallel analysis is run. Finally, to verify that assumptions around the construction and treatment of missing values in the SV questions are not driving results, a parallel analysis is run with only those women who are selected for the violence modules.

Results of the first robustness check indicate that the addition of the mediating variables does not significantly change results, thus refuting the hypothesis that women who experience SV are necessarily have low status (see Tables C5 and C6 for full logit models with composite and specific indicators). This relationship, although counterintuitive, has been confirmed by several other population-level studies examining the association between SV and proxies of women's status such as wealth, employment, and labor force participation (Kishor & Johnson, 2005; Farmer & Tiefenthaler, 1999; Morrison & Orlando, 2004). When samples are reduced to women who have at least one child, coefficients on FGC remain insignificant, refuting the hypothesis that FGC contributes to incontinence through build up of scar tissue and increases in obstructed labor. Finally, results are robust to a parallel analysis conducted using only women selected for the violence modules.[77]

Discussion

Although SV is a significant determinant in two of the three countries included in this analysis, it is unclear if and how civil unrest contributes to delivering these results. Incontinence varies significantly by region for all countries and forced sex varies significantly by region in Rwanda and Uganda which is suggestive of variations in stability within countries. In Rwanda, the boarder regions with DRC have an unusually high percentage of reported incontinence, up to ten times the prevalence in other regions. Northern Uganda, the site of ongoing conflict, has the second highest rate of incontinence after the Western region (also boarders DRC). When the analysis is run just including the Northern province, SV is a significant determinant of incontinence, in line with country-

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[77] Results from the second and third extensions are not presented, however are available from the author upon request.

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level estimates from Rwanda and Malawi (OR = 2.90, 95 percent CI = 0.90 - 9.39; p-value = 0.076, N = 1,662). There are a number of alternative explanations for the lack of statistical significance in the case of Uganda and in general for conflict regions. First, populations in conflict areas are highly mobile and may re-locate in refugee camps or settlements which are excluded from a population-level survey. It is also possible that conflict increases stress and resource scarcity within the household, leading to strained relationships and increases in intimate partner violence. Therefore an indicator of forced sex which captures one component of a larger problem may be obscured by other factors. Finally, it is probable that women in conflict situations face a range of other barriers related to accessing pregnancy care and general health services, resulting in significant differences in health infrastructure and service availability not controlled for in the analysis. Therefore, because of limitations in study design and weak evidence of the forced sex and incontinence association in Uganda, it is unclear how much conflict itself contributes to incontinence over situations of relative stability.

This paper is the first to use selection models for incontinence data in an attempt to correct for diverse sample selection. Ideally, questionnaire design would include fistula and incontinence measures for all women regardless of their specific knowledge surrounding the condition or their birth history; a new survey module designed to ameliorate these shortcomings is now being used in the DHS. Predictions for Rwanda suggest that the selection bias is in the hypothesized direction (only selecting women with a live birth may underestimate the occurrence of incontinence since it leaves out those with stillbirths). For example, among those women who have had a live birth in the past five years, the predicted probability of incontinence is 1.5 percent, while among those who have not had a live birth (the excluded sample), the predicted probability is 3.8 percent (conditional probability is 2.88 percent). Therefore, the sample selection in Rwanda which collects information for only a sub-sample leads to an underestimate of the total incontinence burden. However, predictions in Ethiopia do not follow the expected direction, where women who have heard of fistula and who have not report approximately the same levels of incontinence. Although the inverse Mills ratios on

selection models were significant for both Rwanda and Ethiopia, the level is low (10 percent).

Furthermore, the relationships between SV, FGC and incontinence do not change in significance or

magnitude when run without sample selection. Therefore, the use of sample selection in the DHS

incontinence data must be acknowledged and is important for predicted prevalence levels, however, it

is unclear if selection models significantly change results when examining associations.

There are several limitations worth mentioning. First, measures of SV, FGC and

incontinence are self-reported. This poses less of a challenge in the cases of SV and FGC, as both

indicators are assumed to be an under-report of the true prevalence and thus any significant

associations are lower bounds. However, it is unclear what direction the bias is expected to be in the

case of incontinence itself. There have been several studies comparing women's self-reports and

medical diagnoses of reproductive morbidities which call for caution and attention to the specificity

of questions which may vary by the severity of complication and recall time (Ronsmans, 1996; Filippi

et al., 2000; Bhatia & Cleland, 2000). Reporting may deviate from medical diagnoses and be

influenced by a variety of factors including language and wording, place and timing of the interview,

the interviewer themselves, in addition to the woman's knowledge and willingness to disclose about a

sensitive and shameful subject. Since the validity of the survey instrument included in the DHS has

not been directly tested, it is necessary to note that the measure used in this analysis is a proxy for

fistula and is representative of woman who believe and are willing to report symptoms of

incontinence (see Johnson, 2007 for further discussion of fistula measurement in DHS). As many

control variables which are believed to be associated with fistula remain insignificant across countries

in this analysis, it is important to acknowledge this limitation. Apart from measurement error, there

are several other considerations in approximating findings to a population-level. Since measures of

incontinence, SV and FGC may be relevant for age groups less than 15 years old and over 49, but

may differ from the sampled populations, associations cannot be taken to represent the women of all

ages. Perhaps some of the most extreme violations of human rights involving traumatic fistula that

have been documented include brutal rape of infants and young children; this population is, however,

necessarily excluded from analysis (Nduati & Muita, 1992; ACQUIRE, 2006). In addition, since it is thought that many women experiencing incontinence are ostracized from their communities, it is possible the sampling methodology of a household survey captures women with incontinence who are the 'best off,' while those less fortunate may be living on the streets or perhaps in group quarters. However, this limitation, like those mentioned above is expected to result in an underestimation of the true magnitude and association between SV, FGC and incontinence and thus result in findings which are a lower bound of the true associations.

Conclusion and policy implications

Evidence surrounding the extent and nature of traumatic fistula is a growing interest among health professionals and human rights advocates. This paper is a first effort to explore the associations between SV, FGC and a proxy measure of incontinence using cross-country population-level data from sub-Saharan Africa. Results indicate that overall, SV is significantly associated with incontinence both from forced sexual encounters and from intimate partners is associated with incontinence in Malawi and Rwanda. There is no evidence that FGC contributes to the prevalence of incontinence and this finding is robust to types of cutting and among samples of women who have given birth. However, this result does not preclude the possibility that significant associations would be found in regions where particularly severe forms of FGC are practiced, such as parts of Nigeria and Sudan. Given the scarcity of reliable population-level data on incontinence, a primary objective of the public health community interested in fistula research should be in developing and implementing more comprehensive and sensitive survey instruments in appropriate regions both for obstetric and traumatic fistula (Stanton, Holtz & Ahmed 2007; Johnson & Peterman 2008). In addition, further research on program implementation especially on reintegration of women back into communities and qualitative explorations of how women view the relationship between SV, FGC and incontinence in select conflict areas are necessary next steps.

Findings point to the importance of recognizing SV as a risk factor for incontinence and raising awareness surrounding how these women may be different from a fistula patient suffering

from obstetric related injuries. For example, women who have experienced SV may be less likely to seek care because of stigma and shame in disclosing rape. In addition, they may be more likely to have excess scar tissue or suffer from rectovaginal fistulae as compared to vesicovaginal fistulae typical of women who experience obstetric complications (ACQUIRE 2006; Muleta & Williams 1999). In especially brutal cases of sexual torture, women may have to undergo several surgeries due to deep internal wounds or reconstruct entire organs due to deep internal wounds. Second, it is important to reinforce programs which seek to integrate services to serve women experiencing both SV and fistula, including both short term (emergency contraceptives, STI/HIV and pregnancy tests) and long term (HIV and STI treatment, social reintegration, legal referral and counseling) services. Several organizations in areas with particularly high demand have already rolled out integrated programs. For example, HEAL Africa Hospital fistula program based in Goma, DRC and the General Referral Hospital of Panzi based in Bukavu, DRC provide medical, surgical, psychological and reintegration programs to women suffering from traumatic fistula.[78] Finally, programs to prevent the perpetration of SV both in domestic and conflict situations are a key intervention for reducing women's risk of experiencing traumatic fistula.

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[78] The HEAL program was formerly called Doctor's on Call for Services (DOCS). For more information see www.healafrica.org and panzihospitalbakavu.org.

Tables

Table 4.1: Summary statistics on incontinence

	Malawi (2004) N = 11,698	Rwanda (2005) N = 5,386	Uganda (2006) N = 8,524	Ethiopia (2005) N = 3,907
Incontinence indicators				
Mean (%)	4.69	3.30	2.64	3.41
Confidence interval (95 percent)	(4.25 - 5.13)	(2.78 - 3.81)	(2.25 - 3.04)	(2.60 - 4.22)
Lifetime prevalence (per 1,000 births)[1]	16.40	8.33	5.92	10.43
Regional variation (p-value)	0.057	0.000	0.000	0.017

Note: Mean values are weighted according sampling units provided in the DHS.

[1] Calculated by dividing the sum of all fistula reports by the sum of all live births.

Table 4.2: Weighted mean values for sexual violence and female genital cutting

	Malawi (2004)	Rwanda (2005)	Uganda (2006)	Ethiopia (2005)
Sexual violence indicators (in percentages) [1]	N = 11,698	N = 11,321	N = 8,524	N = 14,066
Intimate partner sexual violence (=1)	13.04	11.62	25.09	---
Other forced sex (=1)	27.42	17.18	22.76	---
Composite measure (=1)[2]	37.84	36.41	42.31	---
Regional variation in intimate partner sexual violence (p-value)	0.000	0.000	0.000	---
Regional variation in forced sex (p-value)	0.598	0.000	0.029	---
Female genital cutting indicators:				
Least severe form (nicked, no skin removed =1)	---	---	---	69.72
Most severe form (partially or all sewn shut =1)	---	---	---	4.53
Any form (=1)	---	---	0.64	74.26

Note: Mean values are weighted according sampling units provided in the DHS.

[1] Mean values reflect prevalence extended to the full sample. For wording of questions and selection percentages by country see Table C2 in the Appendix.

[2] Composite value is the intersection of 'intimate partner sexual violence' and 'other forced sex' with missing values treated the same as above.

Table 4.3: Weighted mean values of control, mediating and excluded variables by country

	Malawi (11,698)	Rwanda (11,321)	Uganda (8,524)	Ethiopia (14,070)
Age:				
Age 15-19 years (omitted)	0.20	0.23	0.23	0.23
Age 20-29 years (=1)	0.43	0.36	0.37	0.36
Age 30-39 years (=1)	0.22	0.23	0.25	0.24
Age 40-49 years (=1)	0.14	0.18	0.15	0.17
Formal education:				
None (omitted)	0.23	0.22	0.19	0.66
Primary only (=1)	0.62	0.68	0.59	0.22
Secondary and above (=1)	0.15	0.10	0.21	0.12
Wealth:				
Bottom decile of wealth index (omitted)	0.17	0.21	0.18	0.17
Second decile of wealth index (=1)	0.19	0.21	0.19	0.19
Third decile of wealth index (=1)	0.20	0.19	0.19	0.19
Fourth decile of wealth index (=1)	0.20	0.19	0.19	0.19
Fifth decile of wealth index (=1)	0.23	0.21	0.25	0.25
Other individual characteristics:				
Ever had still birth (=1)	0.02	0.02	0.02	0.01
Bottom decile of height distribution (=1)	0.09	0.07	0.09	0.10
Missing height information (=1)	0.07	0.50	0.66	0.52
Missing birth information (=1)	0.21	0.37	0.24	0.31
Community-level variables:				
Urban (=1)	0.14	0.17	0.17	0.18
Limited access to health care (=1)[1]	0.61	0.40	0.54	0.68
Mediating variables				
Skilled at last birth (=1)	0.56	0.40	0.45	0.16
Delivery at health facility last birth (=1)	0.58	0.30	0.45	0.09
Participation equation exclusions:				
Ever terminate a pregnancy (=1)	---	0.13	---	---
Ever use contraceptive method (=1)	---	0.21	---	---
Reads magazine or newspaper more than once a week (=1)	---	---	---	0.01
Heard of sexually transmitted disease (=1)	---	---	---	0.90
Heard of tonsillectomy (=1)	---	---	---	0.84
Knows ways to avoid HIV infection (=1)	---	---	---	0.61

Note: Mean values are weighted according sampling units provided in the DHS.

