Hope for the Dying: HIV/AIDS, Antiretroviral Treatment Packages and Intrahousehold Resource Allocation

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Statement of Authorship

I certify that the thesis contains no material which has been submitted for the award of any degree or diploma in any university or other institution, and to the best of my knowledge the thesis contains no material previously published or written by another person, except where due reference is made in the text of the thesis.

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Notice 1

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Abstract

The HIV/AIDS epidemic has devastated and impacted millions of lives worldwide especially in Sub-Saharan Africa. Since its discovery in 1981, the challenge at the onset of the epidemic was the unavailability of treatment but this changed in 1987, with the development of antiretroviral therapy (ART) and subsequently the availability of generic drugs which reduced treatment costs considerably and increased the survival of those infected with HIV.

However, challenges still remain in terms of risk of HIV infection and low use of services for HIV including Voluntary Counselling and Testing (VCT). Additionally, despite the provision of ART especially to resource constrained countries in Sub-Saharan Africa including Uganda, there are other numerous challenges faced by People Living With HIV and AIDS (PLWHA) that impede maximising benefits from ART despite the enormous global commitment in fighting HIV/AIDS.

This thesis generally investigates aspects relating to HIV prevention, care and treatment looking at the case of Uganda and Kenya. Firstly, the thesis explores factors that are important for the use of VCT for women in Kenya and factors that are important to reduce HIV risk for women in Kenya and Uganda. Secondly, the thesis explores how access to treatment of HIV in terms of different ART packages may impact households' resource allocation outcomes; highlighting the personal and household burden of HIV/AIDS in Sub-Saharan Africa.

The literature on HIV/AIDS is vast but challenges still exist in reducing risk and boosting uptake of VCT as a means of HIV prevention. This thesis adds knowledge to the HIV prevention literature by using the Demographic and Health Survey data that incorporate individual HIV status to explain HIV risk and likelihood of using VCT for women as a means of informing HIV prevention policy. The results reveal that individuals from high socio-economic backgrounds are more likely to use VCT but are equally more likely to be at greater risk of HIV infection, unlike past studies that have always emphasised individuals from low socio-economic as those at greater risk. Reduction of risk would require policies that target individuals from all socio-economic backgrounds to achieve better prevention success.

The existing literature on HIV/AIDS and care has considered the provision of ART drugs to resource constrained countries including Uganda which, is mainly focused on here. Given the transformed nature of the illness experience of HIV/AIDS as a result of increased survival due to ART availability, the focus has shifted to how individuals and households manage to live with the illness and has considered aspects relating to wellbeing including work, education and quality of work. However, little attention has been focused on the challenges faced by individuals and households affected by HIV in resource constrained communities despite the fact that such challenges might reduce the benefits from HIV treatment.

This thesis uses both individual and household level data from the Centre for Health Economics Uganda HIV survey to explore how provision of additional support in addition to ART impacts households' wellbeing in terms of children's work, children's education outcomes and adult labour allocation. The thesis reveals that children from households with a PLWHA are likely to engage more in child work and are hence more likely to be potentially vulnerable. Also, adults from households that received additional support are indicated to have better outcomes in terms of labour hours and cash at hand, hence better survival than PLWHA who do not have such additional support. The thesis also adds to the limited literature relating to the impact of formal assistance to households on children's schooling outcomes for households with a PLWHA. The results reveal that although formal assistance may have no impact on children's school enrolment, it is important for schooling quality through better school progression.

Finally, the thesis considers the association between labour supply (for individuals, males and females separately and couples) and belonging to a household with a PLWHA, in terms of antiretroviral treatment packages (ARTP) offered by two healthcare agencies (TASO and MOH) and belonging to a household without a known person living with HIV (non-PLWHA). The results suggest that social support by TASO to households with PLWHA may have unintended outcomes in terms of disincentivising work for males; while females from TASO households supply more hours of labour compared to those receiving support from the MOH. It is possible that social support empowers TASO women to greater participation in the labour market. An analysis of a collective labour participation model reveals that bargaining power among couples influences total household labour supply, with males contributing fewer hours while females contribute more hours to total household labour supply, implying rejection of the unitary model. The results imply that policies aimed at improving household labour outcomes need to consider gender dynamics within the households, and the bargaining power of the intended recipient to be effective.

Publications arising from thesis

1. **Namazzi, A. J.** (2010). "Determinants of Using Voluntary Counseling and Testing for HIV/AIDS in Kenya." Journal of Management Policy and Practice, *11*(5), 89-96.

2. **Abimanyi-Ochom, J.** (2011). The better the worse: risk factors for HIV infection among women in Kenya and Uganda – Demographic and Health Survey. AIDS Care, *23*(12), 1545-1550

3. **Abimanyi-Ochom J**, Lorgelly P, Hollingsworth B, Inder B. "Does social support in addition to ART make a difference? Comparison of households with TASO and MOH PLWHA in Central Uganda." AIDS Care (Forthcoming).

Work in progress

1. The 2010/2011 Centre for Health Economics Uganda HIV Survey (CUHS), CHE Publications, Research Paper 79, 2012 with Lorgelly. P, Inder. B and Hollingsworth, B.

2. Critical help at a critical time: Schooling of vulnerable children given formal assistance to households with PLWHA in Central Uganda (2012) to be submitted to *Social Science and Medicine*

3. What about the Children? Factors that influence child work for households with PLWHA in Central Uganda (2011) to be submitted to Journal of *African Economies*

Conference Presentations

- 34th Australian Conference of Health Economists at Darwin (September 2012); Presentation of paper: Critical help at a critical time: Schooling of vulnerable children given formal assistance to households with PLWHA in Central Uganda

- 34th African Studies Association of Australasia and the Pacific Conference at Flinders University, Adelaide (December 2011); Presentation of paper; Does social support in addition to ART make a difference? Comparison of households with TASO and MOH PLWHA in Central Uganda

- 33rd Australian Conference of Health Economists at Melbourne (October 2011); Presentation of paper; Factors that influence child work for households with PLWHA in Central Uganda

- 31st Australian Conference of Health Economists at Hobart (October 2009); Presentation of paper; Risk factors for HIV infection among women in Kenya and Uganda

- 7th World Congress on Health Economics in Beijing, China (July 2009); Presentation of paper; Risk factors for HIV infection among women in Kenya and Uganda

- 10th Annual International Conference of the International Academy of African Business and Development, Kampala, Uganda. (May 2009); Presentation of paper; factors that influence using voluntary counselling and testing for Women in Kenya

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This thesis uses three datasets: the Kenya Demographic and Health Survey of 2003, the Uganda AIDS Indicator Survey of 2004 and the 2010/2011 Centre for Health Economics Uganda HIV Survey (CUHS).

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List of Abbreviations

ABC	Abstinence Being faithful and Condom use
ACDI/VOCA	Agricultural Cooperative Development International/ Volunteers in Overseas Cooperative Assistance
AIDS	Acquired Immune Deficiency Syndrome
AIS	Aids Indicator Survey
ANC	Antenatal Clinic
ART	Antiretroviral Therapy
ARTP	Antiretroviral Treatment Package
ARVs	Antiretroviral drugs
CASA	Community ART Support Agent
CBO	Community Based Organisation
CDC	Centre for Disease Control and Prevention
CDDPs	Community Drug Distribution Points
CD4	Cluster of Differentiation Antigen 4
CBS	Central Bureau of Statistics
CPT	Co-trimoxazole Preventive Therapy
CUHS	Centre for Health Economics Uganda HIV Survey
CVCT	Couple Voluntary Counselling and Testing
EFA	Education For All
ERA	Education Related Assistance
FAO	Food and Agricultural Organization
FA	Formal Assistance
GOU	Government of Uganda
HC	Health Centre
HSV	Herpes Simplex Virus
HAART	Highly Active Anti-Retroviral Therapy
HBC	Home Based Care
HIV	Human Immunodeficiency Virus
KDHS	Kenya Demographic and Health Survey
KNBS	Kenya National Bureau of Statistics
MC	Male Circumcision

MMC	Medical Male Circumcision
MOH	Ministry of Health
MOHART	Ministry of Health client on ART
MOHPLWHA	Ministry of Health client on septrin or ART
MOHWL	Ministry of Health client on septrin
MTCT	Mother to Child Transmission
NRH	National Referral Hospital
NHP	National Health Policy
OIs	Opportunistic infections
PLWHA	Person(s) Living With HIV/AIDS
PEPFAR	The United States President's Emergency Plan For AIDS Relief
PMTCT	Prevention of Mother to Child Transmission
PHC	Primary Health Care
RRH	Regional Referral Hospital
STIs	Sexually Transmitted Infections
SES	Social Economic Status
SSA	Sub-Saharan Africa
TASO	The AIDS Support Organisation
TASOART	The AIDS Support Organisation client on ART
TASOPLWHA	The AIDS Support Organisation client on septrin or ART
TASOWL	The AIDS Support Organisation client on septrin
TBA	Traditional Birth Attendants
UNAIDS	Joint United Nations Programme on HIV/AIDS
UNGASS	United Nations General Assembly Special Session
VCT	Voluntary Counselling and Testing
WFP	World Food Programme
WL	Waiting List
WHO	World Health Organization

Chapter 1 - Introduction

1.1. HIV/AIDS a global health burden

Human Immunodeficiency Virus (HIV) is a retrovirus that infects cells of the human immune system (mainly CD4 positive T cells and macrophages which are key components of the cellular immune system), and destroys or impairs their function (UNAIDS 2008a). Infection with HIV results in the progressive deterioration of the immune system, leading to immune deficiency (UNAIDS 2008a). A deficient immune system fails to fulfil its role of fighting infections and disease; hence, immunodeficient people are more susceptible to a wide range of infections. Infections associated with severe immunodeficiency are known as opportunistic infections (OIs), because they take advantage of a weakened immune system (UNAIDS 2008a).

AIDS, Acquired Immunodeficiency Syndrome, is a surveillance definition based on signs, symptoms, infections, and cancers associated with the deficiency of the immune system that stems from infection with HIV. After HIV has caused progressive deterioration of the immune system, increased susceptibility to infections may lead to symptoms (UNAIDS 2008a).

HIV stages are classified on the basis of certain signs, symptoms, infections, and cancers grouped by the World Health Organization (WHO 2005a) as indicated in Table 1.1.

Table 1.1: WHO HIV/AIDS Clinical Stage and Corresponding Symptoms

Clinical Stage	Signs, Symptoms and Infections
Primary infection	asymptomatic or experienced as Acute retroviral syndrome[1]
Clinical stage 1	asymptomatic or generalized swelling of the lymph nodes
Clinical stage 2	minor weight loss, minor mucocutaneous manifestations, and recurrent upper respiratory tract infections
Clinical stage 3	unexplained chronic diarrhea, unexplained persistent fever, oral candidiasis or leukoplakia, severe bacterial infections, pulmonary tuberculosis, and acute necrotizing inflammation in the mouth. Some persons with clinical stage 3 have AIDS.
Clinical stage 4	22 opportunistic infections or cancers related to HIV. All persons with clinical stage 4 have AIDS

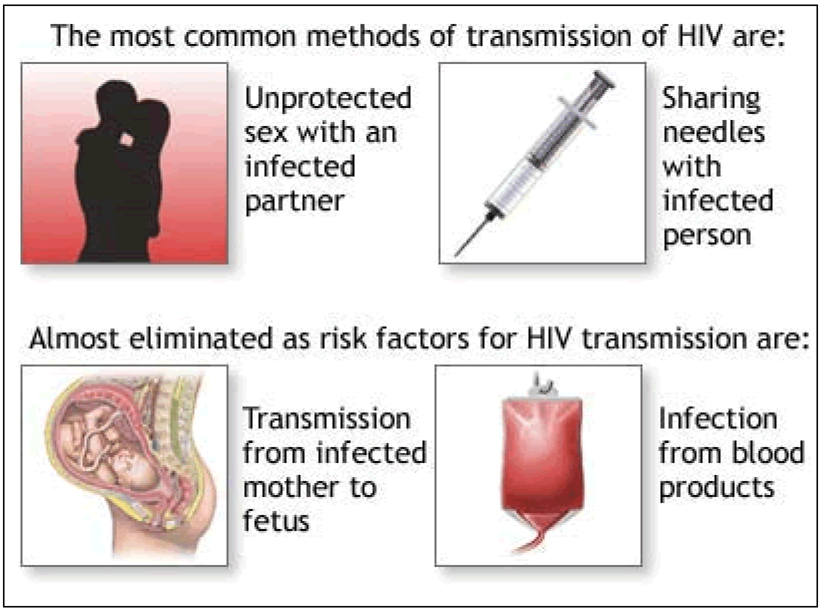
Most of the infections in HIV infected people are opportunistic and can be treated easily in healthy people. The length of time between HIV infection and developing AIDS varies widely between individuals with the majority of infected people developing signs of HIV related illnesses, if untreated, within 5-15 years. AIDS refers to the most advanced stages of HIV infection, defined by the occurrence of more than 20 opportunistic infections or HIV-related cancers. Additionally, AIDS is defined on the basis of a CD4 positive T cell count of less than 200 per mm^3 of blood (Centre for Disease Control and Prevention (CDC) definition) (UNAIDS 2008a).