[1] Community mean of self-report if accessing health care is a big problem.

Table 4.4: Summary of sexual violence and female genital cutting coefficients predicting incontinence
by country

| | Composite indicators | | Specific indicators | | | |
| | (A) SV | (B) FGC | (A1) Intimate partner SV | (A2) Other forced sex | (B1) FGC least invasive | (B2) FGC sewn shut |
Country						
Malawi (N = 11,698)	1.667***	---	1.654***	1.428***	---	---
	(1.379 - 2.017)		(1.298 - 2.106)	(1.161 - 1.757)		
Rwanda (N = 5,386)	3.778***	---	2.375***	2.453***	---	---
	(2.292 - 6.389)		(1.294 - 4.361)	(1.411 - 4.264)		
Uganda (N = 8,524)	1.404	---	1.008	1.500	---	---
	(0.746 - 2.641)		(0.494 - 2.057)	(0.772 - 2.916)		
Ethiopia (N = 3,907)	---	0.819	---	---	0.854	0.369
		(-0.299-0.137)			(0.520 - 1.401`	(0.079 - 1.737)

Note: Coefficients are reported as odds ratios, 95 percent confidence intervals are reported below in ( )'s.
Standard errors (not reported) are clustered at the PSU level. Composite and specific measures are taken
from separate regressions by country. For full regressions using composite measures see Appendix Table
C3; regressions using specific measures see Appendix Table B4. Rwanda and Ethiopia are second stage
equations of Heckman selection models; for full first stage regressions see Appendix Table C7.
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 4.5: Simulations of predicted incontinence prevalence rates eliminating sources of trauma

Scenario:	Malawi (N = 11,698)		Rwanda (N = 11,321)		Uganda (N = 8,524)		Ethiopia (N = 14,066)	
	Level	Percent change	Level	Percent change	Level	Percent change	Level	Percent change
Current predicted prevalence	4.94	0.000	2.86	0.000	2.36	0.000	3.94	0.000
No sexual violence	**4.04**	**-0.182**	**1.72**	**-0.400**	2.06	-0.128	---	---
No intimate partner sexual violence	**4.58**	**-0.073**	**2.43**	**-0.107**	2.35	-0.002	---	---
No forced sex	**4.42**	**-0.106**	**2.72**	**-0.162**	2.14	-0.093	---	---
No female genital cutting	---	---	---	---	2.37	-0.002	4.31	+ 0.095
No female genital cutting, least severe form	---	---	---	---	---	---	4.38	+ 0.112
No female genital cutting, most severe form	---	---	---	---	---	---	4.12	+ 0.141

Note: Bold indicates simulated differences on coefficients with statistical significance at the 10 percent level or better; Changes are percentage increases or decreases.

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Figure J1. Location of sampling clusters in the Kagera Region, Tanzania
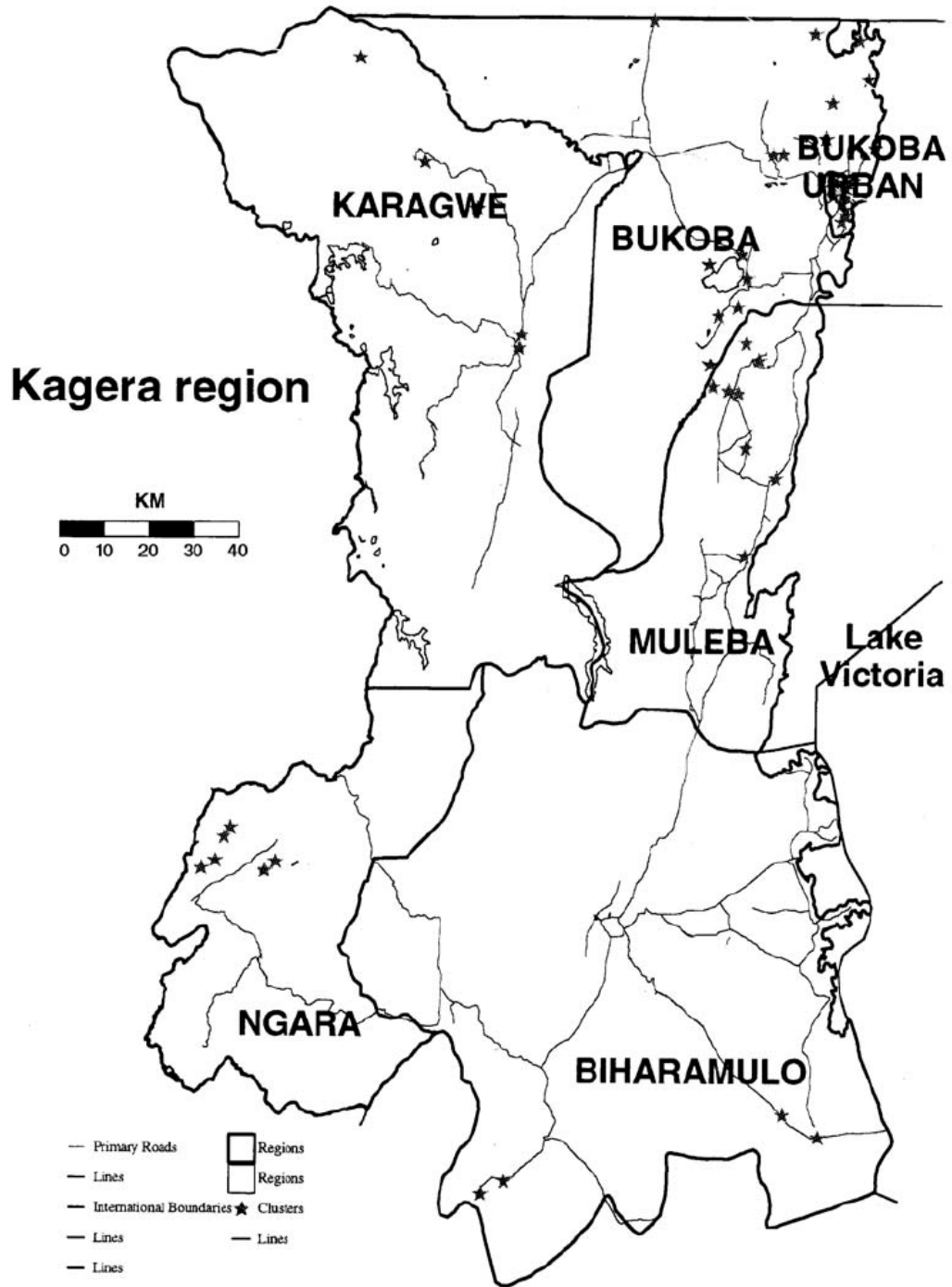
Source: WB, 2004.

Figure A2: Potential pathways between WPIR and consequences of HIV/AIDS
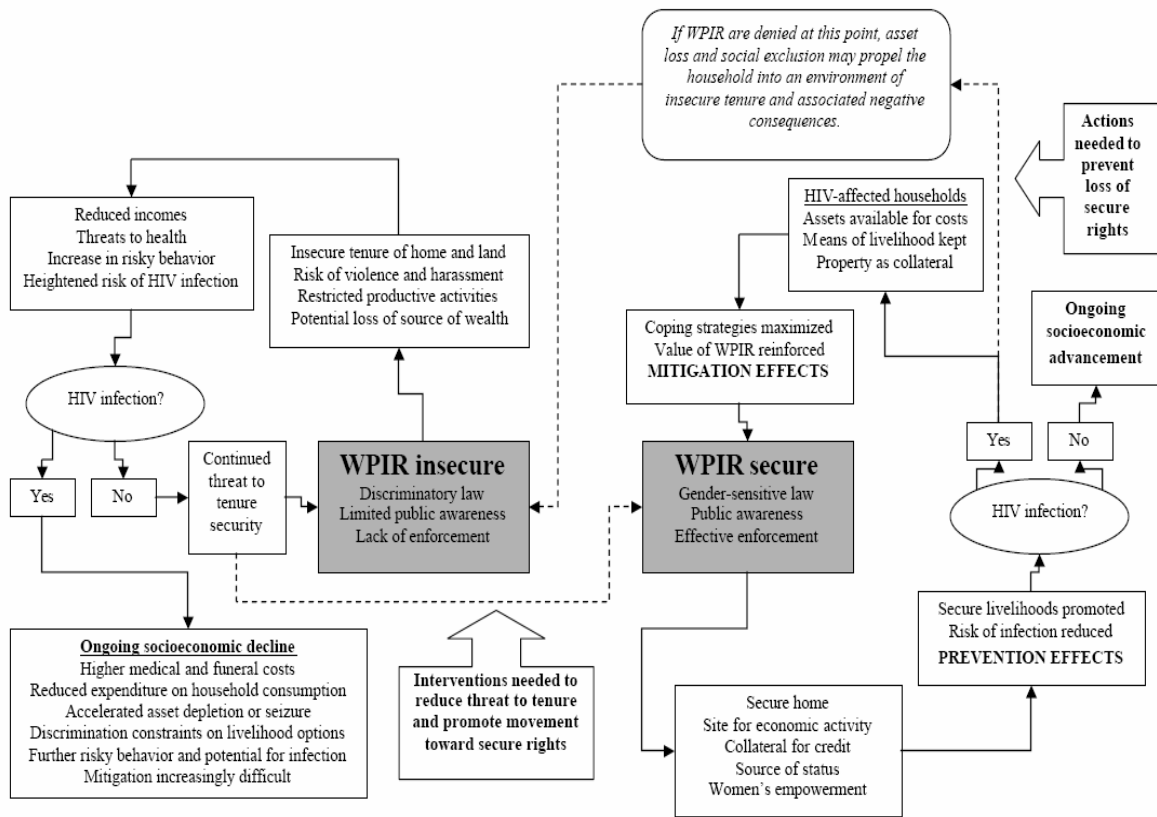
Source: Strickland, 2004.

Table A1: T-tests for attriters versus non-attriters (baseline 1991-94)

	Full baseline sample		
	(by re-interview)		
	(N = 1,480)		
Individual-level variables:	(=0)	(=1)	p-value
Age splines:			
Age 20 to 29 (=1)	0.34	0.27	0.047
Age 30 to 39 (=1)	0.17	0.20	0.058
Age 40 to 49 (=1)	0.08	0.16	0.000
Age 50 and over (=1)	0.05	0.09	0.001
Education:			
No formal education (=1)	0.16	0.24	0.000
Secondary or above (=1)	0.10	0.03	0.000
Marital status:			
Never married (=1)	0.41	0.25	0.000
Widowed or separated (=1)	0.23	0.18	0.026
Religion of HH head:			
Muslim (=1)	0.16	0.13	0.089
Other Christian denominations (=1)	0.30	0.30	0.863
Ethnicity/Tribe of HH head:			
Nyambo (=1)	0.09	0.15	0.001
Hangaza (=1)	0.09	0.14	0.002
Other tribe (=1)	0.17	0.13	0.081
Bottom quintile of wealth distribution (=1)[1]	0.20	0.20	0.678
Community-level variables:			
Urban (=1)	0.30	0.18	0.000
Population (in 1,000's)	3.29	2.97	0.007
Bank (=1)	0.15	0.13	0.420
HHs have electricity (=1)	0.34	0.25	0.000
HHs have piped water (=1)	0.20	0.21	0.625
Public transport (=1)	0.29	0.29	0.920
District is regional capital (=1)	0.29	0.17	0.000

[1] For construction and contributions to wealth index see Table A7.

Table A2: Summary of panel attrition significance in baseline economic welfare estimations (BGLW test)

	Any attrition in follow-up (1= yes, 0 = no)	
Labor force participation and earnings (N = 1,480)	Coeff	SE
Employed outside the home (last week = 1)	-0.029	(0.015)**
Working self employed (last week = 1)	0.001	(0.015)
Earnings (log shillings)	-0.246	(0.137)*
Expenditures [1]		
Total individual expenditures (log shillings)	-0.044	(0.145)
Total household expenditures (log shillings)	0.025	(0.085)
Savings		
Savings account (=1)	0.012	(0.013)
Total individual savings (log shillings)	-0.167	(0.216)
Total household savings (log shillings)	-0.128	(0.244)

Note: All models are estimated using OLS and LPMs. Clustered standard errors at the community level are reported in parentheses.
* indicates significant at 10%; ** significant at 5%; *** significant at 1%.
[1] Expenditures for clothing and medical categories are recalled for 12 months, food expenditures are recalled on two seeks (See Table A5 for details on construction of dependent variables; see Table A6 for control variables).

Table A3: Summary statistics for community level determinants of WPIR (N = 254)

Community-level control variables:	Mean	SD	Min	Max
2004 survey round (=1)	0.20	0.40	0.00	1.00
Percentage female "experts" (%)	0.15	0.15	0.00	0.67
Majority ethnic/religious groups: [1]				
Ethnic group Nyambo (=1)	0.10	0.30	0.00	1.00
Ethnic group Hangaza (=1)	0.12	0.32	0.00	1.00
Ethnic group Sukuma (=1)	0.05	0.21	0.00	1.00
Religion Muslim (=1)	0.02	0.14	0.00	1.00
Religion Christian (=1)	0.03	0.17	0.00	1.00
Economic indicators:				
Urban (=1)	0.22	0.41	0.00	1.00
HHs have electricity (=1)	0.36	0.48	0.00	1.00
HHs have piped water (=1)	0.22	0.41	0.00	1.00
Population (in 1,000's)	3.15	2.39	0.00	1.00
Bank (=1)	0.11	0.31	0.00	1.00

[1] The excluded majority ethnic group is Haya, while the excluded majority religious group is Catholic.

Table A4: Descriptive statistics for *Z* variables used to predict re-interview

	(Baseline, 1991-94)			
Individual-level variables (N = 1,480)	Mean	SD	Min	Max
Enters all four baseline rounds (=1)	0.48	0.50	0.00	1.00
Community-level illness related adult death rate[1]	0.64	0.16	0.14	0.94
Community-level variables:				
Price per tablet of paracet (in shillings)[2]	11.27	3.87	1.34	20.00
Daughter of household head (=1)	0.27	0.45	0.00	1.00

[1] Death rate is for 1988, calculated among adults age 15 to 50 as part of the survey sample selection (enumeration round).
[2] Prices are an average of values collected from two types of markets: 1) the nearest community market and 2) roadside shops. In the case of community markets, three prices were gathered from traders at different locations in the market (WB-DRG, 2004). Prices are deflated to 1991 to adjust for differences in survey year.

Table A5: Construction of economic welfare outcomes

Labor force participation and earnings

Employed outside the home	Measured as a binary indicator for the last week. Woman is asked if she has worked for someone who is not a member of her household and examples are given (employer, the government, a firm, other people). Asked to all household members over the age of seven.
Working self employed	Measured as a binary indicator for the last week. Woman is asked if she has worked for herself or her household and examples are given (independent merchant or fisherman, lawyer, doctor or other self-employed activity). Asked to all household members over the age of seven.
Earnings	Measured in log shillings on a monthly basis, deflated to 1991. Includes paid salary, gratuities and bonuses and in-kind payments for any employed work. Asks for both primary and secondary jobs.

Expenditures

Total individual expenditure	Measured in log shillings bought or acquired in the last year (medical and clothing) and last two weeks (food consumed outside the home), deflated to 1991. Clothing includes khangas and kitenges, fabric and cloth, other clothing and footwear.
	Medical includes medicine and medical services including transportation to and from any health center. Asked to all household members over the age of 15.
Total household expenditure	The sum of all individual-level expenditures measured in log shillings.

Savings

Savings account	Measured as a binary indicator of reporting individual-level bank savings account.
Total individual savings	Measured in log shillings deflated to 1991. Asks the amount of personal savings in the following places: bank savings account, checking account, foreign currency account, other bank accounts, other savings at home or in other's homes. Asked to all adult household members over the age of 15.
Total household savings	Measured in log shillings deflated to 1991. Aggregation of total individual savings for all household members.

Table A6: Distribution of control variables for economic welfare outcomes

| | Baseline | |
| | (1991-94) | |
Individual-level variables: (N = 1,480)	Mean	SD
Age splines:		
Age 15 to 19 (=1, omitted)	0.33	0.47
Age 20 to 29 (=1)	0.30	0.46
Age 30 to 39 (=1)	0.18	0.39
Age 40 to 49 (=1)	0.12	0.32
Age 50 and over (=1)	0.07	0.26
Education:		
No formal education (=1)	0.20	0.40
Complete or partial primary (=1, omitted)	0.74	0.44
Secondary or above (=1)	0.06	0.25
Marital Status:		
Union (=1, omitted)	0.47	0.50
Never married (=1)	0.33	0.47
Widowed or separated (=1)	0.20	0.40
Religion of HH head:		
Catholic (=1, omitted)	0.56	0.50
Muslim (=1)	0.14	0.35
Other Christian denominations (=1)	0.30	0.46
Ethnicity/tribe of HH head:		
Haya (=1, omitted)	0.62	0.49
Nyambo (=1)	0.12	0.33
Hangaza (=1)	0.11	0.31
Other tribe (=1)	0.15	0.36
Bottom quintile of wealth distribution (=1)[1]	0.20	0.40
Community-level variables:		
Urban (=1)	0.23	0.42
Population (in 1,000's)	3.11	2.23
Bank (=1)	0.14	0.35
HHs have electricity (=1)	0.29	0.46
HHs have piped water (=1)	0.24	0.43
Public transport (=1)	0.29	0.45
District is regional capital (=1)	0.23	0.42
Baseline passage indicators:		
Passage 1 (=1, omitted)	0.74	0.44
Passage 2 (=1)	0.10	0.30
Passage 3 (=1)	0.10	0.30
Passage 4 (=1)	0.06	0.23
Seasonal indicators for interview:		
January (omitted =1)	0.14	0.35
February (=1)	0.15	0.36
March (=1)	0.11	0.32
April (=1)	0.01	0.12
May (=1)	0.04	0.19
June (=1)	0.12	0.32
July (=1)	0.03	0.17
August (=1)	0.03	0.16
September (=1)	0.04	0.20
October (=1)	0.13	0.34
November (=1)	0.15	0.35
December (=1)	0.05	0.23

[1] For construction and contributions to wealth index see Table A7.

Table A7: Construction of per capita wealth index

		Baseline (1991 - 1994) (N = 1,480)			End-line (2004) (N = 755)		
Contributing factors:		Mean	Proportion contribution	Cumulative contribution	Mean	Proportion contribution	Cumulative contribution
(1)	Dwelling value (log shillings)	11.07	0.212	0.212	10.77	0.709	0.709
(2)	Land value (log shillings)	11.52	0.121	0.333	10.96	0.330	1.039
(3)	Livestock value (log shillings)	7.19	0.117	0.450	4.38	0.214	1.253
(4)	Toilet (=1)	0.94	0.087	0.536	0.94	0.040	1.293
(5)	TV (=1)	0.00	0.072	0.608	0.03	0.033	1.326
(6)	Car (=1)	0.03	0.069	0.677	0.02	0.001	1.332
(7)	Bicycle (=1)	0.33	0.065	0.742	0.39	-0.005	1.327
(8)	Refrigerator (=1)	0.01	0.059	0.801	0.00	-0.023	1.304
(9)	Stove (=1)	0.21	0.052	0.853	0.16	-0.039	1.265
(10)	Radio (=1)	0.43	0.044	0.897	0.59	-0.055	1.210
(11)	Dwelling has cement floors (=1)	0.18	0.042	0.939	0.19	-0.060	1.149
(12)	Per-capita number of rooms in dwelling	0.62	0.032	0.972	0.53	-0.065	1.084
(13)	Main light source electricity (=1)	0.04	0.029	1.000	0.06	-0.084	1.000

Note: Factors are listed in the order of their proportion of contribution to the score.
Quintile measurements are proportional to households with women entering the baseline and panel respectively.
All values are in shillings and deflated to the baseline year 1991.

Table A8: Regression results of baseline economic welfare estimation (1991-94)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Employed	Self employed	Log earnings	Log total ind expend.	Log total hh expend.	Savings account	Log ind savings	Log hh savings
High WPIR (=1)	0.002	0.075	0.054	0.461	0.300	0.018	0.691	0.420
	(0.034)	(0.025)***	(0.237)	(0.203)**	(0.156)*	(0.017)	(0.295)**	(0.457)
Age 20 to 29 (=1)	0.038	0.048	0.431	0.084	-0.079	0.042	1.142	-0.164
	(0.019)*	(0.019)**	(0.152)***	(0.183)	(0.121)	(0.014)***	(0.272)***	(0.335)
Age 30 to 39 (=1)	0.129	0.072	1.293	-0.287	-0.209	0.114	1.248	-0.611
	(0.034)***	(0.022)***	(0.324)***	(0.219)	(0.114)*	(0.035)***	(0.348)***	(0.363)*
Age 40 to 49 (=1)	0.054	0.068	0.696	-0.235	-0.165	0.075	1.462	-0.297
	(0.027)*	(0.030)**	(0.245)***	(0.216)	(0.124)	(0.027)***	(0.377)***	(0.382)
Age 50 and over (=1)	0.005	0.016	0.154	-0.815	-0.282	0.058	0.889	-0.585
	(0.023)	(0.031)	(0.200)	(0.386)**	(0.236)	(0.024)**	(0.427)**	(0.562)
No formal education (=1)	0.011	-0.025	0.098	-0.803	-0.548	-0.036	-1.318	-1.201
	(0.016)	(0.019)	(0.147)	(0.178)***	(0.116)***	(0.013)***	(0.218)***	(0.317)***
Secondary or above (=1)	0.151	-0.021	1.479	1.019	0.623	0.207	0.759	1.267
	(0.043)***	(0.031)	(0.362)***	(0.183)***	(0.112)***	(0.040)***	(0.365)**	(0.558)**
Never married (=1)	0.042	0.039	0.443	-1.401	-0.231	-0.009	-0.510	-0.887
	(0.022)*	(0.017)**	(0.190)**	(0.236)***	(0.115)*	(0.021)	(0.337)	(0.340)**
Widowed or separated (=1)	0.026	0.072	0.077	-0.898	-0.440	-0.015	0.657	-1.293
	(0.023)	(0.025)***	(0.185)	(0.150)***	(0.102)***	(0.017)	(0.290)**	(0.313)***
Muslim (=1)	-0.038	0.040	-0.284	0.004	0.063	-0.001	-0.542	-0.759
	(0.020)*	(0.021)*	(0.175)	(0.153)	(0.122)	(0.018)	(0.291)*	(0.513)
Other Christian denominations (=1)	-0.022	0.002	-0.121	-0.163	-0.195	0.006	-0.131	-0.100
	(0.021)	(0.017)	(0.171)	(0.146)	(0.108)*	(0.014)	(0.238)	(0.315)
Mnyambo (=1)	-0.035	0.002	-0.213	-0.050	0.059	0.010	0.284	0.651
	(0.030)	(0.030)	(0.249)	(0.213)	(0.167)	(0.028)	(0.287)	(0.675)
Mhangaza (=1)	-0.056	0.027	-0.412	-0.280	-0.430	-0.007	-0.517	0.045
	(0.029)*	(0.020)	(0.217)*	(0.198)	(0.200)**	(0.020)	(0.326)	(0.511)
Other tribe (=1)	0.011	0.024	0.047	-0.118	-0.153	-0.042	-0.693	-0.537
	(0.037)	(0.021)	(0.276)	(0.308)	(0.196)	(0.014)***	(0.313)**	(0.501)
Bottom quintile of wealth (=1)	0.059	-0.030	0.418	-0.634	-1.121	-0.028	-0.582	-2.985
	(0.024)**	(0.014)**	(0.181)**	(0.192)***	(0.134)***	(0.008)***	(0.225)**	(0.364)***
Constant	-0.010	-0.071	-0.351	8.707	10.125	-0.029	2.159	7.609
	(0.031)	(0.034)**	(0.239)	(0.258)***	(0.215)***	(0.025)	(0.423)***	(0.545)***
F-test for community controls (χ²)	0.041	0.003	0.004	0.000	0.000	0.016	0.011	0.001
F-test for seasonal controls (χ²)	0.085	0.131	0.086	0.048	0.001	0.729	0.108	0.105
F-test for passage controls (χ²)	0.242	0.241	0.241	0.270	0.007	0.010	0.766	0.013
R²	0.089	0.082	0.112	0.1543	0.3063	0.141	0.121	0.207