HIV transmission

HIV is transmitted through unprotected sex (vaginal, anal and to a lesser extent oral sex) with an infected person; sharing contaminated syringes, needles or other sharp instruments; from mother to child during pregnancy, childbirth or breast feeding when the mother is already HIV positive and blood transfusion with contaminated blood (UNAIDS 2009b) as illustrated in Figure 1.1.

[1]Glandular fever-like illness, rash, joint pains and enlarged lymph nodes, usually developed by some people at the time of seroconversion UNAIDS. (2008b, March 2012). "Fast Facts About HIV." Retrieved March 2012, from http://www.unaids.org/en/media/unaids/contentassets/dataimport/pub/factsheet/2008/20080519_fastfacts_hiv_en.pdf..

Figure 1.1: Modes of HIV transmission



Source: Highleyman, 2010

HIV has two types namely, HIV-1 and HIV-2. Both types have similar modes of transmission and eventually lead to AIDS. The difference between the two types is the fact that HIV-2 immunodeficiency is milder and develops more slowly and HIV-2 is comparatively less infectious early in the course of infection (CDC 2011). Hence, worldwide, the predominant virus is HIV-1. HIV-2 is concentrated in West African nations and these have low HIV prevalence usually slightly above 1 percent (CDC 2011).

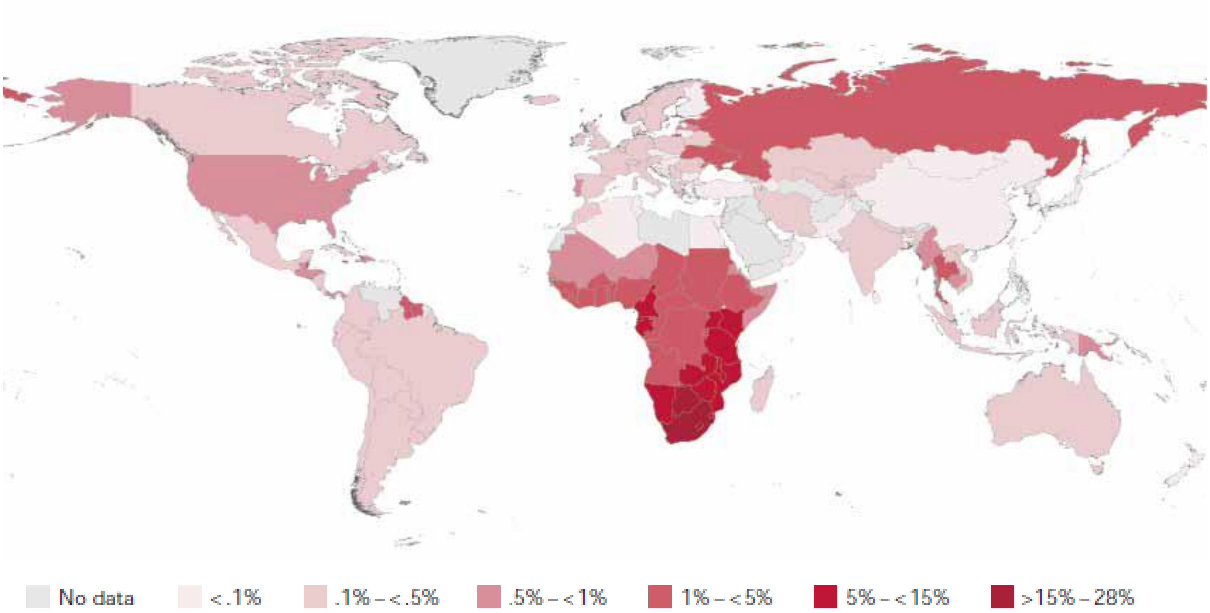
The first cases of AIDS were officially confirmed in 1981. The cases were identified in homosexual patients hospitalised in Los Angeles in the United States. However, HIV was present in Africa before the 1980's with the earliest known case of infection with HIV-1 in humans detected in a blood sample collected in 1959 from a man in Kinshasa, Democratic Republic of Congo[2]. Scientists discovered the virus that causes AIDS in 1983 for HIV-1 and 1986 for HIV-2 and this was named HIV (human immunodeficiency virus) (CDC 2006).
Scientists suspected the origin of HIV to be from other primates and HIV-1 was discovered by an international team of researchers in 1999 in a subspecies of chimpanzees native to West Africa. The researchers believed the HIV-1 virus to have been introduced into the human population when hunters became exposed to infected blood (CDC 2006). The chimpanzee

[2]The means by which this man became infected is unknown

version of immunodeficiency virus (called simian immunodeficiency virus (SIV) is believed to have been transmitted to humans and mutated into HIV.

Although, unknown 27 years ago, HIV/AIDS has already caused an estimated 25 million deaths worldwide and has generated profound demographic changes in the most heavily affected countries (UNAIDS 2008a). At the end of 2010, an estimated 34 million people were living with HIV worldwide; with the number of people dying of AIDS related illnesses estimated as 1.8 million (UNAIDS, 2011). Global prevalence of HIV ranged from less than 1 percent to 28 percent in the most affected areas in 2009 as shown in Figure 1.2. Consequently, goal six of the Millennium Development Goals (MDGs) aims at combating HIV/AIDS, malaria and other diseases.

Figure 1.2: Global prevalence of HIV, 2009



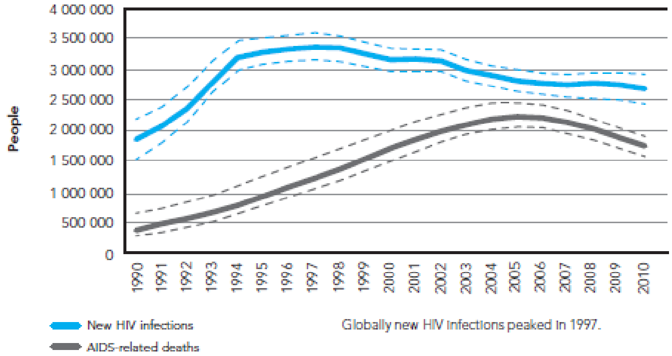
Source: UNAIDS, 2010

The recent falling trend in the HIV/AIDS epidemic is promising, with global estimates indicating a reduction in new infections among children and a reduction in AIDS related deaths (Foster *et al.* 2010; UNAIDS 2010) as shown in Figure 1.3. This is partly attributed to antiretroviral therapy (ART[3]), which has been indicated to restore health and improve health

[3] ART is a combination of three or more drugs as HIV treatment.

outcomes even in resource limited countries in Sub-Saharan Africa (SSA) (Song *et al.* 2007; Seeley *et al.* 2009).

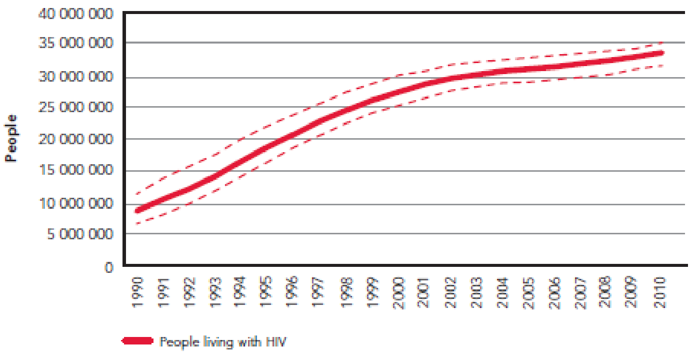
Figure 1.3: New HIV Infections and AIDS related Deaths



Source: UNAIDS, 2011b

While the percentage of Persons Living With HIV/AIDS (PLWHA) stabilized since 2000, the overall number of PLWHA has steadily increased as new infections occur each year as shown in Figure 1.4. In 2010, there were 2.7 million new HIV infections including 390,000 children. This was 21 percent less than the new infections at the peak of the epidemic in 1997 (see Figure 1.3).

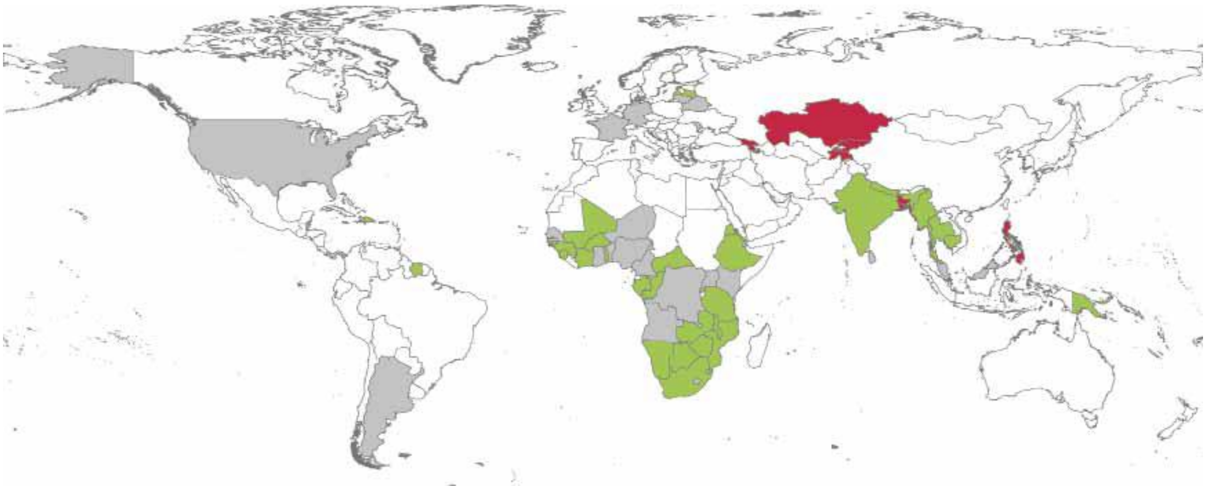
Figure 1.4: People Living With HIV/AIDS



Source: UNAIDS, 2011b

New infections are reported to have declined due to a combination of factors including the impact of HIV prevention and the natural course of the epidemic. Among young people, decreased incidence and safer sexual behaviour have been shown to contribute to the decline in prevalence. Compared to 2001, the incidence rate of HIV in several countries was stable or declining in 2009, except for some countries in Eastern Europe and Asia, as illustrated in Figure 1.5.

Figure 1.5: Changes in the incidence rate of HIV infection for selected countries from 2001 to 2009



□ Increasing>25%, □Stable, □ Decreasing >25%, □Not included in analysis: Source[4]: UNAIDS, 2010

Additionally, increased access to prevention of mother to child transmission (PMTCT) services has been indicated to reduce the total number of children born with HIV/AIDS (UNAIDS 2010). It has been reported that 350,000 children have avoided acquiring AIDS since 1995 because of antiretroviral prophylaxis provided to pregnant women living with HIV (WHO *et al.* 2011). A total of 2.5 million deaths have been averted in low-middle income countries since 1995 due to the introduction of ART, with 700,000 AIDS related deaths averted in 2010 alone (UNAIDS, 2011).

Despite the decline, HIV/AIDS continues to impact communities and households in SSA, through its devastating impact on quality of life through poor health, reversing achieved human development progress, making such communities vulnerable (Tumushabe 2000; Richter 2004; UNAIDS *et al.* 2004; UNICEF and UNAIDS 2005; Bukusuba *et al.* 2007; Maguire *et al.* 2008; Boutayeb 2009; UNAIDS 2010).

[4] Changes in incidence rates were obtained through modeling using spectrum methods which estimate HIV incidence trends from HIV prevalence overtime combined with the changing level of ART (UNAIDS, 2010).

Economic burden of HIV

HIV/AIDS has impacted on many countries, leaving populations vulnerable to poverty, malnutrition, morbidity and mortality (UNAIDS 2006a; Bukusuba *et al.* 2007; Boutayeb 2009; UNAIDS 2010). The impact of HIV/AIDS epidemic is enormous with the epidemic affecting all sectors of the economy.

At the macro-level, the net effect of the epidemic on the growth rate of GDP per capita in affected countries has been indicated to be substantially negative in some countries (McDonald and Roberts 2001; Dixon *et al.* 2002; UNDESA 2004). HIV/AIDS has diverted public spending from investments in physical and human capital to health expenditure and this may reduce long run growth (UNDESA 2004).

In 38 African countries, life expectancy at birth has been shown to have declined by 5.7 years compared to the scenario that AIDS is absent. Life expectancy with AIDS is expected to be only 51.3 years by 2020-2025, compared to life expectancy at birth of 62.1 years in 2020-2025 in the absence of HIV/AIDS, 10.8 years higher than life expectancy with HIV/AIDS (UNDESA 2004).

At the household level, HIV has impacted on households by leading to loss of income of the infected family member with greater impact when the infected member is the main breadwinner (Zaba *et al.* 2004b). HIV/AIDS increases household expenditures to cover the medical costs and also leads to absenteeism of family members from work or school in order to take care of the sick patient. AIDS affected households have been shown to be more than twice as likely to be poor, and face long term poverty as the non-affected households. (Booysen 2003)

HIV/AIDS has affected household composition by increasing the number of female headed households, gradually reducing the parental generation and leaving children to be cared for by grandparents and other relatives. Notably, HIV/AIDS has led to an increasing number of vulnerable children who have lost one or both parents and consequently live with overburdened caregivers or in child-headed households (Richter 2004; UNAIDS *et al.* 2004; Sarker *et al.* 2005; Andrews *et al.* 2006; Miller 2007). Adult deaths lead to dissolution of households and in some instances children are withdrawn from school if the family cannot afford school related fees (Bennell 2005). The impact of HIV/AIDS has also been shown to be gender dependant, with household food and nutrition security being affected further when an adult woman die, with an even larger impact on household income when an adult male dies (UNDESA 2004)).

HIV/AIDS has led to an increased number of orphans with 16 million children under the age of 18 having lost at least one parent at the end of 2009, of which 14.8 million of these children live in SSA (UNAIDS 2010). Orphans have been shown to suffer disadvantages in education, nutritional status and wellbeing (UNDESA 2004). Children are also affected by AIDS because their adult caregivers are ill or caring for the ill, with such children receiving inadequate care and support from adults (Kendall and O'Gara 2007). Families with a PLWHA have lower income by as much as 60 percent, more expenditure on health care, depleted savings and reduced consumption (Gilborn *et al.* 2001; Richter 2004).

HIV/AIDS has been shown to impact on firms by affecting the labour force through absenteeism, loss of productivity through illness and increasing firm costs through retraining as a consequence of lost workers. HIV/AIDS is indicated to substantially impact labour intensive firms (UNDESA 2004) for example HIV positive workers in large scale tea farms in Kenya are reported to have plucked 4.11-7.93 kg/day less tea leaves in the last year and 6 months before termination (Fox *et al.* 2004).

Agriculture is the backbone of many developing countries and such countries have been greatly affected by the HIV/AIDS through significant reductions in food production. Food reductions due to AIDS of up to 50 percent have been reported in Burkina Faso and Swaziland. AIDS has also lead to a reduction in the supply of labour for food and livestock production with women with sick husbands in Tanzania reported to spend 45 percent less time on agricultural tasks than women whose husbands were healthy (UNDESA 2004). HIV/AIDS has led to shifts of production from the more labour intensive cash crops to food crops leading to reduced income in the affected households.

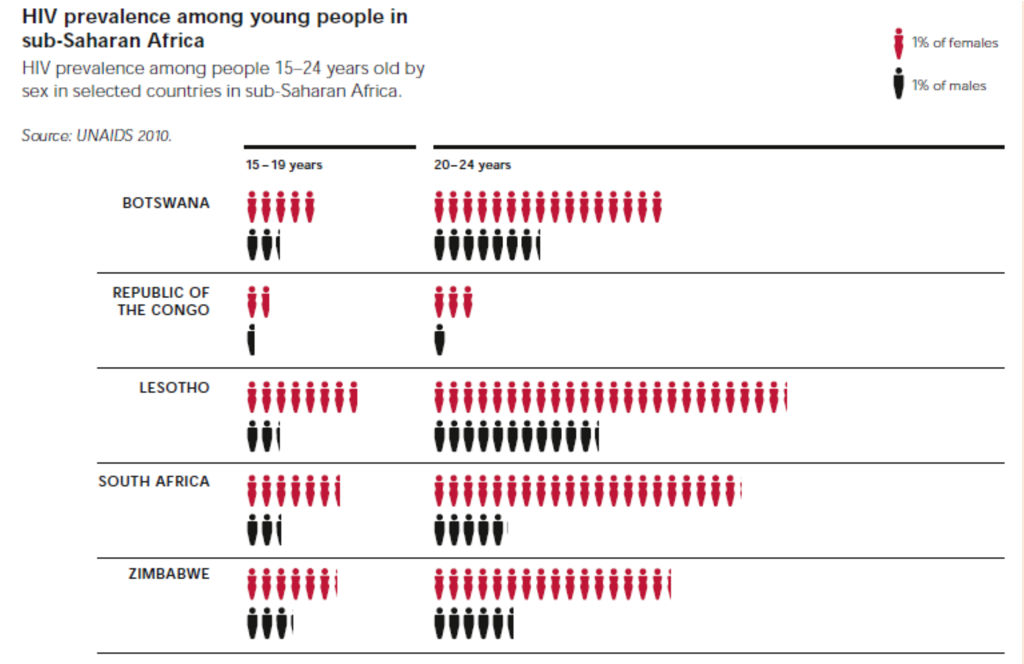
The AIDS epidemic has impacted on the education sector by increasing costs on the education system for medical care, recruiting and replacement of teachers lost to AIDS (Hyde *et al.* 2001; UNDESA 2004). The quality of education may decline due to teachers being absent or ill and due to reduction in investments in education as a result of funds being diverted to the fight against AIDS.

Similar to the education sector, absenteeism and deaths of health workers have posed a serious threat to the health care system especially in the most affected countries with rural areas affected most by shortage of doctors and nurses. Additionally, increased mortality of health workers is a threat to quality health care. Most affected countries have limited resources and hence have insufficient funds to cover AIDS related expenditures, hence dependence on international donors to meet the health care needs imposed by HIV/AIDS (UNDESA 2004) (For example, in 2007, Kenya spent 226 million USD on HIV/AIDS of which 220.7 million USD was donor funded (Kenya UNGASS Report 2010).

Women remain more vulnerable than men in Sub-Saharan Africa and the Caribbean with 59 percent and 53 percent of PLWHA being women respectively (UNAIDS 2011b). Figure 1.6 illustrates how women in some SSA countries are more vulnerable to HIV/AIDS for all age groups compared to the men of the same age. An example is Lesotho where for women 20-24 years old, HIV prevalence is 24.5 percent while it is 11.5 precent for men of the same age (UNAIDS, 2010).

HIV/AIDS has led to immense health expenditure with the total expenditure in high income countries estimated at USD $3.3 trillion and USD $427 billion in low and middle income countries (WHO 2003d; de Lay *et al.* 2007). In 2006, $9 billion was available for the HIV/AIDS response although $15 billion was needed (UNAIDS 2006b). Estimates in terms of disability adjusted life years (DALYs) by the WHO indicated 31 percent of communicable, maternal, perinatal and nutritional conditions were attributable to HIV (WHO 2002a; de Lay *et al.* 2007). HIV/AIDS has impacted all sectors of the economy and has therefore threatened millennium development goal achievement in developing countries leading to more poverty and reduced health outcomes (Boutayeb 2009).

Figure 1.6: Women disproportionately affected by HIV in SSA



Source: UNAIDS, 2010.

HIV Treatment approaches

At the beginning of the AIDS epidemic in the early 1980's, people living with HIV/AIDS (PLWHA) did not have any kind of treatment and hence may have lived for only a few years. With the development of HIV drugs called antiretroviral drugs (ARVs), PLWHA can now live longer. ARVs do not cure HIV/AIDS but do stop the virus from multiplying in the body and hence stops the virus from damaging the immune system. However, ARVs cannot eliminate the virus from the body thereby requiring PLWHA to continuously take ARVs (UNAIDS 2009a).

ARVs interfere with the way HIV makes copies of itself and the way it spreads from cell to cell. The main classes of ARVs include;

- Nucleoside Reverse Transcriptase Inhibitors: HIV needs a protein substance called reverse transcriptase to make new copies of its genetic material and this group of drugs inhibits this protein
- Non-Nucleoside Reverse Transcriptase inhibitors: this group also blocks the reverse transcriptase protein needed to multiply HIV
- Protease Inhibitors: HIV needs protease to make copies of itself and this group of drugs blocks the protein to stop HIV from multiplying (UNAIDS, 2009a).

ARVs are also classified as first, second and third line drugs. The HIV virus develops resistance to drugs through mutations and hence different drug combination levels have been developed to counter this. The first combination of drugs taken by HIV patients is referred to as first line regimen and once these no longer work to block HIV, another combination of drugs, referred to as second line ARVs are taken. Once the second line drugs fail, a third line or salvage, or cocktail, of medicines is recommended (UNAIDS 2009a). 95 percent of patients on treatment are on first line ARVs the majority of which are off-patent (UNAIDS 2011a). Therefore, in this regard, adherence to ARVs is very crucial to avoid HIV resistance to drugs.

Antiretroviral therapy (ART) is a combination of three or more drugs as HIV treatment as shown in Figure 1.7 below. Highly Active Anti-Retroviral Therapy (HAART) is another term used for a combination of three or more HIV drugs. Standard ART consists of at least three ARVs to maximally suppress the HIV virus and stop the progression of HIV disease (UNAIDS 2009a; WHO 2011b; WHO 2011c).

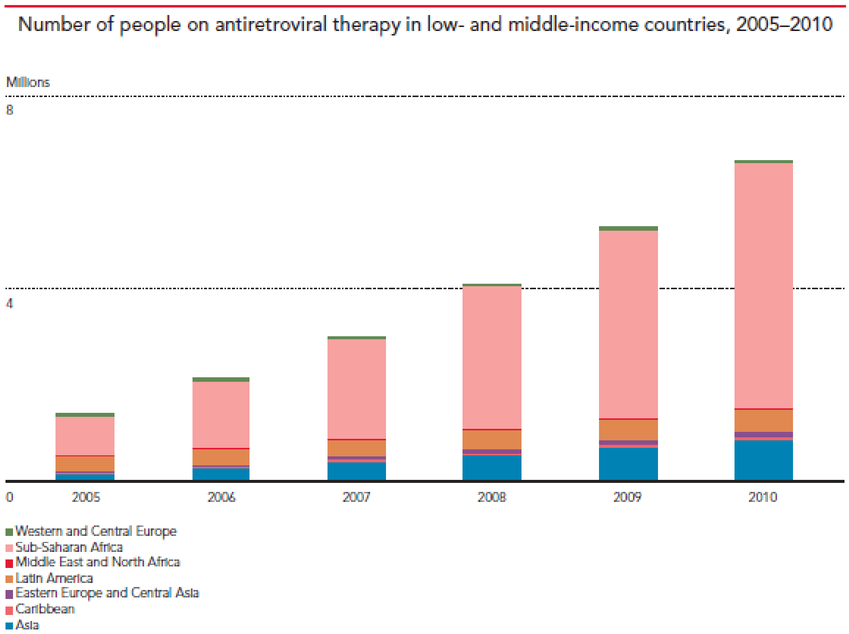
Figure 1.7: Antiretroviral therapy- a combination of antiretroviral drugs

Photograph by Thomas Mukoya/Reuters (http://www.guardian.co.uk/society/sarah-boseley-global-health/2011/may/13/hiv-infection-aids)

ART is also used to prevent mother to child transmission (MTCT) of HIV that usually occurs during pregnancy, delivery, or breast feeding. Through routine testing, pregnant women can get to know their HIV status. HIV positive pregnant mothers are given ARVs during pregnancy and delivery to prevent transmission of the virus to the baby, usually referred to as prevention of mother to child transmission (PMTCT). ARVs used for PMTCT include Nevirapine and Zidovudine (AZT). In most high income countries, infection of babies through PMTCT has been reduced to less than 1 percent (UNAIDS 2009a).

The first approved ARV drug was Zidovudine (AZT) in 1987 for adult HIV patients and later for HIV positive children in 1990. Access to ARVs was limited given the high cost of the drugs until the emergence of generics in January 1996, which, improved access to ARVs and led to marked improvement in the quality of life of HIV patients (UNAIDS 2009a). The number of people receiving ART increased 22 fold between 2001 and 2010 (UNAIDS 2011a). In 2010, 15 million people were in need of ART and 6.6 million people had access to ART in low and middle income countries including 465,000 children (UNAIDS 2011a; WHO *et al.* 2011). Access to ART has accelerated significantly in several regions including Sub-Saharan Africa (SSA) as illustrated in Figure 1.8, where, access to ART increased by 31 percent in 2010, and 21 percent in the Middle East and Northern Africa. By December 2009, seven low and middle income countries had already attained 80 percent treatment coverage of eligible individuals (UNAIDS 2011a).