Note: All models are estimated using LPM and OLS models. Standard errors clustered at the community level are reported in parentheses. Also included but not reported are community-level controls found in Table A6 (urban, population, bank HHs have electricity, HHs have piped water, public transport, district is regional capital), seasonal controls and baseline passage controls).
* indicates significant at 10%; ** significant at 5%; *** significant at 1%.

Table A9. Panel fixed effects regression results of economic welfare estimation
       (1991-94 to 2004)

	(1)	(2)	(3)	(4)	(5)
				Log	Log
		Self	Log	total ind	total hh
	Employed	employed	earnings	expend	expend
High WPIR (=1)	-0.004	0.066*	0.029	0.048	0.219
	(0.04)	(0.04)	(0.26)	(0.24)	(0.29)
Age 20 to 29 (=1)	0.022	0.096*	0.243	0.318	-0.326
	(0.05)	(0.05)	(0.37)	(0.38)	(0.35)
Age 30 to 39 (=1)	0.082	0.129*	0.627	-0.567	-0.787*
	(0.07)	(0.07)	(0.49)	(0.47)	(0.45)
Age 40 to 49 (=1)	0.101	0.156*	0.825	-0.645	-0.997
	(0.10)	(0.08)	(0.72)	(0.66)	(0.69)
Age 50 and over (=1)	0.110	0.114	0.674	-0.948	-1.159
	(0.12)	(0.10)	(0.89)	(0.89)	(0.94)
No formal education (=1)	0.005	-0.019	0.010	-0.719	-0.442
	(0.04)	(0.04)	(0.30)	(0.47)	(0.30)
Secondary or above (=1)	0.122	0.079	1.735	0.423	0.076
	(0.16)	(0.11)	(1.07)	(0.67)	(0.36)
Never married (=1)	0.043	0.030	0.292	-1.055**	-0.648**
	(0.06)	(0.04)	(0.46)	(0.40)	(0.26)
Widowed or separated (=1)	-0.004	0.053	0.133	-0.865**	0.045
	(0.05)	(0.06)	(0.42)	(0.43)	(0.38)
Bottom quintile of wealth (=1)	0.036	-0.030	0.317	-0.182	-0.883***
	(0.04)	(0.04)	(0.35)	(0.31)	(0.33)
Constant	0.039	-0.051	0.377	8.552***	10.389***
	(0.08)	(0.09)	(0.62)	(0.54)	(0.71)
F-test for community controls (χ^2)	0.280	0.979	0.463	0.609	0.929
F-test for seasonal controls (χ^2)	0.750	0.781	0.790	0.696	0.425
R^2 (within)	0.051	0.088	0.062	0.113	0.099

Note: Columns 1 and 2 are estimated using a fixed effects linear probability model, the
remaining use OLS; Standard errors clustered at the community level are reported in
parentheses. Also included but not reported are time variant community-level controls
found in Table A6 (population, bank, HHs have electricity, HHs have piped water, public
transport) and seasonal controls.
* indicates significant at 10%; ** significant at 5%; *** significant at 1%.

Table A10. Inverse probability weighting (IPW) fixed effects regression results of economic welfare estimation (1991-94 to 2004)

	(1)	(2)	(3)	(5)	(6)
				Log	Log
		Self	Log	total ind	total hh
	Employed	employed	earnings	expend	expend
High WPIR (=1)	0.153	-0.144	1.336	-0.323	-0.468
	(0.065)**	(0.099)	(0.576)**	(0.490)	(0.527)
Age 20 to 29 (=1)	-0.214	-0.048	-2.180	-0.391	-1.058
	(0.077)***	(0.100)	(0.718)***	(0.499)	(0.478)**
Age 30 to 39 (=1)	-0.084	0.004	-1.193	-0.943	-1.396
	(0.092)	(0.102)	(0.801)	(0.553)*	(0.808)*
Age 40 to 49 (=1)	-0.057	0.111	-0.837	-0.305	-0.445
	(0.118)	(0.092)	(1.020)	(0.877)	(0.951)
Age 50 and over (=1)	-0.060	0.160	-1.096	-0.492	-0.088
	(0.148)	(0.110)	(1.351)	(1.203)	(1.429)
No formal education (=1)	-0.020	0.030	-0.164	-0.570	-0.740
	(0.048)	(0.074)	(0.394)	(0.672)	(0.643)
Secondary or above (=1)	-0.187	0.284	-2.209	-1.293	-1.315
	(0.181)	(0.188)	(1.508)	(0.715)*	(0.663)*
Never married (=1)	-0.007	0.009	0.352	-2.590	-2.478
	(0.136)	(0.109)	(1.018)	(0.523)***	(0.603)***
Widowed or separated (=1)	-0.071	-0.049	-0.814	-2.967	-2.910
	(0.079)	(0.075)	(0.619)	(0.472)***	(0.414)***
Bottom quintile of wealth (=1)	0.024	0.037	0.263	-0.564	-0.925
	(0.057)	(0.075)	(0.407)	(0.414)	(0.513)*
Constant	0.293	0.290	2.810	17.018	20.548
	(0.128)**	(0.139)**	(1.015)***	(0.709)***	(0.949)***
F-test for community controls (χ^2)	0.746	0.672	0.754	0.017	0.001
F-test for seasonal controls (χ^2)	0.203	0.000	0.000	0.000	0.000
R^2 (within)	0.363	0.953	0.439	0.981	0.975

Note: All models are estimated using a fixed effects OLS and LPM. Standard errors clustered at the community level are reported in parentheses. Also included but not reported are time variant community-level controls found in Table A6 (population, bank, HHs have electricity, HHs have piped water, public transport) and seasonal controls.
* indicates significant at 10%; ** significant at 5%; *** significant at 1%.

Table B1: Construction of economic welfare outcomes

Labor force participation and earnings

Employed outside the home	Measured as a binary indicator for the last week. Woman is asked if she has worked for someone who is not a member of her household and examples are given (employer, the government, a firm, other people). Asked to all household members over the age of seven.
Working self employed	Measured as a binary indicator for the last week. Woman is asked if she has worked for herself or her household and examples are given (independent or fisherman, lawyer, doctor or other self-employed activity). Asked to all household members over the age of seven.
Earnings	Measured in log shillings on a monthly basis, deflated to 1991. Includes paid salary, gratuities and bonuses and in-kind payments for any employed work. Asks for both primary and secondary jobs.

Savings

Savings account	Measured as a binary indicator of reporting individual bank savings account. Asked to all adult household members over the age of 15.
Total individual savings	Measured in log shillings deflated to 1991. Asks the amount of personal savings in the following places: bank savings account, checking account, foreign currency account, other bank accounts, other savings at home or in other's homes. Asked to all adult household members over the age of 15.
Any savings	Measured as a binary indicator of any total individual savings reported.
Participates in informal credit group	Measured as a binary indicator of reporting current participation in a local credit group (*bujunis*). Asked to all adult household members of the age of 15.

Expenditures

Total individual expenditure	Measured in log shillings bought or acquired in the last year (medical and clothing) and last two weeks (food consumed outside the home), deflated to 1991. Clothing includes khangas and kitenges, fabric and cloth, other clothing and footwear. Medical includes medicine and medical services including transportation to and from any health center. Asked to all household members over the age of 15.
Any expenditures	Measured as a binary indicator of any total individual expenditures reported.

Table B2: Distribution of control variables used in prediction of economic welfare outcomes

	Pooled (1991-94) (N = 3,781)		Wave 1 (1991-94) (N = 956)		Wave 4 (1994) (N = 825)	
Individual-level variables: (N = 1,480)	Mean	SD	Mean	SD	Mean	SD
Age	27.19	[9.88]	27.12	[9.78]	27.53	[9.94]
Age²	837.05	[595.83]	831.16	[585.63]	856.69	[602.71]
Education:						
No formal education (=1, omitted)	0.05	[0.22]	0.19	[0.39]	0.00	[0.05]
Partial/completed primary (=1)	0.77	[0.42]	0.75	[0.44]	0.81	[0.40]
Secondary or above (=1)	0.06	[0.24]	0.06	[0.23]	0.06	[0.24]
Marital status:						
Union (=1, omitted)	0.47	[0.50]	0.48	[0.50]	0.46	[0.50]
Never married (=1)	0.35	[0.48]	0.34	[0.47]	0.36	[0.50]
Widowed or separated (=1)	0.19	[0.39]	0.18	[0.39]	0.18	[0.39]
Religion of HH head:						
Catholic or Christian (=1, omitted)	0.87	[0.34]	0.86	[0.35]	0.87	[0.34]
Muslim (=1)	0.13	[0.34]	0.14	[0.35]	0.13	[0.34]
Ethnicity/tribe of HH head:						
Haya (=1, omitted)	0.63	[0.48]	0.61	[0.49]	0.62	[0.48]
Nyambo (=1)	0.13	[0.34]	0.13	[0.34]	0.13	[0.34]
Hangaza (=1)	0.12	[0.32]	0.12	[0.32]	0.12	[0.32]
Other tribe (=1)	0.13	[0.34]	0.14	[0.35]	0.12	[0.33]
Bottom 40% wealth distribution[1]	0.40	[0.49]	0.39	[0.49]	0.40	[0.49]
Community-level variables:						
Urban (=1)	0.21	[0.41]	0.22	[0.41]	0.21	[0.41]
Population (in 1,000's)	3.44	[2.95]	2.88	[1.66]	3.97	[3.98]
Bank (=1)	0.12	[0.33]	0.13	[0.33]	0.12	[0.32]
Daily market in community (=1)	0.62	[0.48]	0.41	[0.49]	0.78	[0.42]
HHs have electricity (=1)	0.29	[0.45]	0.28	[0.45]	0.29	[0.45]
HHs have piped water (=1)	0.23	[0.42]	0.23	[0.42]	0.23	[0.42]

Note: Also included as control variables are wave indicators and seasonal indicators.
[1] For construction and contributions to wealth index see Appendix Table B3.