Figure 1.8: Number of people on ART, 2005-2010



Source UNAIDS, 2011a

The changing of WHO guidelines on starting treatment at CD4 cell count of <350 cells per mm3 has increased ART need to about 50 percent higher than when indication was at <200 CD4 cell counts per mm^3 (UNAIDS 2011a). Nevertheless, expanded access to ART has replaced despair with hope for HIV patients that were doomed to death at the start of the HIV epidemic. HAART has saved 14.4 million life years worldwide as of December 2009 since its emergence in 1996, with 3.7 million years having been saved in SSA (UNAIDS 2011a).

Despite the dramatic increase in access to ART, there is still more to be done with 9 million of those eligible for ART in 2010 unable to receive treatment. Children living with HIV have considerably low access to ART with only 28 percent of those eligible accessing treatment at the end of 2010 (UNAIDS 2011a).

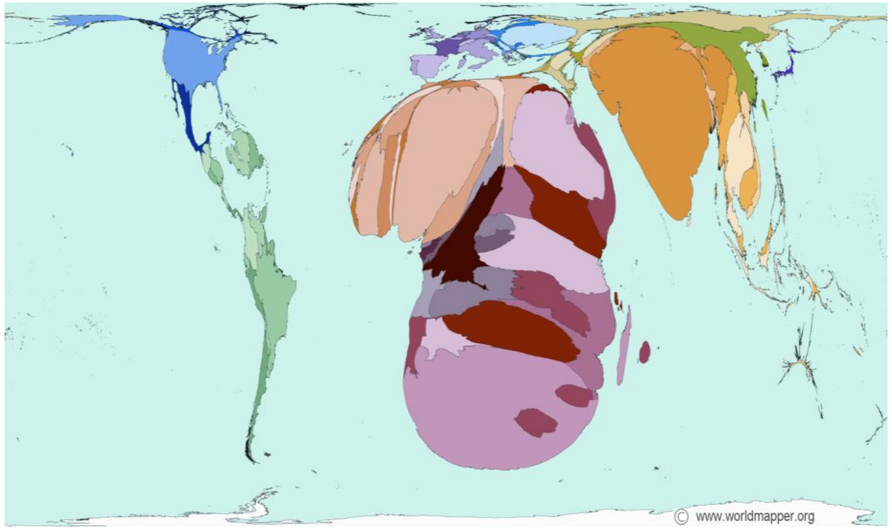
Whereas ART is a cornerstone for HIV treatment and care, health outcomes can only be optimised when ART services take into account each individual's needs. Nutritional care has been shown to be crucial for HIV patients especially after initiating ART since they have been indicated to be 2-6 times more likely to die soon after ART initiation if malnourished (UNAIDS 2011a). Additional support to PLWHA to enable them to deal with their basic needs including food and children's school fees is crucial to ensure enrolment of PLWHA in care, and prevent acute poverty and financial pressure from forcing the choice between life-saving treatment and daily substance (UNAIDS 2011a). Additional support will be explored in Chapter 5 of this thesis.

1.2. HIV burden in Sub-Saharan Africa

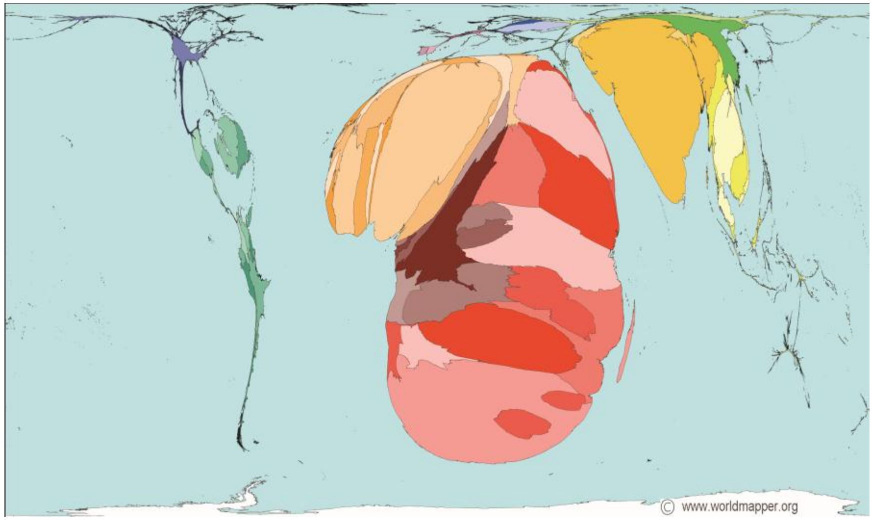
The HIV/AIDS epidemic remains one of the greatest health and development challenges facing SSA with consequences that will be felt for decades to come (Gillespie and Kadiyala 2005; Bärnighausen *et al.* 2007; Rena 2008). SSA still bears a disproportionate share of the global HIV burden with 68 percent (22.9 million) of the global total of PLWHA despite SSA comprising only 12 percent of the global population (UNAIDS 2011b). Figure 1.9 illustrates how HIV/AIDS is a great burden to SSA through SSA having the highest prevalence and deaths due to HIV despite being only a relatively small proportion of the world's population.

Figure 1.9. Maps indicating the burden of HIV in terms of deaths and prevalence compared to population in SSA

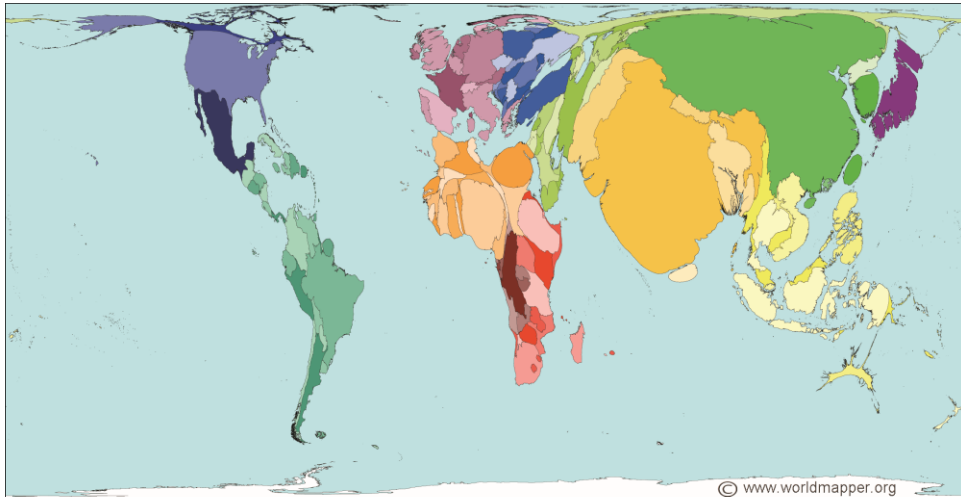
HIV Deaths



HIV Prevalence



Total population map



Source: worldmapper.org

SSA, as the region most heavily affected by HIV, accounted for 70 percent (1.9 million) of new infections in 2010, with South Africa having the greatest number of PLWHA (5.6 million) than any other country in the world.

The main mode of HIV transmission is unprotected heterosexual intercourse, followed by transmission from mother to child - to newborns and breast feeding infants. Having unprotected sex with multiple partners is reported to remain the greatest risk factor for HIV in the region (UNAIDS 2010). High risk populations that are not normally catered for in prevention strategies include discordant couples, sex workers, men who have sex with men, injecting drug users, prisoners and migrants (Lingappa *et al.* 2008; UNAIDS 2010; WHO *et al.* 2011).

The number of people becoming infected with HIV/AIDS in SSA is falling with incidence decreasing in a majority of countries in SSA[5], with the largest epidemics in Ethiopia, Nigeria, South-Africa, Zambia and Zimbabwe stabilising or showing signs of decline (UNAIDS 2010) (see Figure 1.5).

The availability of ART has led to a decline in HIV related deaths in SSA (1.2 million deaths in 2010, 29 percent fewer than 2005), and a similar decline in the total number of new infections. New HIV infections in SSA have been reported to drop by more than 26 percent to 1.9 million in 2010 compared to 2.6 million at the height of the epidemic in 1997 (UNAIDS 2010).

HIV incidence has been shown to decline partly because of behavioural change including reduction of casual partners, especially for men, and an increase in the use of condoms for non-casual partners (UNAIDS 2010). In East Africa, the epidemic began declining about a decade ago from 14 percent in the 1990s to 5 percent in 2006 for Kenya, with prevalence in Uganda stabilising between 6.5 percent and 7 percent while prevalence in Rwanda has stabilised at 3 percent since 2005 (UNAIDS 2010). Modelling by UNAIDS (2011b) suggests that without behavioural change in SSA, HIV incidence would have remained twice as high as the current rates, leading to 350,000 extra deaths annually (UNAIDS 2010).

[5] UNAIDS (2011) reports global incidence falling in 33 countries of which 22 were from SSA.

The number of people receiving ART in low-middle countries (including SSA) has been estimated as 6.65 million with an increase of 1.35 million from 2009 to 2010. Of the 6.65 million receiving ART, 5.06 million were from Africa. There was an increase in the availability of ART with 47 percent of eligible people living with HIV/AIDS on ART at the end of 2010 compared to 39 percent at the end of 2009. In general, the availability of ART in SSA increased by 20 percent from 2009 to 2010; with the proportion of the eligible population receiving ART increasing by 19 percent in Uganda and Kenya from 40 to 59 percent, and 60 to 79 percent respectively (UNAIDS 2011b). Considering males and females; 39 and 37 percent of eligible male adults in Kenya and Uganda received ART respectively, while 61 and 63 percent of eligible female adults in Kenya and Uganda accessed ART respectively (WHO *et al.* 2011). The coverage of ART for children who needed ART was only 8 and 16 percent for Kenya and Uganda respectively (WHO *et al.* 2011).

In SSA, Botswana is exceptional by having the highest ART coverage - exceeding 90 percent. As a result, HIV related deaths are reported to have declined by half, and children newly orphaned by HIV have fallen by 40 percent. Botswana's extensive provision of ART has potentially averted 50,000 adult deaths, hence Botswana is a good example of how resource allocation to HIV prevention and treatment can avert an epidemic and save lives (UNAIDS 2011b).

Despite the increase in ART availability in SSA, more can still be done given that only 49 percent of the 10.3 million people needing ART in Africa were able to receive ART (WHO *et al.* 2011). Similarly in East Africa, only 56 percent (4.22 million people) accessed ART compared to 7.6 million who needed ART. The situation is worse for children who need ART, with only 26 percent of those eligible in East Africa being able to access ART (WHO *et al.* 2011).

The majority of people receiving ART in SSA also start treatment late, limiting the overall impact of HIV treatment programmes. To further exacerbate the situation, infrastructure, systems, and staff required to properly monitor treatment follow up are becoming increasingly inadequate as programs are scaled up (UNAIDS 2010). Moreover, funding of HIV programs in most of SSA is donor funded and this raises questions of sustainability of

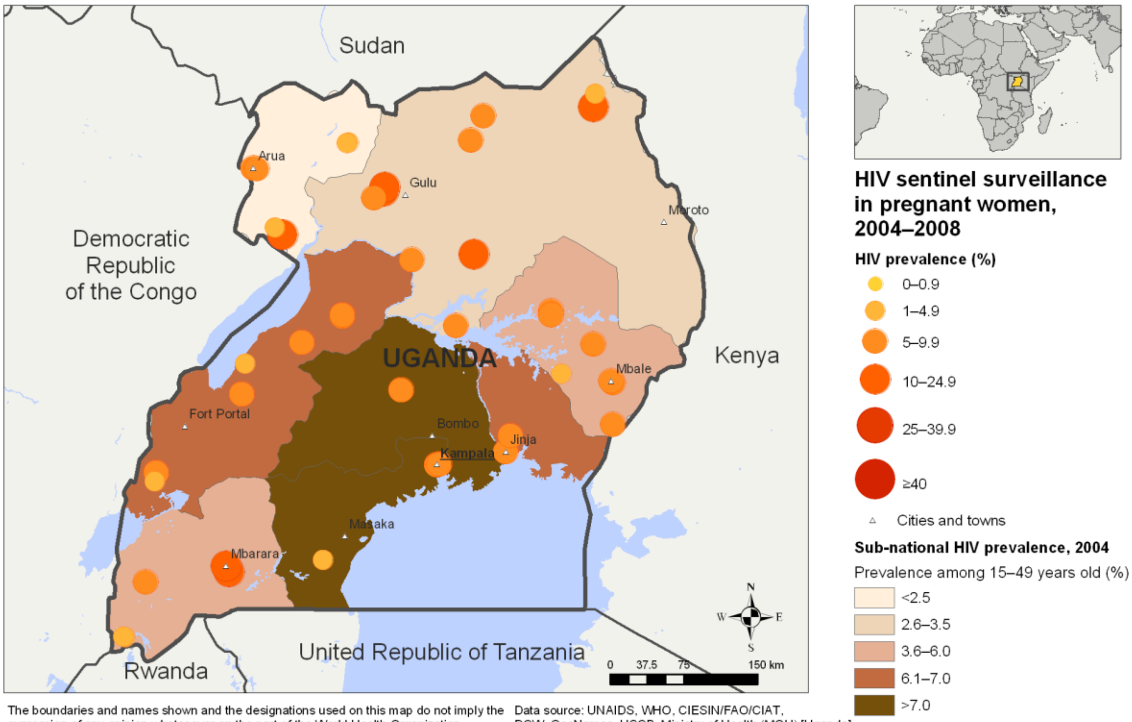
ART programs, which may threaten future gains (Daily Monitor 2011; New Vision 2011; PEPFAR 2011).