Table B3: Construction of wave 1 household per capita wealth index

	Mean	SD	Proportion contribution	Cumulative contribution
Contributing factors				
(1) Dwelling value (log shillings)	11.08	[1.59]	0.211	0.211
(2) Land value (log shillings)	11.37	[3.34]	0.128	0.339
(3) Livestock value (log shillings)	6.54	[4.49]	0.123	0.462
(4) Toilet (=1)	0.94	[0.24]	0.093	0.554
(5) TV (=1)	0.00	[0.06]	0.088	0.641
(6) Car (=1)	0.02	[0.14]	0.076	0.718
(7) Bicycle (=1)	0.34	[0.47]	0.069	0.786
(8) Refrigerator (=1)	0.01	[0.10]	0.056	0.842
(9) Radio (=1)	0.41	[0.49]	0.048	0.890
(10) Dwelling has cement floors (=1)	0.17	[0.37]	0.046	0.937
(11) Per-capita number of rooms in dwelling	0.67	[0.42]	0.033	0.969
(12) Main light source electricity (=1)	0.03	[0.18]	0.031	1.000

Note: Factors are listed in the order of their proportion of contribution to the score.
All values are in shillings and deflated to the baseline year 1991.

Table B4: Full regressions of pooled cross-sections models predicting economic welfare outcomes (N = 3,781)

Determinants	(1) Empld last week	(2) Self-empld last week	(3) Log earnings	(4) Savings account	(5) Any savings	(6) Log total savings	(7) Credit group par	(8) Any exp	(9) Log total exp
Contraceptive use (=1)	0.050**	0.024	0.509**	0.046**	0.105***	0.943***	0.045*	0.036**	0.650***
	(0.025)	(0.019)	(0.233)	(0.018)	(0.023)	(0.181)	(0.023)	(0.014)	(0.145)
Age (years)	0.028***	0.023***	0.273***	0.023***	0.064***	0.543***	0.025***	0.006	0.116**
	(0.005)	(0.006)	(0.050)	(0.006)	(0.010)	(0.076)	(0.007)	(0.005)	(0.046)
Age² (years)	-0.000***	-0.000***	-0.004***	-0.000***	-0.001***	-0.008***	-0.000**	0.000	-0.002***
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)
Partial/completed primary (=1)	-0.022*	0.056***	-0.108	0.038***	0.212***	1.588***	0.042*	0.039*	0.794***
	(0.012)	(0.011)	(0.084)	(0.010)	(0.022)	(0.162)	(0.024)	(0.020)	(0.185)
Secondary or above (=1)	0.073*	0.035	1.061***	0.201***	0.237***	2.308***	-0.043	0.079**	1.829***
	(0.043)	(0.036)	(0.389)	(0.036)	(0.040)	(0.346)	(0.032)	(0.032)	(0.304)
Never married (=1)	0.071***	0.036*	0.628***	0.021	0.030	0.300	-0.139***	-0.071***	-1.048***
	(0.019)	(0.020)	(0.167)	(0.019)	(0.041)	(0.289)	(0.029)	(0.018)	(0.190)
Widowed or separated (=1)	0.011	0.063***	0.024	-0.021	0.124***	0.882***	-0.027	-0.052***	-0.641***
	(0.020)	(0.023)	(0.153)	(0.015)	(0.031)	(0.248)	(0.032)	(0.016)	(0.186)
Muslim (=1)	-0.029*	0.046*	-0.225	-0.013	-0.013	0.047	0.028	-0.006	0.053
	(0.017)	(0.026)	(0.180)	(0.017)	(0.034)	(0.262)	(0.023)	(0.018)	(0.185)
Nyambo (=1)	-0.055***	-0.007	-0.410**	0.005	0.021	0.097	-0.199***	-0.003	-0.126
	(0.018)	(0.033)	(0.158)	(0.027)	(0.028)	(0.245)	(0.040)	(0.023)	(0.285)
Hangaza (=1)	-0.031	-0.019	-0.178	-0.001	-0.141***	-0.844***	-0.288***	0.01	0.271
	(0.022)	(0.023)	(0.192)	(0.017)	(0.024)	(0.193)	(0.031)	(0.021)	(0.231)
Other tribe (=1)	-0.019	0.059**	-0.132	0.004	-0.045	-0.166	-0.203***	-0.018	-0.145
	(0.024)	(0.028)	(0.200)	(0.014)	(0.043)	(0.339)	(0.044)	(0.022)	(0.317)
Bottom 40% wealth (=1)	0.042***	-0.031**	0.225**	-0.031***	-0.066***	-0.714***	-0.012	-0.042***	-0.717***
	(0.012)	(0.013)	(0.101)	(0.010)	(0.018)	(0.135)	(0.019)	(0.013)	(0.144)
Urban (=1)	0.023	0.042	0.383*	0.066**	0.081**	0.916***	-0.042	0.021	0.628***
	(0.022)	(0.027)	(0.224)	(0.026)	(0.039)	(0.295)	(0.041)	(0.022)	(0.226)
Constant	-0.384***	-0.400***	-3.934***	-0.380***	-0.733***	-6.928***	-0.095	0.890***	6.214***
	(0.076)	(0.095)	(0.808)	(0.104)	(0.161)	(1.266)	(0.114)	(0.073)	(0.681)
F-test seasonal cont. (F-prob)	0.113	0.142	0.214	0.354	0.312	0.369	0.193	0.080	0.274
F-test community cont. (F-prob)	0.319	0.000	0.105	0.001	0.056	0.002	0.380	0.000	0.009
R²	0.062	0.072	0.089	0.157	0.178	0.136	0.193	0.046	0.099

Note: Columns 1, 2, 4, 5, 7 and 8 are binary outcomes and estimated with LPMs. Standard errors clustered at the community level are reported below in ( ). Omitted are married, no schooling, Catholic/Christian religion and Haya ethnic group.
Also included as control variables but not reported are community-level indicators (daily market, population, bank, HHs have electricity, HHs have piped water), wave indicators and seasonal indicators.
* significant at 10%; ** significant at 5%; *** significant at 1%

Table B5: Full regressions of pooled cross-sectional instrumental variable models predicting economic welfare outcomes (N = 3,781)

Determinants	(1) Empld last week	(2) Self-empld last week	(3) Log earnings	(4) Savings account	(5) Any savings	(6) Log total savings	(7) Credit group par	(8) Any exp	(9) Log total exp
Contraceptive use (=1)	0.022	0.024	0.778	-0.211	0.126	1.611	0.156	-1.219	-0.216
	(0.170)	(0.154)	(1.480)	(0.142)	(0.290)	(2.092)	(0.241)	(1.880)	(0.205)
Age (years)	0.029***	0.023***	0.263***	0.032***	0.064***	0.519***	0.021**	0.180**	0.014*
	(0.007)	(0.007)	(0.064)	(0.006)	(0.012)	(0.087)	(0.010)	(0.080)	(0.008)
Age² (years)	-0.000***	-0.000***	-0.004***	-0.000***	-0.001***	-0.007***	0.000	-0.003**	-0.000*
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)
Partial/completed primary (=1)	-0.021	0.056***	-0.122	0.051***	0.211***	1.553***	0.036*	0.893***	0.052***
	(0.015)	(0.013)	(0.121)	(0.009)	(0.027)	(0.187)	(0.021)	(0.169)	(0.019)
Secondary or above (=1)	0.078*	0.035	1.015***	0.245***	0.233***	2.193***	-0.062	2.146***	0.122***
	(0.040)	(0.036)	(0.360)	(0.037)	(0.061)	(0.452)	(0.048)	(0.394)	(0.044)
Never married (=1)	0.071***	0.036**	0.627***	0.022*	0.030	0.299	-0.139***	-1.041***	-0.070***
	(0.016)	(0.015)	(0.137)	(0.013)	(0.026)	(0.192)	(0.018)	(0.154)	(0.016)
Widowed or separated (=1)	0.012	0.063***	0.011	-0.009	0.123***	0.851***	-0.032	-0.552***	-0.040**
	(0.015)	(0.017)	(0.127)	(0.013)	(0.026)	(0.192)	(0.023)	(0.155)	(0.017)
Muslim (=1)	-0.029**	0.046***	-0.223**	-0.016	-0.013	0.054	0.029	0.033	-0.009
	(0.012)	(0.016)	(0.102)	(0.010)	(0.023)	(0.171)	(0.019)	(0.139)	(0.015)
Nyambo (=1)	-0.055***	-0.007	-0.411***	0.004	0.021	0.095	-0.198***	-0.135	-0.004
	(0.012)	(0.016)	(0.103)	(0.013)	(0.029)	(0.205)	(0.021)	(0.176)	(0.018)
Hangaza (=1)	-0.031**	-0.019	-0.173	-0.005	-0.140***	-0.831***	-0.286***	0.241	0.006
	(0.015)	(0.015)	(0.127)	(0.010)	(0.028)	(0.196)	(0.018)	(0.179)	(0.020)
Other tribe (=1)	-0.019	0.059***	-0.140	0.008	-0.046*	-0.184	-0.205***	-0.118	-0.014
	(0.016)	(0.019)	(0.124)	(0.011)	(0.028)	(0.201)	(0.022)	(0.175)	(0.021)
Bottom 40% wealth (=1)	0.041***	-0.031***	0.233***	-0.037***	-0.065***	-0.696***	-0.009	-0.763***	-0.048***
	(0.010)	(0.011)	(0.083)	(0.008)	(0.018)	(0.128)	(0.014)	(0.112)	(0.012)
Urban (=1)	0.023	0.041**	0.363***	0.076***	0.078***	0.872***	-0.048**	0.692***	0.031
	(0.015)	(0.017)	(0.124)	(0.012)	(0.027)	(0.200)	(0.023)	(0.180)	(0.019)
Constant	-0.397***	-0.400***	-3.811***	-0.495***	-0.723***	-6.622***	-0.034	5.381***	0.778***
	(0.106)	(0.094)	(0.908)	(0.087)	(0.168)	(1.221)	(0.045)	(1.095)	(0.114)
Exclusion restrictions (F-prob)	0.030	0.339	0.002	0.000	0.122	0.000	0.019	0.228	0.245
Exclusion restrictions (F-stat)	2.250	1.160	3.360	7.350	1.640	4.640	2.430	1.360	1.320
F-test seasonal cont. (F-prob)	0.098	0.142	0.236	0.311	0.330	0.408	0.193	0.094	0.277
F-test community cont (F-prob)	0.600	0.000	0.382	0.001	0.088	0.002	0.414	0.000	0.005
R²	0.058	0.072	0.084	0.153	0.132	0.172	0.192	0.045	0.095

Note: Columns 1, 2, 4, 5, 7 and 8 are binary outcomes and estimated with LPMs. Bootstrapped standard errors with 1,000 replications are clustered at the community level and are reported below in ( ). Omitted are married, no schooling, Catholic/ Christian religion and Haya ethnic group. Also included as control variables but not reported are community-level indicators (daily market, population, bank, HHs have electricity, HHs have piped water), wave indicators and seasonal indicators.
* significant at 10%; ** significant at 5%; *** significant at 1%

Table B6: Full regressions of pooled cross-sectional instrumental variable models predicting economic welfare outcomes, variation 1 using non-self clustered mean as an addition to first-stage instruments (N = 3,781) .