1.3. HIV in Uganda and Kenya

1.3.1. Status of the epidemic in Kenya and Uganda

Uganda and Kenya are two SSA countries that have experienced a stabilisation of HIV prevalence (see Figure 1.5) having had the epidemic for three decades (UNAIDS and WHO 2009). However, potential complacency to the disease has seen a rise in prevalence in some instances due to changing sexual behaviour especially through having multiple concurrent partnerships with most of the new infections occurring among monogamous relationships and individuals reporting multiple partners. The concentration of the epidemic has shifted from younger to older individuals with the highest prevalence for men being among the 35-39 years olds while, for the women it is among the 30-34 year olds (UNGASS Kenya Report 2007 2008; UNGASS Uganda Report 2007 2008; Kenya UNGASS Report 2010; Uganda UNGASS Report 2010). Also, for both Kenya and Uganda, the regions surrounding Lake Victoria are most at risk with sub-national HIV prevalence greater than 7 percent as shown in Figure 1.10. The most at risk region in Uganda is Central region and the Nyanza region along Lake Victoria (east and North West of Kisumu) in Kenya.

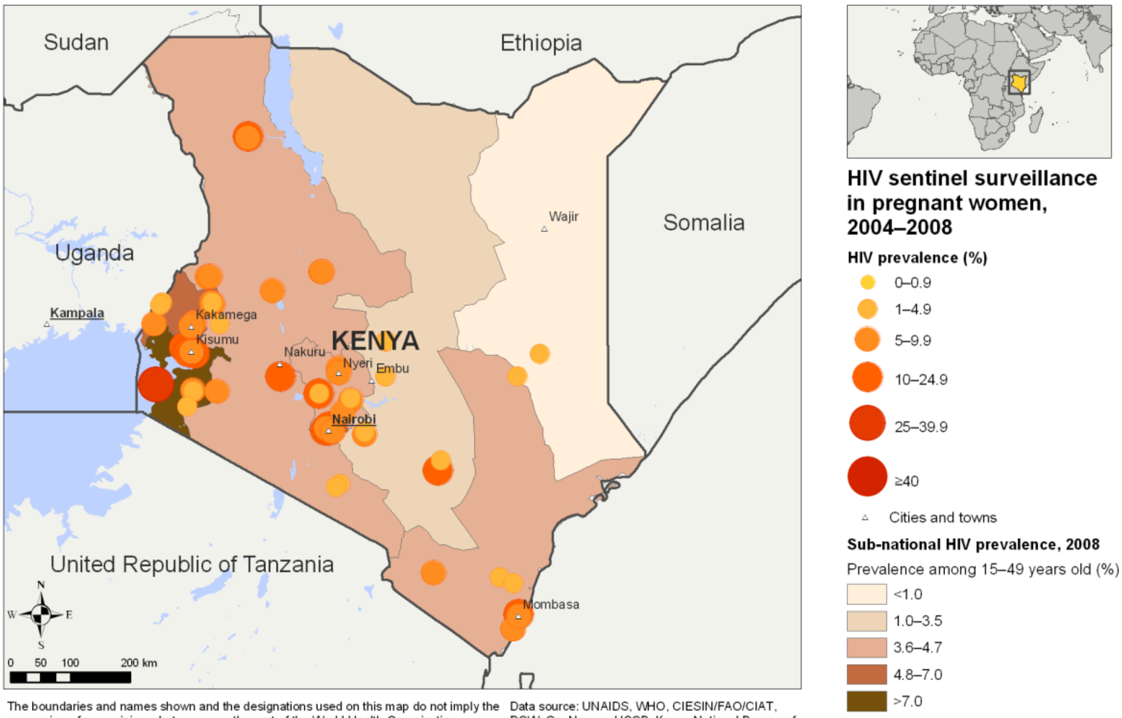
Figure 1.10: HIV prevalence in different regions of Uganda and Kenya



The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement.
Map production: Public Health Information and Geographic Information Systems (GIS), WHO.

Data source: UNAIDS, WHO, CIESIN/FAO/CIAT, DCW, GeoNames, USCB. Ministry of Health (MOH) [Uganda] and ORC Macro. 2006. Uganda HIV/AIDS Sero-behavioural Survey 2004-2005. Calverton, Maryland, USA: Ministry of Health and ORC Macro.

World Health Organization



The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement.
Map production: Public Health Information and Geographic Information Systems (GIS), WHO.

Data source: UNAIDS, WHO, CIESIN/FAO/CIAT, DCW, GeoNames, USCB. Kenya National Bureau of Statistics (KNBS) and ICF Macro. 2010. Kenya Demographic and Health Survey 2008-09. Calverton, Maryland: KNBS and ICF Macro.

World Health Organization

Source: UNAIDS, 2011a

HIV prevalence is still higher in women compared to men, with women in Kenya 20-24 years old indicated to 5.5 times more likely to be infected with HIV/AIDS than their male counterparts (Kenya UNGASS Report 2010). Prevalence has also remained higher in urban areas compared to other localities. The epidemic has been characterised with HIV/AIDS related mortality and morbidity (Kenya UNGASS Report 2010; Uganda UNGASS Report 2010). Around 1.1 million people were living with HIV in Uganda by December 2008 of which 120,000 were children 14 years and under. During 2008, an estimated 110,694 new infections occurred and 61,306 people died from AIDS in Uganda (UNGASS Uganda Report 2007 2008). In contrast, Kenya had 1.3-1.6 million people living with HIV/AIDS, 100,000 new infections in 2009 of which 44 percent were through regular unions/partnerships. The cumulative number of children affected by HIV was 184,052 by 2009, of which 22,259 were new infections in 2009. In 2007, a total of 172,000 HIV positive patients were on ART and 30,000 children affected by HIV received nutritional support. By the end of 2009, Kenya had 2.4 million orphans of which 50 percent are due to HIV/AIDS (Kenya UNGASS Report 2010).

Table 1.2 gives a summary of a comparison of HIV related statistics on Kenya and Uganda. As shown in Table 1.2, both countries depend heavily on donor funding, with ART spending in 2008 from Uganda and Kenya comprising 87 and 89 percent respectively from an international source (UNAIDS, 2011).

Table 1.2: Comparison of Uganda and Kenya HIV related Stats

Variable	Uganda	Kenya
Prevalence	6.5	6.3
Life expectancy	52.0	54.0
HDI	Low	Low
PMTCT coverage	42.0%	43.0%
ART coverage	47.0%	61.0%
PLWHA	1.2 million	1.5 million
New infections	124,300	113,700
Annual HIV deaths	64,000	79,900
GDP/K	500	790
Population	33.4 million	40.5 million
PLWHA on ART 2010	248,200	432,600
ART spending 2008	296.6 million USD	659.9 million USD
ART spending 2008 (million USD)		
Public	38.7 (13%)	73.6 (11%)
International	258.0 (87%)	586.3 (89%)
International Funding Sources 2008		
Bilateral	246.2 (83%) million USD	523.0 (79.3%)
Global Fund	2.3 (0.8%)	16.1 (2.4%)
UN Agencies	9.5 (3.2%)	9.7 (1.5%)
Other source	-	37.4 (5.7%)
Spending by program (2008)		
Prevention	64.2 (21.6%)	158.6 (24.0%)
Care and treatment	147.4 (49.7%)	379.6 (57.5%)
Orphans and vulnerable children	15.3 (5.2%)	50.9 (7.7%)
Program management and admin	65.5 (22.1%)	67.2 (10.2)
Source UNAIDS, 2011		

Both Uganda and Kenya have developed policies, guidelines and plans over the years to combat the effect and spread of HIV/AIDS. Generally, Uganda has been regarded a success story given a reduction in incidence and prevalence, especially among younger age cohorts. This rapid decline has been attributed to high level political support that was multi-sectoral in response, including involving religious leaders and faith based organisations that addressed women, youth, stigma and discrimination. Sexual behavioural change promoted partner reduction, delaying sexual debut by remaining abstinent, remaining faithful to one uninfected person (zero-grazing), and using condoms for those with multiple partners (Green *et al.* 2002). Kenya, on the other hand recognised the problem of HIV/AIDS later and the involvement of government, community groups and the church was delayed compared to Uganda. However, Kenya later developed strategies and policies to combat HIV through VCT, ART and PMCT and HIV prevalence in Kenya is reported to having started to decline, similar to Uganda. (Cheluget *et al.* 2006).

Kenya and Uganda have developed several policies to fight the HIV/AIDS epidemic since its emergence in the region about three decades ago. These initially included the ABC (abstinence, being faithful and using a condom) strategy and later, the expansion to ABC-plus that additionally included knowing one's HIV status through use of Voluntary Counselling and Testing (VCT), Prevention of Mother to Child Transmission (PMTCT), Antiretroviral Therapy (ART) and HIV care and support services (MOH and ORC Macro 2006; Irungu *et al.* 2008).

1.4. HIV prevention strategies

HIV/AIDS prevention strategies have been mainly aimed at reducing risky sexual behaviour given that the predominant mode of transmission in East Africa is through heterosexual contact. For that reason, many HIV/AIDS testing programs in Africa aim to reduce risk taking behaviour by providing individuals with information about their own HIV status through voluntary counselling and testing (VCT) services (de Paula *et al.* 2008).

VCT is the process by which an individual undergoes confidential counselling to enable the individual to make an informed choice about learning his/her HIV status and to take appropriate action (UNFPA and IPPF 2004). VCT has been shown to be an effective strategy to facilitate behaviour change for HIV prevention. It offers an entry point for early care and support for those infected with HIV and Prevention of Mother To Child Transmission (PMTCT). VCT also plays a critical role in reducing stigma and discrimination for PLWHA (UNFPA and IPPF 2004). Over the past 20 years, VCT programs have helped millions of people learn their HIV status. VCT services are important in HIV infection prevention because knowledge of an individual's own HIV status can motivate them to practice safer sexual behaviour thereafter to avoid transmitting the virus to others or getting infected (MOH and ORC Macro 2006).

However, despite the numerous benefits of VCT, the use of VCT services is low, with about 10 percent of the population reported to know their HIV status in SSA (CBS *et al.* 2004;

Matovu and Makumbi 2007). HIV testing in Kenya is reported to have more than doubled between 2003 and 2007 and yet, 83 percent of Kenyans living with HIV/AIDS in 2007 were still undiagnosed (Kenya Ministry of Health 2009; UNAIDS and WHO 2009). Uganda is listed among the countries that had the highest number of tests per 1000 population, having 146 tests per 1000 population but this is still low, considering that its only 14.6 percent (the highest was Botswana with 21%) (UNAIDS and WHO 2009).

The underutilisation of VCT services however, impedes the potential for VCT to contribute to HIV prevention in SSA. There is evidence that inadequate testing rates impede national AIDS responses leading to late entry into medical care for infected people and unknown HIV transmission especially for serodiscordant couples (UNAIDS and WHO 2009). Reasons for low utilisation include fear of discrimination due to HIV and fear of being condemned to death due to lack of medication (Pignatelli *et al.* 2006). For women, discovering positive HIV status through testing may lead to break up of marriage or sexual relationship, discrimination at birth by Traditional Birth Attendants (TBA), and domestic violence (De Cock *et al.* 2002; Porter *et al.* 2004).

VCT literature has explored many issues including: the reasons for low utilisation of VCT in SSA countries (Grinstead *et al.* 2001; Pool *et al.* 2001; De Cock *et al.* 2002; Porter *et al.* 2004; Pignatelli *et al.* 2006; Chiao *et al.* 2009); aspects of preventing heterosexual transmission through encouraging couple VCT and involvement of men in reproductive services including PMTCT (Painter 2001; Sherr and Barry 2004; Allen *et al.* 2007); factors that affect demand and supply of VCT services in SSA including measures to reduce stigma such door to door VCT and mobile VCT (Roberts *et al.* 2007; Angotti *et al.* 2009; Zheng *et al.* 2010); and, outlining supply side deficiencies and justifying supplier induced VCT through routine HIV testing as a means of improving VCT uptake (Bayer 1999; De Cock *et al.* 2003; WHO 2003b; Ole-Nguyaine *et al.* 2004; WHO and UNAIDS 2007a).

However, given low utilisation, it is important to investigate what factors determine the use of VCT especially for women, given their vulnerability for HIV. Kenya has been exceptional in the scaling up of VCT services and it is therefore imperative to investigate why utilisation of VCT is low despite the benefits, especially in high HIV prevalence areas like East Africa. Provision of VCT services is important as exemplified by Kenya but discovering the factors that lead to low utilisation of VCT, especially for women, can help inform policy in the different ways in which improvement of VCT use can be enhanced.

Since very few people know their HIV status, an alternative HIV prevention strategy would be through reduction of exposure especially through risky sexual behaviour. Several factors are believed to favour HIV transmission in many African societies, especially sub-Saharan Africa (SSA) than elsewhere in the world. These mainly include socio-economic, cultural, and demographic factors, sexual behavioural patterns, circumcision practices, especially for men, and prevalence of sexually transmitted infections (STI). Exposure to HIV risk is mostly through heterosexual sex, hence, prevention strategies focus on behavioural risk factors including the number of sexual partners, age at first marriage or sex, and use of a condom (Piot *et al.* 2001). Differentials in HIV prevalence have been shown to exist between countries, regions of the same country and, residence types like urban and rural areas (Boerma *et al.* 2002).

Women have especially been indicated to be more vulnerable given gender inequality that results from women's cultural and social roles (Gillespie *et al.* 2001; CBS *et al.* 2004; de Walque 2006b). The cultural and social role of women makes them subordinate in society and has been indicated to limit women's control over their sex lives and their negotiation of safe sex through use of condoms, making them more vulnerable to HIV risk. In addition, HIV prevention strategies have failed to address underlying inequality by promoting strategies that limit women's control for example; partner reduction and use of condoms, hence limiting women's protection against HIV risk (Heise and Elias 1995; MOH and ORC Macro 2006; Mermin *et al.* 2008). To make matters worse, women are usually less educated and are likely to adopt risky behaviour including transactional sex for survival, which increases their vulnerability to HIV (WHO 2011a). Focusing on women for HIV prevention is vital given that they have greater vulnerability than men, and given their crucial role in the effort in preventing HIV transmission to the child (de Walque 2006b; Otwombe *et al.* 2007; UNAIDS 2008a).

Numerous studies have explored risk factors for HIV and most of them have concentrated on risky sexual behaviour including the number of sexual partners, having risky sex without a condom as risk factors for HIV (Bunnell *et al.* 2008; Morris *et al.* 2009; Mah and Halperin

2010). Other studies have dwelt on the role of education in HIV prevention by exploring the robustness of the education gradient in several countries and using systematic reviews (Hargreaves and Glynn 2002; Brent 2006; Fortson 2008). However, few studies have investigated risk factors for HIV using individual HIV status except for de Walque (2006b), Johnson and Way (2006) and Fortson (2008). Nevertheless, Fortson dwells more on the education gradient and HIV risk; Johnson and Way investigates only Kenya, while de Walque 2006, compares risk for men and women in five different African countries but does not include Uganda in the analysis.

This thesis seeks to inform more about HIV prevention through investigating HIV risk factors for Kenya and Uganda to enable comparison of these countries given their similar HIV prevention policies. This is important, given the need to harmonise policies for the impending East African Federation formation, given that the two countries share the transport corridor from the coast of Mombasa to Kisumu to Busia, and to Kampala through to Katuna near the Rwandan border. This is important for HIV prevention given that HIV has been shown to follow routes of trade and transportation leading to transmission of the HIV virus to different areas of the country (Carswell *et al.* 1989). Also, Uganda and Kenya share the second largest fresh water lake in the world, Lake Victoria, and lake shores have been indicated to have the highest prevalence (see Figure 1.10) given risky sexual behaviour of migrant fishermen including paying for sex and having multiple sexual partners (Gysels *et al.* 2002). Investigating risk factors for HIV will help inform policy on how such risky behaviour can be reduced to avert the possibility of having an increment in HIV prevalence after having achieved a remarkable stabilisation of prevalence in these countries.

1.5. HIV treatment and management strategies

In addition to understanding factors that are associated with HIV prevention strategies, exploring the effect of care and treatment of people that are already affected by HIV/AIDS is very important, especially in high HIV prevalence countries like Uganda. Treatment for people living with HIV/AIDS is vital in improving the health of PLWHA particularly in reducing opportunistic infections. Fortunately, the benefits of the global commitment of making ART available has started bearing fruit with reductions in new infections and deaths due to AIDS related illness (WHO *et al.* 2011), improved quality of life for the PLWHA and renewed hope for affected families and communities (UNAIDS 2008a).

Several studies have indicated that households with a PLWHA have their resource allocation disrupted; for example, children's school attendance may be reduced to look after an ill relative or compensate for lost adult labour on the family farm; money may be diverted to buy medicine for opportunistic infection other than food for the household; and, time spent in the gardens may be reduced because of the sick in the household (Gilborn *et al.* 2001; Palamuleni *et al.* 2003; Bukusuba *et al.* 2007; Graff Zivin *et al.* 2007). A majority of households with a PLWHA depend on family farm production and illness of an adult would require replacement of lost labour to enable household consumption smoothing. Provision of ART to PLWHA has been shown to reduce opportunistic infections, hence reducing days lost due to such illness, which impacts household productivity.

However, provision of services by ART service providers has been shown to differ. The majority of ART service providers provide only ART, but recent evidence indicates that the needs of PLWHA go beyond accessing ART alone (TASO Uganda 2008; Ilebani and Fabusoro 2011; UNAIDS 2011a). PLWHA have been shown to experience several other challenges that relate to household resource allocation including lack of school fees for their children's education, limited food supply given reduced household labour input, challenges with caring for the sick at home, and transport costs and time that affects collection of drugs from distant clinics (TASO Uganda 2011b). Some ART service providers have developed programs that aim at remedying some of these concerns by providing additional support in the form of home based care, health out reaches, provision of scholastic materials, provision of income generating assets, in addition to providing ART in order to maximise the benefits from ART provision.

Despite the effect of ART on household resource allocation, there is a paucity of information on the impact of such treatment on resource allocation for households with a PLWHA. The exception is Graff Ziffin et al., (2009) who indicated treatment of HIV infected adults improved children's school attendance and education; and D'Adda et al., (2009) who find treatment to increase productivity of patients and reduce time spent seeking medical care. In addition, past research has only investigated the association between ART and household resource allocation but has not disentangled the effect of the nature of treatment received by the PLWHA on household resource allocation. Given that PLWHA have indicated resource constraints which may affect household resource allocation, this thesis additionally investigates how the nature of treatment may affect household resource allocation. This thesis seeks to contribute to this scarce literature by investigating how the nature of HIV treatment in terms of ART (ART or prophylactic co-trimoxazole (septrin)) and in terms of the antiretroviral treatment package (ARTP) (ART-plus or ART-only) received by the PLWHA is associated with household resource allocation. Comparisons with households with no known PLWHA (non-PLWHA) are also undertaken.

For this thesis, the combination of the nature of treatment and additional support (or its absence) offered by ART service providers is referred to as “antiretroviral treatment packages” (ARTP), namely ART-plus, where clients receive support in addition to ART and ART-only where only ART is obtained for MOH clients. Among the surveyed PLWHA there are four groups, two from TASO: one receiving ART and additional support (TASOART), one on the waiting list (WL), receiving septrin and additional support (TASOWL); and two from the MOH, one receiving ART (MOHART), one on the WL receiving septrin (MOHWL). This gives four groups of PLWHA: TASOART, TASOWL, MOHART and MOHWL. A detailed description is in Chapter 4.

Policy makers aim at maximising benefits from HIV treatment but challenges for PLWHA may impact adherence negatively and hence affect potential benefits from treatment for PLWHA. This may potentially delay national targets relating to HIV care and treatment. Given that the majority of national and global resources in this area have been invested in HIV care and treatment, it is important from a policy perspective to have information on how and whether the nature of treatment received by a PLWHA affects households’ resource allocation for adults and children within the household.

Clients (and members of their household) from service providers that provide ART-only and ART-plus were interviewed via a new survey to investigate differences in resource allocation outcomes, with households with a client on ART-plus (referred to as ART-plus households) expected to be better off. Furthermore, the thesis explores whether outcomes differ for individuals from households with PLWHA and households with non-PLWHA. Resource allocation is explored in terms of labour supply for family farm work and domestic work for children. Also, in light of resource constraints as mentioned by PLWHA, the thesis investigates how the nature of treatment affects children’s schooling outcomes (in terms of school enrolment, participation, attendance hours and progression) given formal assistance to the PLWHA household. This would have policy implications in regard to resource allocation to health programs and importantly for HIV care and treatment programs. This has the potential to inform budgetary policies especially in a resource poor country like Uganda where budgetary allocations to health is 10 percent despite being one of the African Union signatories that agreed to allocate a minimum of 15 percent of the national budget to health (Kevin 2010).

In general, there is evidence of how resource allocation is affected differently by gender (FAO 2011; Seebens 2011). For that reason, applying a blanket policy to the household may not be effective if such gender differences exist. Investigating the factors that affect labour allocation by gender would inform policy in regard to aspects that can enhance female and male labour participation, and probably improve productivity for AIDS affected households. It is unclear how the nature of treatment will affect labour supply for men and women, and whether the association between the nature of treatment and labour supply will be the same for males and females. Information on factors that affect women's and men's labour supply will be helpful in informing policies to improve household productivity.

In many African countries including Uganda, women are usually more constrained than men in accessing resources, which impacts their labour supply (FAO 2011). Such inequalities influence bargaining power for couples and may influence labour supply in households. For households with a PLWHA, it will be informative to investigate the effect of bargaining power for couples (as measured by share of education, age differences and wage differences) conditional on treatment and how this affects labour supply especially for females that are usually constrained and subordinate due to the cultural roles in patriarchal communities like Central Uganda. The results may inform policy in terms of improving empowerment for disadvantaged women which may reduce the gender gap to improve labour supply for women. This will be beneficial not only to the women themselves but has potential to improve children's health, nutrition and education which is an importantly investment in the nation's future.

1.6. Objectives of the thesis and research questions

The general aim of this thesis is to investigate factors relating to the reduction of HIV risk for women in Kenya and Uganda; and additionally explore how provision of social support in addition to ART to Person Living With HIV/AIDS (PLWHA) in such households affects resource allocation within such households compared to households with a PLWHA on ART but not receiving any social support. In households where meeting basic needs is a challenge, realising benefits from ART can be a challenge, hence the importance of ART service providers integrating social support into their programs particularly in resource constrained countries like Uganda.

The first two chapters of this thesis examine aspects relating to HIV prevention for women. Given the issues raised above, it is important to understand factors associated with VCT use, and factors associated with HIV risk for women.

Questions of interest relating to VCT include: Why are few people tested for HIV? What factors are associated with higher likelihood of testing for HIV/AIDS especially for women, given that they are more vulnerable than men? The factors associated with use of Voluntary Counselling and Testing (VCT) for women in Kenya are explored to answer the questions above. Given low utilisation of VCT, this aims at informing HIV prevention policies about the important aspects that can be focused on to improve utilisation of VCT services and maximise HIV prevention strategies.

Also, given differentials in association of HIV risk and socio-economic and demographic factors, it would be informative for HIV prevention policies to explore the following questions: What factors are associated with HIV risk for women in Kenya and Uganda? Are the associations to HIV risk similar or different for women in Kenya and Uganda? Given the pending formation of the East African Federation, what are the implications for harmonising HIV prevention policies in Kenya and Uganda? Empirical evidence of risk factors for HIV infection is investigated for women in Kenya and Uganda. This seeks to explore factors that are associated with high risk for HIV and inform policy in regard to targeting vulnerable groups for HIV prevention. Comparing Kenya and Uganda gives important information in regard to the similarities and differences relating to HIV risk can be helpful in policy formulation in view of the pending formation of the East African Federation, and given risk of

HIV transmission through the shared Mombasa-Kisumu-Busia-Katuna transport corridor and risky Lake Victoria fishing sites. This will give insight into which HIV prevention policies may be harmonised for both countries.