Determinants	(1) Empld last week	(2) Self-empld last week	(3) Log earnings	(4) Savings account	(5) Any savings	(6) Log total savings	(7) Credit group par	(8) Any exp	(9) Log total exp
Contraceptive use (=1)	0.061	0.091	1.131	0.003	0.394*	4.184**	0.300	-0.080	0.411
	(0.141)	(0.137)	(1.164)	(0.110)	(0.239)	(1.723)	(0.203)	(0.167)	(1.561)
Age (years)	0.028***	0.021***	0.251***	0.025***	0.054***	0.430***	0.016*	0.010	0.124*
	(0.006)	(0.006)	(0.052)	(0.005)	(0.011)	(0.077)	(0.009)	(0.007)	(0.070)
Age² (years)	-0.000***	-0.000***	-0.004***	-0.000***	-0.001***	-0.006***	0.000	0.000	-0.002**
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)
Partial/completed primary (=1)	-0.023	0.052***	-0.14	0.040***	0.197***	1.419***	0.029	0.045**	0.806***
	(0.015)	(0.013)	(0.110)	(0.008)	(0.026)	(0.176)	(0.021)	(0.018)	(0.162)
Secondary or above (=1)	0.072*	0.024	0.957***	0.208***	0.188***	1.761***	-0.086*	0.099***	1.869***
	(0.037)	(0.035)	(0.326)	(0.034)	(0.054)	(0.408)	(0.044)	(0.039)	(0.355)
Never married (=1)	0.071***	0.036**	0.626***	0.021	0.029	0.289	-0.140***	-0.070***	-1.047***
	(0.016)	(0.015)	(0.136)	(0.013)	(0.026)	(0.192)	(0.018)	(0.016)	(0.155)
Widowed or separated (=1)	0.011	0.059***	-0.005	-0.019	0.110***	0.731***	-0.039*	-0.046***	-0.628***
	(0.014)	(0.017)	(0.118)	(0.012)	(0.025)	(0.183)	(0.022)	(0.017)	(0.148)
Muslim (=1)	-0.029**	0.047***	-0.219**	-0.014	-0.010	0.082	0.030	-0.008	0.050
	(0.012)	(0.016)	(0.101)	(0.010)	(0.023)	(0.171)	(0.019)	(0.015)	(0.138)
Nyambo (=1)	-0.055***	-0.006	-0.408***	0.005	0.023	0.111	-0.197***	-0.004	-0.129
	(0.012)	(0.016)	(0.103)	(0.013)	(0.029)	(0.205)	(0.021)	(0.018)	(0.177)
Hangaza (=1)	-0.031**	-0.018	-0.168	-0.002	-0.136***	-0.789***	-0.283***	0.008	0.268
	(0.015)	(0.015)	(0.128)	(0.010)	(0.027)	(0.194)	(0.018)	(0.020)	(0.176)
Other tribe (=1)	-0.019	0.058***	-0.145	0.004	-0.050*	-0.223	-0.207***	-0.017	-0.146
	(0.016)	(0.019)	(0.123)	(0.011)	(0.028)	(0.197)	(0.022)	(0.021)	(0.175)
Bottom 40% wealth quintile (=1)	0.043***	-0.029***	0.243***	-0.032***	-0.058***	-0.628***	-0.005	-0.045***	-0.722***
	(0.010)	(0.011)	(0.080)	(0.007)	(0.018)	(0.126)	(0.014)	(0.012)	(0.109)
Urban (=1)	0.022	0.039**	0.353***	0.067***	0.069***	0.785***	-0.052**	0.025	0.627***
	(0.014)	(0.017)	(0.114)	(0.011)	(0.026)	(0.192)	(0.022)	(0.018)	(0.174)
Constant	-0.379***	-0.370***	-3.651***	-0.398***	-0.602***	-5.465***	0.020	0.838***	6.112***
	(0.092)	(0.088)	(0.771)	(0.076)	(0.151)	(1.108)	(0.120)	(0.102)	(0.992)
Exclusion restrictions (F-prob)	0.037	0.414	0.003	0.000	0.113	0.000	0.019	0.290	0.329
Exclusion restrictions (F-stat)	2.100	1.060	3.180	6.630	1.650	4.080	2.370	1.240	1.170
F-test seasonal cont. (F-prob)	0.113	0.126	0.084	0.152	0.360	0.447	0.184	0.086	0.258
F-test community cont. (F-prob)	0.634	0.000	0.253	0.375	0.103	0.003	0.458	0.000	0.079
R²	0.058	0.072	0.335	0.000	0.132	0.173	0.192	0.044	0.944

Note: Columns 1, 2, 4, 5, 7 and 8 are binary outcomes and estimated with LPMs. Bootstrapped standard errors with 1,000 replications are clustered at the community level and are reported below in ( ). Omitted are married, no schooling, Catholic/ Christian religion and Haya ethnic group. Also included as control variables but not reported are community-level indicators (daily market, population, bank, HHs have electricity, HHs have piped water), wave indicators and seasonal indicators.
* significant at 10%; ** significant at 5%; *** significant at 1%

Table B7: Full regressions of pooled cross-sectional instrumental variable models predicting economic welfare outcomes, variation 2 using cluster fixed effects as an addition to first-stage instruments (N = 3,781) .

Determinants	(1) Empld last week	(2) Self-empld last week	(3) Log earnings	(4) Savings account	(5) Any savings	(6) Log total savings	(7) Credit group par	(8) Any exp	(9) Log total exp
Contraceptive use (=1)	0.082	0.037	0.896	0.024	0.239*	2.487**	0.191*	0.057	1.049
	(0.077)	(0.084)	(0.614)	(0.054)	(0.134)	(0.970)	(0.113)	(0.092)	(0.870)
Age (years)	0.027***	0.023***	0.259***	0.024***	0.060***	0.489***	0.020***	0.005	0.102*
	(0.005)	(0.005)	(0.039)	(0.004)	(0.008)	(0.059)	(0.006)	(0.005)	(0.053)
Age² (years)	-0.000***	-0.000***	-0.004***	-0.000***	-0.001***	-0.007***	-0.000*	0.000	-0.002**
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)
Partial/completed primary (=1)	-0.024*	0.055***	-0.128	0.039***	0.205***	1.508***	0.034*	0.038**	0.773***
	(0.013)	(0.012)	(0.098)	(0.006)	(0.023)	(0.157)	(0.019)	(0.016)	(0.145)
Secondary or above (=1)	0.068**	0.033	0.997***	0.205***	0.214***	2.050***	-0.067*	0.076**	1.762***
	(0.031)	(0.030)	(0.282)	(0.030)	(0.043)	(0.333)	(0.035)	(0.030)	(0.276)
Never married (=1)	0.071***	0.036**	0.626***	0.021	0.030	0.294	-0.140***	-0.071***	-1.049***
	(0.016)	(0.015)	(0.136)	(0.013)	(0.026)	(0.192)	(0.018)	(0.016)	(0.154)
Widowed or separated (=1)	0.01	0.062***	0.006	-0.020*	0.118***	0.810***	-0.034	-0.053***	-0.659***
	(0.013)	(0.016)	(0.108)	(0.010)	(0.023)	(0.169)	(0.021)	(0.016)	(0.140)
Muslim (=1)	-0.028**	0.046***	-0.221**	-0.013	-0.012	0.064	0.029	-0.006	0.058
	(0.012)	(0.016)	(0.101)	(0.010)	(0.023)	(0.171)	(0.019)	(0.015)	(0.138)
Nyambo (=1)	-0.055***	-0.007	-0.408***	0.005	0.022	0.106	-0.198***	-0.003	-0.124
	(0.012)	(0.016)	(0.103)	(0.013)	(0.029)	(0.206)	(0.021)	(0.018)	(0.177)
Hangaza (=1)	-0.030**	-0.019	-0.172	-0.001	-0.138***	-0.818***	-0.285***	0.011	0.278
	(0.015)	(0.015)	(0.126)	(0.010)	(0.027)	(0.194)	(0.017)	(0.020)	(0.174)
Other tribe (=1)	-0.019	0.059***	-0.138	0.004	-0.047*	-0.189	-0.205***	-0.019	-0.153
	(0.016)	(0.018)	(0.122)	(0.011)	(0.028)	(0.196)	(0.022)	(0.020)	(0.173)
Bottom 40% wealth quintile (=1)	0.043***	-0.030***	0.236***	-0.031***	-0.062***	-0.673***	-0.008	-0.042***	-0.706***
	(0.010)	(0.010)	(0.076)	(0.007)	(0.017)	(0.120)	(0.013)	(0.012)	(0.104)
Urban (=1)	0.021	0.041**	0.367***	0.066***	0.076***	0.861***	-0.047**	0.020	0.610***
	(0.013)	(0.016)	(0.109)	(0.011)	(0.025)	(0.183)	(0.021)	(0.018)	(0.167)
Constant	-0.370***	-0.394***	-3.761***	-0.389***	-0.673***	-6.238***	-0.034	0.900***	6.394***
	(0.073)	(0.073)	(0.614)	(0.060)	(0.122)	(0.894)	(0.030)	(0.079)	(0.778)
Exclusion restrictions (F-prob)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Exclusion restrictions (F-stat)	4.100	3.360	4.550	4.000	3.010	2.250	5.580	2.140	3.650
F-test seasonal cont. (F-prob)	0.129	0.118	0.268	0.374	0.397	0.499	0.161	0.076	0.294
F-test community cont. (F-prob)	0.536	0.000	0.156	0.000	0.651	0.002	0.453	0.000	0.058
R²	0.058	0.072	0.082	0.153	0.132	0.173	0.192	0.045	0.095

Note: Columns 1, 2, 4, 5, 7 and 8 are binary outcomes and estimated with LPMs. Bootstrapped standard errors with 1,000 replications are clustered at the cluster level and are reported below in ( ). Omitted are married, no schooling, Catholic/ Christian religion and Haya ethnic group. Also included as control variables but not reported are community-level indicators (daily market, population, bank, HHs have electricity, HHs have piped water), wave indicators and seasonal indicators.
* significant at 10%; ** significant at 5%; *** significant at 1%

Table B8: Full regressions of individual-level fixed effects models predicting economic welfare outcomes
(N = 3,781 women years; 1,159 women)

Determinants	(1) Empld last week	(2) Self-empld last week	(3) Log earnings	(4) Savings account	(5) Any savings	(6) Log total savings	(7) Credit group par	(8) Any exp	(9) Log total exp
Contraceptive use (=1)	0.008	0.025	0.031	0.020*	0.074**	0.571**	0.044	0.051**	0.637***
	(0.021)	(0.021)	(0.128)	(0.010)	(0.034)	(0.240)	(0.033)	(0.023)	(0.226)
Age (years)	0.010	0.033*	0.098	0.013*	0.074***	0.616***	0.017	-0.015	0.165
	(0.015)	(0.017)	(0.104)	(0.007)	(0.027)	(0.194)	(0.029)	(0.024)	(0.211)
Age² (years)	0.000	0.000	-0.002	-0.000*	-0.001**	-0.008***	0.000	0.000	-0.003
	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)	(0.003)	(0.000)	(0.000)	(0.003)
Partial/completed primary (=1)	-0.011	0.024	-0.188	-0.004	0.040	0.200	0.012	0.013	0.415
	(0.023)	(0.022)	(0.171)	(0.006)	(0.040)	(0.239)	(0.034)	(0.046)	(0.392)
Secondary or above (=1)	-0.044	-0.036	-0.301	-0.043	0.014	0.065	0.004	0.029	0.711
	(0.051)	(0.064)	(0.328)	(0.049)	(0.098)	(0.687)	(0.091)	(0.075)	(0.646)
Never married (=1)	-0.007	-0.058	-0.011	-0.038	-0.016	-0.184	-0.043	-0.014	-0.101
	(0.049)	(0.072)	(0.375)	(0.030)	(0.096)	(0.687)	(0.058)	(0.071)	(0.689)
Widowed or separated (=1)	0.017	-0.084	-0.079	-0.039	-0.017	-0.149	-0.058	-0.042	-0.553
	(0.035)	(0.053)	(0.285)	(0.043)	(0.068)	(0.495)	(0.063)	(0.040)	(0.354)
Bottom 40% wealth quintile (=1)	0.028	-0.018	0.262	0.005	0.001	-0.106	-0.013	-0.025	-0.226
	(0.022)	(0.021)	(0.174)	(0.013)	(0.032)	(0.216)	(0.025)	(0.030)	(0.273)
Constant	-0.019	-0.539**	-0.330	-0.116	-0.717*	-7.085**	0.068	1.358***	5.701*
	(0.224)	(0.268)	(1.560)	(0.112)	(0.425)	(3.122)	(0.417)	(0.366)	(3.228)
Hausman test of FE vs. RE	0.046	0.004	0.001	0.000	0.000	0.000	0.000	0.000	0.001
F-test seasonal cont. (F-prob)	0.568	0.120	0.852	0.290	0.606	0.623	0.152	0.165	0.300
F-test community cont. (F-prob)	0.238	0.003	0.168	0.019	0.424	0.749	0.965	0.741	0.920
R² (within)	0.013	0.025	0.011	0.012	0.012	0.015	0.014	0.02	0.021