Chapters 2 and 3 of this thesis aim at informing HIV prevention policies especially for women given that they have been indicated to be more vulnerable than men in SSA. Chapter 2 uses data from the 2003 Kenya Demographic and Health Survey to explore factors that determine VCT use for women in Kenya; while Chapter 3 seeks to explore risk factors for HIV infection, which can be helpful in informing HIV prevention policies especially for women in Kenya and Uganda. This also has the potential to help forge direction for the harmonising of HIV prevention policies for the East African Federation. Chapter 3 uses the 2003 Kenya Demographic and Health Survey and 2004 Uganda AIDS Indicator Survey datasets.

To further understand aspects relating to HIV, the thesis examines how care and treatment for PLWHA influences allocation of resources within the household. Research on the association between ART and resource allocation is limited and given constraints to PLWHA that can affect ART adherence and hence affect benefits from ART, it is important to investigate whether the nature of HIV treatment will make a difference to resource allocation within the household. The thesis provides empirical evidence of the effect of ART compared to septrin; ART-plus compared to ART-only and PLWHA compared to non-PLWHA using the 2010/2011 Centre for Health Economics Uganda HIV Survey (CUHS). The CUHS covered PLWHA from two ART service providers; one that provides ART-only (Health Centres from the Ministry of Health) and another that provides additional support in addition to ART, referred to as ART-plus (The AIDS Support Organisation (TASO)).

Resource allocation in households with a PLWHA has been shown to be disrupted by AIDS related illness (Gilborn *et al.* 2001; Bennell 2005; de Janvry *et al.* 2006). As a result, households adjust their resources, especially labour for farm production so that consumption is not affected. To further explore the effect of HIV on resource allocation within a household, the thesis explores how children's labour allocation in PLWHA households is affected compared to children from non-PLWHA households. Children in PLWHA households have been indicated to compensate for adult labour deficits when an adult is ill and this may impact on their time allocation, especially schooling. Researching children's labour supply in

PLWHA households has important policy implications in reducing vulnerability of children in AIDS affected households. Furthermore, given resource constraints by many households affected by HIV and the overburdened community safety net, the thesis seeks to explore the influence of formal assistance on schooling outcomes for children residing in households with a PLWHA. Most studies investigate enrolment rates for children in AIDS affected households, but few have explored how school progression for children is affected.

Furthermore, empirical evidence regarding the effect of formal assistance on schooling outcomes for AIDS affected households is not currently available. The thesis aims to fill this knowledge gap by investigating how formal assistance may influence schooling outcomes including school progression and whether the nature of ART received by the PLWHA affects schooling outcomes differently. Such information will be helpful in informing educational investment policies especially for households with a PLWHA and may have implication for ART initiation, if ART seems superior to WL (PLWHA on septrin).

Finally, the thesis seeks to explore the gender dimensions of labour supply for households with PLWHA and non-PLWHA households. Traditional models of household behaviour have been shown to assume that family members act as if they maximise a single utility function, hence are treated as having unified preferences under the unitary model (Becker 1991). However, households have been shown to be non-homogenous with individual preferences of family members affecting resource allocation, thus challenging the unitary or common preference model. The allocation mechanism in individual utility models can generally be subdivided into categories: non-cooperative bargaining (Sutton 1986; Lundberg and Pollak 1994), cooperative bargaining (McElroy and Horney 1981; Lundberg and Pollak 1993) and a generic "collective" approach that assumes family resource allocation follows a Pareto efficient sharing rule that certifies certain regularity conditions (Chiappori 1988; Chiappori 1997; Lundberg *et al.* 1997). Female and male wage labour supply are analysed separately, assuming a non-unitary model of resource allocation.

Also, factors that favour supply of labour for men and women will be explored separately. This is important for policy makers especially in promoting women's labour supply in a gender biased society like central Uganda. In addition to understanding factors that favour male and female labour supply, the thesis aims to explore power dynamics for couples in

PLWHA and non-PLWHA households following the collective model of resource allocation (Chiappori 1988). Empirical analysis will test for the unitary assumptions in regard to labour supply for PLWHA (in terms of antiretroviral treatment packages (ARTP), HIV clients from TASO (TASOPLWHA) and HIV clients from MOH (MOHPLWHA) and households without known PLWHA (non-PLWHA). Rejection of the unitary model (Becker 1965) would inform policy makers in regard to formulating policies that target individual decision makers in households, rather than applying blanket policies to the household as a whole. Various economic measures will be used as proxies for bargaining power including the male-female age difference, male-female wage difference and male share of education. If women have less bargaining power, policy makers can influence policy formulation by targeting women to close the gender gap and empower women in the face of the HIV/AIDS epidemic challenge.

1.7. Structure of the thesis

Chapter 2 explores the determinants of using voluntary counselling and testing (VCT) services for women in Kenya. The chapter has a brief introduction regarding voluntary counselling and testing services in SSA and reviews the literature relating to use of VCT. The 2003 Kenya Demographic and Health Survey (KDHS) is used for the analysis and associations to VCT are explored using multivariate probit models.

Chapter 3 investigates risk factors for HIV infection for women in Kenya and Uganda. It starts with a brief introduction and reviews past literature regarding risk factors for HIV especially for women in SSA. It especially investigates socio-economic factors as risk factors for HIV/AIDS. The 2003 KDHS and the 2004 Uganda AIDS Indicator Survey (AIS) are the datasets used and their sampling strategy and methodology is summarised. Model estimation using Probits for both univariate analysis and multivariate analysis is undertaken for both countries.

Chapter 4 outlines the 2010/2011 Centre for Health Economics Uganda HIV Survey (CUHS) undertaken for this study. This was a case study survey of households with a person living with HIV/AIDS (PLWHA) in Uganda. The survey explored how within household resource allocation can be affected by the nature of antiretroviral treatment package (ARTP) received by a PLWHA in that particular household. The chapter starts with an introduction to the survey, a primary data collection undertaken specifically for this PhD, undertaken principally by the candidate. It then gives detailed information about the methodology of the survey, the survey sampling method, the sample sizes and nature of populations that were interviewed for the survey.

Chapter 5 presents empirical evidence on the relationship between different household and individual outcomes for those receiving ART-plus or ART-only using a sub-sample from the 2010/2011 CUHS. The individual and household outcomes explored include direct physical health outcomes (occurrence of acute or chronic disease) and indirect physical health outcomes (through better productivity as measured by the number of individual non-wage labour hours per week, likelihood to have savings and the amount of cash at hand). The analysis uses probit models for the indicator binary variables (acute or chronic disease, savings), and ordinary least squares (OLS) models for cash at hand and number of non-wage labour hours per week. Physical health outcomes from ART-plus households are hypothesised to be superior to outcomes from ART only.

Chapter 6 examines the effect of being in a household with a PLWHA on resource allocation for children. The chapter investigates how children's labour allocation and hours for domestic and farm work differ if a child is from a PLWHA household compared to a child from a non-PLWHA household. A two part model is used to explore labour participation (probit) and level of labour hours (OLS) for both domestic work and farm work separately. The Heckman selection model is used to test for the independence of the Probit and OLS regression equations of the two part model. This chapter aims to investigate whether children from PLWHA households are more vulnerable to child work.

Chapter 7 extends the analysis of chapter 6 by exploring the effect of formal assistance (FA) on schooling outcomes for children in PLWHA households. The chapter gives a brief background on the importance of education, and how education of children in households with PLWHA may be constrained. It further provides evidence of how the community safety net is constrained and how formal assistance may be the way forward to improve benefits from educational investment for children in PLWHA households. The focus is how three types of FA (Home Based Care (HBC), Health Out Reach (HOR) and Education Related Assistance (ERA)) provided to PLWHA can influence schooling outcomes for children in terms of quantity (enrolment rate, school participation and schooling hours per week) and quality (school progression). The influence of the nature of the antiretroviral treatment package (ARTP) on schooling outcomes is also explored. The chapter helps answer questions on how ARTP and formal assistance affects schooling outcomes for children in PLWHA households.

Chapter 8 turns to adult resource allocation, particularly labour supply of activities that earned some form of income. The chapter initially explores a general model that considers individual labour supply irrespective of gender using OLS and 2SLS. Additionally, the chapter focuses on the gender dimensions of labour supply for PLWHA (in terms of ARTP, TASOPLWHA and MOHPLWHA) and non-PLWHA households[6]. This is motivated by the fact that past studies have indicated males and females to participate differently in the labour market with women having lower participation.

Furthermore, given that labour allocation decisions may not occur at the individual level, the chapter investigates household labour allocation decisions using the collective model. The collective model illustrates how bargaining power between couples influences labour supply controlling for PLWHA categories (in terms of ARTP, TASOPLWHA and MOHPLWHA) and non-PLWHA. The assumption of the unitary model of household decision making is also tested. The chapter also seeks to explore the effect of the nature of treatment, including ARTP on adult labour supply. Robustness checks include controlling for the severity of HIV using the CD4 cell count and WHO clinical stage. Controlling for HIV severity excludes the non-PLWHA households. Chapter eight seeks to answer questions relating to adult labour resource allocation and how this differs with ARTP, with individuals, with gender and with bargaining power among couples.

In conclusion, Chapter 9 summarises the main findings of the thesis and discuses some policy implications, given the findings. It also highlights the lessons learnt from the CUHS fieldwork in Uganda. The chapter further indicates the limitations of the research and highlights areas for future research.

[6] ARTP-Antiretroviral treatment package, TASOPLWHA-HIV clients from TASO and MOHPLWHA-HIV clients from MOH; and non-PLWHA- households without known PLWHA.

Chapter 2 - Determinants of use of Voluntary Counselling and Testing for HIV/AIDS in Kenya[7]

"It may be better not to know your status and you live longer"

(Nuwaha *et al.* 2002).

2.1. Introduction

Voluntary Counselling and Testing (VCT) was developed in the mid-1980s as the standard of care for individuals seeking to know their HIV status (WHO 2002b). VCT is the process by which an individual or couples undergo confidential pre-test counselling to enable the individual or couple to make an informed choice about learning his or her or their HIV status and to take appropriate action. VCT also enables referral for medical and support services by trained counsellors (Boswell and Baggaley 2002; WHO 2002b; UNFPA and IPPF 2004; de Paula *et al.* 2008; Irungu *et al.* 2008).

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VCT is the cornerstone for early access to prevention of HIV infection and care and support for those infected with HIV. It is also the main entry point for interventions to prevent HIV infections in infants and young children. Through testing, HIV infected women are able to make informed decisions regarding their reproductive lives, obtain access to antiretroviral drugs (ARVs), infant-feeding counselling and support which can reduce the risk of Mother To Child Transmission (MTCT) especially when pregnant (Basset 2002; WHO 2002b; UNFPA and IPPF 2004). VCT provides psychosocial benefits that enable those infected to cope better and live positive lives, and prevents HIV transmission by providing information, education, guidance and continued support (Coovadia 2000). VCT also plays a critical role in reducing denial, stigma and discrimination for Persons Living With HIV/AIDS (PLWHA) (UNAIDS 2000; WHO 2002b; UNFPA and IPPF 2004).

Over the past 20 years, VCT programs have helped millions of people learn their HIV status. VCT services are important in HIV infection prevention because knowledge of an individual's own HIV status can motivate him or her to practice safer sexual behaviour thereafter to avoid transmitting the virus to others. VCT has also been shown to lower the incidence of sexually transmitted infections (STIs) (Irungu *et al.* 2008) and has been proven to be an effective strategy to facilitate behaviour change for HIV prevention (The Voluntary HIV-1 Counseling and Testing Efficacy Study Group 2000; Chu *et al.* 2005; MOH and ORC Macro 2006; Oster 2007; Denison *et al.* 2008; de Paula *et al.* 2011). The value of testing is that it not only identifies HIV positive individuals but also informs HIV negative individuals of their status so that they can take greater precautionary measures to prevent HIV infection (de Paula *et al.* 2008).

Kenya has seen a phenomenal expansion of VCT sites from only three in the year 2000 to 630 in 2005 and over 865 sites in 2007 (WHO 2005b; Kimani *et al.* 2007; National AIDS and STI Control Programme 2008). This expansion has been through government initiatives as a means of increasing the number of people that test for HIV. Despite the rapid scale up, the use of VCT services is still low with about 15 percent of women and 14 percent of men having used the services in 2003 (CBS *et al.* 2004), which improved to 56.5 percent for women and 39.9 percent for men as reported by the 2008-2009 Kenya Demographic and Health Survey (KDHS) (KNBS and ICF Macro 2010). More than 80 percent of PLWHA in low and middle income countries do not know that they are infected (UNAIDS 2000). The KDHS of 2009 revealed that 41.6 percent of women and 58.2 percent of men had never tested for HIV. Incredibly, around 92 percent of the respondents in the KDHS of 2009 knew where to find a VCT facility.