Note: Columns 1, 2, 4, 5, 7 and 8 are binary outcomes and estimated with LPMs. Standard errors clustered at the community level are reported below in ( ). Omitted variables are married and no schooling. Also included as control variables but not reported are community-level indicators (daily market, population) and seasonal indicators.
* significant at 10%; ** significant at 5%; *** significant at 1%

Table B9: Summary of coefficient results of modern contraceptive use predicting
economic welfare outcomes (left column)

	(A) Pooled Cross-section (N = 3,781)		(B) Individual panel FE (N = 3,781)	
Labor force participation and earnings	Coeff	SE	Coeff	SE
Employed outside the home (last week = 1)	0.080**	(0.033)	0.044	(0.029)
Working self employed (last week = 1)	0.043	(0.028)	0.084**	(0.040)
Earnings (log shillings last month)	0.783**	(0.340)	0.369*	(0.199)
Savings				
Savings account (=1)	0.036	(0.027)	0.015	(0.026)
Any savings (=1)	0.139***	(0.033)	0.112**	(0.052)
Savings amount (log shillings)	1.208***	(0.280)	0.754**	(0.379)
Participates in informal credit group (=1)	0.083**	(0.038)	0.046	(0.052)
Expenditures [1]				
Any expenditures (=1)	0.049***	(0.018)	0.075***	(0.024)
Total expenditures (log shillings)	0.743***	(0.203)	0.759***	(0.271)

Note: All models are estimated using OLS and LPMs using same specifications as
in main models. Standard errors clustered at the community level are reported in
parentheses ( ). All shilling amounts are deflated to the base year 1991.
[1] Expenditures categories are clothing, medical and food consumed outside the home.
Clothing and medical expenses are recalled on 12 months, food expenses are recalled
for two weeks.
* indicates significant at 10%; ** significant at 5%; *** significant at 1%.

Table B10: Summary of coefficient results of dual contraceptive use predicting
economic welfare outcomes (left column)

	(A) Pooled Cross-section (N = 3,781)		(B) Individual panel FE (N = 3,781)	
Labor force participation and earnings	Coeff	SE	Coeff	SE
Employed outside the home (last week = 1)	0.174**	(0.071)	0.138	(0.099)
Working self employed (last week = 1)	0.005	(0.044)	0.035	(0.060)
Earnings (log shillings last month)	1.646***	(0.611)	0.869	(0.656)
Savings				
Savings account (=1)	0.005	(0.035)	-0.029	(0.040)
Any savings (=1)	0.169**	(0.076)	0.100	(0.094)
Savings amount (log shillings)	1.481**	(0.568)	0.436	(0.641)
Participates in informal credit group (=1)	0.040	(0.061)	-0.014	(0.071)
Expenditures [1]				
Any expenditures (=1)	0.031	(0.041)	0.066	(0.051)
Total expenditures (log shillings)	0.922*	(0.501)	0.791	(0.483)

Note: All models are estimated using OLS and LPMs using same specifications as
in main models. Standard errors clustered at the community level are reported in
parentheses ( ). All shilling amounts are deflated to the base year 1991.
[1] Expenditures categories are clothing, medical and food consumed outside the home.
Clothing and medical expenses are recalled on 12 months, food expenses are recalled
for two weeks.
* indicates significant at 10%; ** significant at 5%; *** significant at 1%.

Table B11: Descriptive statistics of community-level determinants
of stocking contraceptive pill (N = 204)

Indicators	Mean	SD
Average completed fertility (women 15 to 50)	2.95	[0.78]
Average completed fertility (women 30 to 50)	3.74	[1.71]
Ethnic majorities		
Haya (omitted =1)	0.75	[0.44]
Nyambo (=1)	0.10	[0.30]
Hangaza (=1)	0.12	[0.32]
Sukuma (=1)	0.04	[0.19]
Religious majorities		
Catholic (omitted =1)	0.90	[0.30]
Muslim (=1)	0.02	[0.14]
Christian/Protestant/other (=1)	0.08	[0.19]
Economic indicators		
Urban (=1)	0.22	[0.41]
Population (1,000's)	3.19	[2.48]
Bank (=1)	0.12	[0.32]
Daily market (=1)	0.60	[0.49]
HHs have electricity (=1)	0.27	[0.45]
HHs have piped water (=1)	0.22	[0.41]
Regional indicators		
District 1 (=1)	0.10	[0.30]
District 2 (=1)	0.33	[0.47]
District 3 (=1)	0.16	[0.36]
District 4 (=1)	0.08	[0.27]
District 5 (=1)	0.12	[0.32]
District 6 (omitted =1)	0.22	[0.41]
Passage indicators		
Passage 1 (omitted =1)	0.25	[0.43]
Passage 2 (=1)	0.25	[0.43]
Passage 3 (=1)	0.25	[0.43]
Passage 4 (=1)	0.25	[0.43]

Table B12: Community-level determinants of nearest health facility stocks
contraceptive pill (N = 204)

Determinants	(A)	(B)
Average fertility (women 15 to 50)	---	0.138***
	---	(0.046)
Average fertility (women 30 to 50)	0.079**	---
Ethnic majorities (omitted = Haya)	(0.036)	---
Nyambo (=1)	0.000	0.280
	(0.000)	(0.258)
Hangaza (=1)	0.354	0.205
	(0.247)	(0.255)
Sukuma (=1)	0.268	0.263
Religious majorities (omitted = Catholic)	(0.213)	(0.226)
Muslim (=1)	-0.437*	-0.471**
	(0.244)	(0.235)
Christian/Protestant (=1)	-0.108	-0.151
Economic indicators	(0.181)	(0.185)
Urban (=1)	0.216	0.133
	(0.228)	(0.227)
Population (1,000's)	-0.017	-0.014
	(0.022)	(0.022)
Bank (=1)	-0.172	-0.141
	(0.155)	(0.157)
Daily market (=1)	0.043	0.048
	(0.077)	(0.076)
HHs have electricity (=1)	0.160	0.142
	(0.122)	(0.120)
HHs have piped water (=1)	-0.140	-0.155
Regional indicators (omitted = district 6)	(0.125)	(0.122)
District 1 (=1)	0.408	0.000
	(0.253)	(0.000)
District 2 (=1)	0.443**	0.332
	(0.220)	(0.226)
District 3 (=1)	0.482**	0.394*
	(0.220)	(0.221)
District 4 (=1)	0.574**	0.406
	(0.260)	(0.270)
District 5 (=1)	0.000	0.000
	(0.000)	(0.000)
Constant	-0.236	-0.059
	(0.294)	(0.219)
R^2	0.1449	0.1593
F-test of demographic indicators (F-prob)	0.164	0.237
F-test of economic indicators (F-prob)	0.541	0.644
F-test of regional indicators (F-prob)	0.223	0.349

Note: Coefficients are from LPMs and robust standard errors are reported
below in parenthesis ( ); included but not reported are passage indicators.
* significant at 10%; ** significant at 5%; *** significant at 1%

Figure C1: Pathways to fistula diagram

Source: Wall et al., 2001 'The obstetric fistula pathway: Origins and consequences.'

Figure C2: Fistula module questionnaire for Malawi (2004)

432A	After this birth, did you experience a problem such as:				
		YES	NO	DON'T KNOW	
	Heavy bleeding?	1	2	3	
	High blood pressure?	1	2	3	
	Stroke/convulsions?	1	2	3	
	Infection/fever?	1	2	3	
	Uncontrollable leakage of urine or stool from your vagina?	1	2	3	
	Post-partum depression/blues?	1	2	3	
494B	Sometimes a woman can have a problem, usually after a difficult childbirth, such that she experiences an uncontrollable leakage of urine or stool from her vagina. Have you ever experienced this problem?	YES . . . . 1 NO . . . . 2 DON'T KNOW 8			

Note: Question 432A is asked only to women who had received postpartum care for a birth in the last five years. Question 494B is asked to all women regardless of childbearing status.

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Figure C3: Fistula module questionnaire for Rwanda (2005)

433A	Avez-vous jamais souffert d'une fistule obstétricale ? (MALADIE CARACTÉRISÉE PAR L'ÉCOULEMENT INCONTRÔLÉ DES URINES OU/ÉT DES SELLES DU VAGIN À CAUSE DE LA PERFORATION DE LA PAROI DU VAGIN QUI LE MET EN COMMUNICATION AVEC LA VESSIE ET/OU LE RECTUM)	OUI..1 NON...2 PASSER A 434	
433B	Avez-vous recherché des soins pour ce problème ?	OUI..1 NON...2	

Note: Question 433A is asked only to women who report having a birth in the last five years.

Figure C4: Fistula module questionnaire for Uganda (2006)

| 643C | Sometimes a woman can have a problem, usually after a difficult childbirth, in which she experinces uncontrollable leakage of urine or stool from her vagina.

Have you ever experienced this problem? | YES 1
NO 2
DON'T KNOW . . . . 8 | |

Note: Question 643C is asked to all women ages 15 to 49.

Figure C5: Fistula module questionnaire for Ethiopia (2005)

1021	Have you ever heard of obstetric fistula (USE LOCAL TERM)? IF NO PROBE: Have you ever heard of a condition in which a woman continuously leaks urine and/or faeces following childbirth?	YES . . . . 1 NO 2	→ 1101
1022	Have you yourself experienced obstetric fistula?	YES . . . . 1 NO 2	→ 1024
1023	Have you ever been treated for obstetric fistula?	YES . . . . 1 NO 2	
1024	Are there any (other) women in your household who suffer from obstetric fistula?	YES . . . . 1 NO 2	→ 1101
1025	How many (other) women in your household suffer from obstetric fistula?	NUMBER . . . . DON'T KNOW 98	

Note: Question 1021 is asked to all women ages 15 to 49.

Table C1: Background maternal health and welfare indicators by country

Maternal health:	Malawi (2004)	Rwanda (2005)	Uganda (2006)	Ethiopia (2005)
Maternal Mortality Ratio (per 100,000 live births)	984	750	435	673
Percentage births with skilled attendance	57.0	38.6	42.0	5.7
Total fertility rate (TFR)	6.0	6.1	6.7	5.4
Median age at first birth (ages 24-49)	19.0	22.0	17.8	19.0
Female life expectancy at birth (years)[1]	40.1	44.1	50.0	49.0
Gender equity:				
Ratio literate women to men (aged 15-24)	0.91	0.96	0.83	0.62
Gender related development index (GDI) value[2]	0.378	0.416	0.483	0.347
Gender related development index (GDI) rank[2]	132	129	117	139
Poverty:				
Per-capita Gross national Income (GNI)[3]	160	230	280	160
Per-capita Gross Domestic Product (GDP)[2]	570	1,250	1,490	810

Note: Unless otherwise noted, indicators are from the current DHS country reports.
[1] From UNFPA and PRB, 2005: Country Profiles for Population and Reproductive Health: Policy Developments and Indicators for 2005.
[2] UNDP, 2003. The GDI index ranges from 0.941 to 0.279; the GDI rank is out of 144 countries with available data; GDP is purchasing power parity as of 2001 in USD.
[3] WB, 2007. World Develop Indicators Database. Atlas method, purchasing power parity as of 2005 in USD.

Table C2: Construction of sexual violence indicators by country

Malawi (2004)	**Intimate partner SV:** 71 percent (ever married).	(QDV06A (h)): (Does/did) your (last) husband/partner ever: (i) physically force you to have sexual intercourse with him even when you did not want to?
	Forced sex: 76 percent (sexually active).	(QDV21B): The first time you had sexual intercourse, would you say that you had it because you wanted to, or because you were forced to have it against your will?
		(QDV21C): In the last 12 months, has anyone forced you to have sexual intercourse against your will?
Rwanda (2005)	**Intimate partner SV**: 22 percent (ever married).	(Q1106A (i)): (Does/did) your (last) husband/partner ever: (i) physically force you to have sexual intercourse with him even when you did not want to?
	Forced sex: 34 percent (sexually active).	(Q 542): The first time you had sexual intercourse, did you want to have sex or you were forced against your will?
		(Q 543): In the last 12 months, did someone force you to have sex against your will?
Uganda (2006)	**Intimate partner SV:** 20 percent (ever married).	(Q1105 (h)): (Does/did) your (last) husband/partner ever do any of the following things to you: (h): physically force you to have sexual intercourse with him even when you did not want to?
	Forced sex: 22 percent (sexually active).	(Q1121): The first time you had sexual intercourse, would you say that you had it because you wanted to, or because you were forced to have it against your will?
		(Q1125): At any time in your life, as a child or as an adult, has anyone ever <u>forced you in any way</u> to have sexual intercourse or perform any other sexual acts?

Table C3: Logit models for determinants of incontinence by country using composite measures

Determinants:	Malawi (2004) N = 11698	Rwanda (2005) N = 5386	Uganda (2006) N = 8524	Ethiopia (2005) N = 3907
Sexual violence (=1)	1.667***	3.778***	1.404	---
Not selected for domestic violence module (=1)	1.087	1.943**	1.246	---
Female genital cutting (=1)	---	---	1.207	0.819
Age 20 to 29 (=1)	0.887	1.018	1.079	1.036
Age 30 to 39 (=1)	0.856	0.523	1.211	1.244
Age 40 to 49 (=1)	0.784	0.673	1.114	2.103
Primary only (=1)	0.881	1.220	1.219	1.224
Secondary and above (=1)	0.547**	1.083	1.126	0.656
Bottom decile of height distribution (=1)	1.211	0.828	2.054**	0.207
Missing information on height (=1)	0.491**	0.840	0.960	1.076
Ever had still birth (=1)	1.729**	0.843	1.947*	0.000
Missing information on birth (=1)	0.058***	---	0.101***	0.365**
Second wealth quintile (=1)	1.106	1.030	0.951	0.979
Third wealth quintile (=1)	0.944	1.214	0.920	0.649
Fourth wealth quintile (=1)	0.841	1.119	0.898	1.054
Fifth wealth quintile (=1)	0.634**	1.073	0.731	0.496
Urban (=1)	0.938	0.712	0.861	1.835
Limited access to health care (=1)[1]	1.204	1.868**	1.240	1.023
Inverse Mills ratio	---	3.404*	---	0.078*
Pseudo R²	0.064	0.037	0.049	0.114

Note: Coefficients are reported as odds ratios and standard errors (not reported) are clustered at the PSU level. Omitted categories are age 15 to 19, less than primary education and first wealth quintile. Rwanda and Ethiopia are second stage regressions of Heckman selection models.

* significant at 10%; ** significant at 5%; *** significant at 1%

[1] Community mean of self-report if accessing health care is a big problem.

Table C4: Logit models for determinants of incontinence by country using specific measures

Determinants:	Malawi (2004) N = 11698	Rwanda (2005) N = 5386	Uganda (2006) N = 8524	Ethiopia (2005) N = 3907
Intimate partner sexual violence (=1)	1.654***	2.375***	1.008	---
Other forced sex (=1)	1.428***	2.453***	1.500	---
Not selected for domestic violence module (=1)	1.096	2.038***	1.261	---
Female genital cutting (least invasive =1)	---	---	---	0.854
Female genital cutting (sewn shut =1)	---	---	---	0.369
Female genital cutting (any =1)	---	---	1.200	---
Age 20 to 29 (=1)	0.882	0.930	1.075	1.054
Age 30 to 39 (=1)	0.851	0.475	1.203	1.255
Age 40 to 49 (=1)	0.786	0.611	1.100	2.121
Primary only (=1)	0.873	1.213	1.215	1.221
Secondary and above (=1)	0.547**	1.115	1.127	0.682
Bottom decile of height distribution (=1)	1.213	0.809	2.047**	0.206
Missing information on height (=1)	0.496**	0.821	0.959	1.089
Ever had still birth (=1)	1.753**	0.834	1.944*	0.000
Missing information on birth (=1)	0.062***	---	0.105***	0.367**
Second wealth quintile (=1)	1.099	1.015	0.952	0.942
Third wealth quintile (=1)	0.942	1.210	0.921	0.631
Fourth wealth quintile (=1)	0.845	1.105	0.898	1.009
Fifth wealth quintile (=1)	0.630**	1.053	0.733	0.477
Urban (=1)	0.936	0.740	0.858	1.946
Limited access to health care (=1)[1]	1.195	1.916**	1.243	1.046
Inverse Mills ratio	---	3.454*	---	0.066*
Pseudo R²	0.065	0.039	0.049	0.116

Note: Coefficients are reported as odds ratios and standard errors (not reported) are clustered at the PSU level. Omitted categories are age 15 to 19, less than primary education and first wealth quintile. Rwanda and Ethiopia are second stage regressions of Heckman selection models.
* significant at 10%; ** significant at 5%; *** significant at 1%
[1] Community mean of self-report if accessing health care is a big problem.

Table C5: Logit models for determinants of incontinence by country using composite measures including mediating variable for health seeking behavior

Determinants:	Malawi (2004) N = 11698	Rwanda (2005) N = 5386	Uganda (2006) N = 8524	Ethiopia (2005) N = 3907
Sexual violence (=1)	1.673***	3.713***	1.406	---
Missing information on sexual violence (=1)	1.086	1.904**	1.251	---
Female genital cutting (=1)	---	---	1.191	0.816
Age 20 to 29 (=1)	0.891	1.082	1.065	1.031
Age 30 to 39 (=1)	0.859	0.574	1.19	1.250
Age 40 to 49 (=1)	0.786	0.721	1.101	2.145
Primary only (=1)	0.871	1.192	1.227	1.239
Secondary and above (=1)	0.534**	1.073	1.151	0.669
Bottom decile of height distribution (=1)	1.215	0.848	2.060**	0.208
Missing information on height (=1)	0.493**	0.858	0.962	1.082
Ever had still birth (=1)	1.729**	0.871	1.978*	0.000
Missing information on birth (=1)	0.059***	---	0.100***	0.368**
Second wealth quintile (=1)	1.104	1.023	0.954	0.986
Third wealth quintile (=1)	0.939	1.202	0.925	0.644
Fourth wealth quintile (=1)	0.830	1.093	0.918	1.036
Fifth wealth quintile (=1)	0.622**	1.091	0.752	0.486
Urban (=1)	0.935	0.712	0.88	1.843
Limited access to health care (=1)[1]	1.256	1.831**	1.213	1.008
Skilled attendance last birth (=1)[2]	1.165	2.080***	0.436	1.557
Delivered in facility last birth (=1)	0.979	0.510**	1.959	0.641
Inverse Mills ratio	---	3.067	---	0.076
Pseudo R²	0.064	0.047	0.050	0.115

Note: Coefficients are reported as odds ratios and standard errors (not reported) are clustered at the PSU level. Omitted categories are age 15 to 19, less than primary education and first wealth quintile. Rwanda and Ethiopia are second stage regressions of Heckman selection models.
* significant at 10%; ** significant at 5%; *** significant at 1%
[1] Community mean of self-report if accessing health care is a big problem.
[2] Skilled attendance includes doctors, nurses, midwives and trained birth assistance and excludes traditional birth attendants.

Table C6: Logit models for determinants of incontinence by country using specific measures including mediating variable for health seeking behavior

Determinants:	Malawi (2004) N = 11698	Rwanda (2005) N = 5386	Uganda (2006) N = 8524	Ethiopia (2005) N = 3907
Intimate partner sexual violence (=1)	1.667***	2.346***	1.017	---
Other forced sex (=1)	1.431***	2.384***	1.511	---
Not selected for domestic violence module (=1)	1.095	2.000**	1.266	---
Female genital cutting (least invasive =1)	---	---	---	0.851
Female genital cutting (sewn shut =1)	---	---	---	0.362
Female genital cutting (any =1)	---	---	1.182	---
Age 20 to 29 (=1)	0.886	0.985	1.061	1.051
Age 30 to 39 (=1)	0.854	0.518	1.183	1.262
Age 40 to 49 (=1)	0.787	0.653	1.088	2.168
Primary only (=1)	0.862	1.182	1.223	1.236
Secondary and above (=1)	0.534**	1.092	1.154	0.694
Bottom decile of height distribution (=1)	1.218	0.823	2.054**	0.207
Missing information on height (=1)	0.499**	0.838	0.961	1.097
Ever had still birth (=1)	1.753**	0.856	1.975*	0.000
Missing information on birth (=1)	0.062***	---	0.104***	0.371**
Second wealth quintile (=1)	1.098	1.010	0.955	0.946
Third wealth quintile (=1)	0.937	1.200	0.927	0.623
Fourth wealth quintile (=1)	0.833	1.085	0.918	0.989
Fifth wealth quintile (=1)	0.617**	1.074	0.754	0.466
Urban (=1)	0.934	0.740	0.877	1.951
Limited access to health care (=1)[1]	1.250	1.866**	1.215	1.032
Skilled attendance last birth (=1)[2]	1.201	2.071***	0.434	1.586
Delivered in facility last birth (=1)	0.960	0.514**	1.961	0.633
Inverse Mills ratio	---	3.132	---	0.064*
Pseudo R²	0.066	0.044	0.050	0.117

Note: Coefficients are reported as odds ratios and standard errors (not reported) are clustered at the PSU level. Omitted categories are age 15 to 19, less than primary education and first wealth quintile. Rwanda and Ethiopia are second stage regressions of Heckman selection models.
* significant at 10%; ** significant at 5%; *** significant at 1%
[1] Community mean of self-report if accessing health care is a big problem.
[2] Skilled attendance includes doctors, nurses, midwives and trained birth assistance and excludes traditional birth attendants.

Table C7: First stage logit models: Rwanda, live birth in last five years; Ethiopia, ever heard of fistula.

	Rwanda (2005) N = 11321	Ethiopia (2005) N = 14059
Instruments:		
Ever terminate a pregnancy (=1)	1.598***	
Ever use contraceptive method (=1)	3.587***	
Reads magazine or newspaper more than once a week (=1)		1.863***
Heard of sexually transmitted diseases (=1)		2.995***
Heard of tonsillectomy (=1)		2.947***
Knows ways to avoid HIV infection (=1)		2.235***
Other covariates:		
Age 20 to 29 (=1)	33.416***	1.574***
Age 30 to 39 (=1)	67.738***	2.031***
Age 40 to 49 (=1)	11.149***	2.609***
Primary only (=1)	0.735***	1.692***
Secondary and above (=1)	0.433***	5.100***
Second wealth quintile (=1)	1.017	1.258**
Third wealth quintile (=1)	1.144	1.154
Fourth wealth quintile (=1)	1.105	1.151
Fifth wealth quintile (=1)	0.837*	1.298**
Urban (=1)	0.664***	1.711***
F-test for instrument strength (p-value)	0.000	0.000
F-statistic for instrument strength (χ^2)	448	339
Exclusion F-test in second stage (p-value)	0.501	0.167
Pseudo R^2	0.289	0.223

Note: Coefficients are reported as odds ratios and standard errors (not reported) are clustered at the PSU level. Omitted categories are age 15 to 19, less than primary education and first wealth quintile.

* significant at 10%; ** significant at 5%; *** significant at 1%.