It is intriguing to explore what could be the causes of an individual's reluctance to use VCT services, despite the immense potential benefits. This chapter analyses the factors that determine the utilisation of VCT services for females in Kenya using data from the 2003 KDHS. The focus on women is vital given their increasing vulnerability to infection through higher infection rates and their crucial role in the effort of Prevention of Mother to Child Transmission (PMTCT) (de Walque 2006b; Otwombe *et al.* 2007; UNAIDS 2008a).

2.2. Literature Review

2.2.1. Introduction

There has been a great deal of research on the utilisation of VCT, especially in Sub-Saharan Africa (SSA). The literature ranges across investigation of acceptability and utilisation of VCT, means of increasing utilisation, exploring associations between gender and HIV through VCT, ensuring equitable use of VCT, and investigating factors that can improve utilisation and delivery of VCT (De Cock *et al.* 2002; de Walque 2006a; Pignatelli *et al.* 2006; Hageman *et al.* 2010). Much of the recent literature looks at engendering VCT including couple counselling and inclusion of men in family planning to reduce vulnerability of women while other recent research advocates for universal knowledge of HIV status and routine HIV testing in health care facilities. This literature review will seek to explore aspects that have been associated with utilisation of VCT especially in Africa. Before focusing on factors associated with VCT, a brief review of the role of VCT is outlined.

VCT has been incorporated as part of the primary health care package in many African countries including Kenya (Coovadia 2000; Boswell and Baggaley 2002; Pronyk *et al.* 2002; Day *et al.* 2003). VCT programs aim to reduce risk taking behaviour by providing individuals with information about their own HIV status (Coates 2000; Day *et al.* 2003; Marum *et al.* 2006; de Paula *et al.* 2008). HIV/AIDS is a major public health concern in Kenya, hence Kenya developed a four pronged approach emphasising Abstinence, Being faithful and

Condom use (ABC) and knowledge of one's HIV status through VCT to fight HIV/AIDS (Irungu *et al.* 2008).

The predominant mode of HIV transmission is through heterosexual contact (horizontal), followed in magnitude by perinatal (vertical) transmission, in which the mother passes the virus to the child during pregnancy, delivery or breastfeeding (MOH and ORC Macro 2006).

Through VCT vertical transmission can be prevented by offering PMTC services - targeting women with specific interventions and information. Women who are HIV negative can be advised as to how to stay HIV negative, HIV positive women can be advised on how to access treatment, reduce pregnancy risk and on the importance of not affecting others including their unborn children. VCT provides counselling support, preventive therapy against opportunistic infections and antiretroviral therapy (ART) (Pool *et al.* 2001; Day *et al.* 2003; Hutchinson and Mahlalela 2006).

2.2.2. VCT- Reasons for low utilisation in SSA

Despite the potential benefits, utilisation of VCT has been very low. Given this, numerous studies have explored reasons for this. Women have shown a high willingness to participate in VCT, but a low number may return for the results (Yeatman 2007; Enquselassie and Girma 2009; Sherr *et al.* 2007). Women have indicated reasons that deter them from using VCT include fear relating to confidentiality, discrimination at birth, especially by Traditional Birth Attendants (TBA), domestic violence, break-up of marriage and break-up of a sexual relationship once their husbands or partners know their status (Grinstead *et al.* 2001; Pool *et al.* 2001; De Cock *et al.* 2002; Porter *et al.* 2004). Research in Burkina Faso revealed that low uptake was possibly due to women requiring male consent to accept a VCT proposal, social stigma[8] and fear of not having access to treatment (Pignatelli *et al.* 2006).

Furthermore, being ostracised by family and friends through estrangement and being disowned, and discrimination by health personnel and employers (social rejection) are other

[8] AIDS related stigma is the process of devaluation of people with or associated with HIV/AIDS Sharma, (2003) as cited in Furber, Hodgson, Desclaux, & Mukasa, (2004) Sharma, D. C. (2003). "India unprepared for antiretroviral treatment plan." The Lancet **362**(9400): 1988, Furber, A. S., Hodgson, I. J., Desclaux, A. and Mukasa, D. S. (2004). "Barriers to better care for people with AIDS in developing countries." BMJ **329**(7477): 1281-1283.

negative events that have been indicated to arise after using VCT (Grinstead *et al.* 2001; Manirankunda 2009). Such negative events have been argued to be worse for more vulnerable groups like HIV sero-positive[9] female partners as part of a serodiscordant couple, hence emphasising the need for stronger post-test support for coping and HIV risk management to reduce their social vulnerability (Grinstead *et al.* 2001; Painter 2001). HIV has been shown to increase the powerlessness of women and make worse their control over their sexuality and fertility, compromising their capacity to access health services and benefit from them (Heise and Elias 1995; Coovadia 2000). Women infected with HIV have been reported to be more likely to have had a physically violent partner in their lifetime and to have experienced physical violence, sexual violence, or both with their current partner, exacerbating their vulnerability (Maman *et al.* 2002). Women's limitations may be exacerbated by the fact that men usually have the final say on number of children, the decision to use a condom, and men are usually the sole bread winners and hence control finances for treatment and household expenditure (Pool *et al.* 2001).

Shared confidentiality has been highlighted as one of the remedies to stigma (Makoae and Jubber 2008) and women's vulnerability following VCT. However, gender inequality and dominance of patriarchal structures has been shown as making shared confidentiality complex. Disclosure to a partner or husband may consequently lead to domestic violence and separation due to the partner's assumption of the wife having been unfaithful (Pool *et al.* 2001; Irungu *et al.* 2008; Chiao *et al.* 2009). Encouraging joint voluntary counselling has been proposed as an important option particularly for discordant couples (de Walque 2006a). A study by Kowalczyk et al., (2002) affirmed that women preferred couple counselling because this would make it easier to accept positive results. Couples in a long term relationship or intending to marry but unaware of their differing HIV status can be a source of further adult and paediatric infections, and HIV negative partners in such discordant relationships have been proven to be the largest and most vulnerable group in Africa (De Cock *et al.* 2002).

2.2.3. VCT-Heterosexual couples (prevention of horizontal transmission)

Cohabiting and married heterosexual couples in Africa have been revealed as the world's largest HIV risk group (Painter 2001; MOH and ORC Macro 2006; Allen *et al.* 2007). This

[9]Seropositive means antibody positive, it is the same as being HIV positive

has led to the innovation of involvement of male partners so that VCT intervention is acceptable through Couples' Voluntary Counselling and Testing (CVCT), which is recommended to be broadly implemented as a point of entry for prevention, care and support (Painter 2001; Allen *et al.* 2007). Couple counselling has been recommended since it has been shown to effectively help couples make informed decisions about sexual relationships, marriage, family planning or pregnancy and promote behaviour change (Strachan *et al.* 2004). VCT has been indicated to be effective when partners are tested together but this is rare in Africa (Pignatelli *et al.* 2006). Involvement of men in HIV reproductive related services like Prevention of Mother to Child Transmission (PMTCT) has been ignored and yet this is important for HIV prevention (Sherr and Barry 2004). Addressing couples has been proven to remove the pressure on one spouse carrying the message to the other (Allen *et al.* 2007).

Promotional strategies including door to door outreach by community workers or leaders and weekend VCT services in antenatal clinics have been reported to increase the number of individuals and couples tested (Were *et al.* 2003; Allen *et al.* 2007; Yamauchi and Ueyama 2008; Hageman *et al.* 2010). VCT invitations delivered to couples have been associated with the greatest likelihood of couple VCT, and those given to men have been indicated to more likely result in testing than those given to women alone (Allen *et al.* 2007).

Fear of stigma among couples has been reported to be common but public endorsement of VCT by Government, community leaders, service providers and prominent activists has been indicated to overcome fear and discrimination (Green *et al.* 2006). Openness and public endorsement of HIV prevention interventions has been proven as an effective strategy in addressing psychological barriers to accessing clinical services. Systematic efforts to address the social, political and cultural obstacles to VCT have been recommended for enforcement so that the desired outcomes of public health are realised (Allen *et al.* 2007).

2.2.4. VCT-Demand factors

Several factors have been demonstrated to affect demand for VCT. Demand for VCT has been reported to be low because of the belief that monogamy is 'safe', fear of stigma, gender inequality due to culture and lack of knowledge of availability of VCT (Heise and Elias 1995; Mill and Anarfi 2002; Taegtmeyer *et al.* 2006; Weiser *et al.* 2006; Allen *et al.* 2007; Mseeni and Kayombo 2009).

Unlike other health services, VCT is linked with HIV infection which is in itself a stigmatised state. Stigma affects the dignity of those infected by portraying them as persons with loose morals (Skinner and Mfecane 2005), hence confidentiality and anonymity in VCT is an issue unlike some other testing services (Yoder and Matinga 2004; Njeru *et al.* 2009; Wouters *et al.* 2009).

Lack of time and money has been cited as another obstacle to VCT. HIV testing has been shown to be hampered by unaffordable indirect costs, such as long distances to travel to VCT, which may partly explain low uptakes even in high prevalence areas (Fylkesnes and Siziya 2004; Njeru *et al.* 2009).

Home based testing and mobile units that decentralize VCT have been proven as an effective means of bringing services closer to the clients (including hard to reach high risk populations such as factory migrant workers (Corbett *et al.* 2006; Buregyeya *et al.* 2008). Door to door testing, mobile VCT and home based testing have been reported as convenient (services brought closer to the people), confidential (employ VCT counsellors from outside the test area) and credible in cases where rapid testing have been used, minimising stress and loss to follow up hence leading to extremely high testing rates (Roberts *et al.* 2007; Angotti *et al.* 2009; Zheng *et al.* 2010). Such options are expensive, which is an issue given resource constraints in most SSA health care systems (Wolff *et al.* 2005; Yoder *et al.* 2006; Wringe *et al.* 2008). Nonetheless, VCT uptake has been indicated to increase with age, possibly due to perceived higher cumulative risk of infection with age and the fact that older women are more likely to take autonomous decisions. Uptake has also been positively associated with the number of pregnancies, number of dead children and number of miscarriages (Pignatelli *et al.* 2006).

Likewise, VCT services are positively associated with education, socioeconomic status, proximity to clinics, availability of rapid testing, outreach services like door to door HIV testing, perceived declining general health, perceived risk of HIV and low levels of HIV/AIDS stigma (Fylkesnes and Siziya 2004; Hutchinson and Mahlalela 2006; Allen *et al.* 2007; Angotti *et al.* 2009).

2.2.5. VCT-Supply side deficiencies

On the supply side, public hospital VCT services are free given the abolition of user charges (GOU MOH 2010). However, VCT has been revealed to be deficient in terms of medical services not being available, poor health infrastructure, absent support, restricted availability, few trained counsellors and hence heavy workloads yet with workers usually poorly remunerated (Obermeyer and Osborn 2007). Other criticisms of VCT include poor policies, limited resources, unreasonable demand on councillors, difficulty of access to services, inappropriate atmosphere in the clinic, lack of privacy and confidentiality, and no follow-up support. Constraints of training and resources have been reported to limit providers' ability to offer quality services (Obermeyer and Osborn 2007), hence poor responsiveness of VCT to patient demand (Njeru *et al.* 2009).

Furthermore, logistical issues such as long laboratory turn-around times and counsellors' absence have been indicated to affect women's ability to obtain results after testing. Nevertheless, the shortage of health care professionals in Africa has been addressed in part by the training of community and lay workers to provide testing and counselling, treatment support, and other services (Furber *et al.* 2004; De Cock *et al.* 2006).

Increasing the participation of the private sector has been suggested to help address bottlenecks relating to public VCT services. The private sector is largely independent of government and donor financial support, offers more flexible hours of operation and has had a reputation for better service quality and superior confidentiality to the public sector. However, the recent global attention given to AIDS, reflected by large amounts of donor money given to the public sector and NGOs could possibly have crowding out effects on the private sector in providing HIV services like VCT. Nonetheless, recent studies have portrayed the private sector to be actively involved in HIV service delivery and playing a greater role in STI care than the public sector in some countries. For example, Uganda is reported to have a high level of private sector STI care and also a comparatively high level of private sector testing; and, Guyana and Haiti has been shown to have high utilisation of the private sector for both HIV testing and STI care (Wang *et al.* 2011). Given the evidence that STI symptoms are positively associated with HIV risk, use of STI care can also be viewed as an entry point for HIV prevention such as VCT (Wang *et al.* 2011). Use of private sector services would however require out of pocket payment. This would make such services inaccessible to the low socioeconomic groups of the population given that they may not afford to pay for such services. Wang et al., (2010) revealed that use of private health sector for HIV testing and STI care increased with wealth.

VCT uptake has also been shown to be particularly low when offered from centres located in general health clinics. Seeking an HIV test at a health facility involves anticipation, travel, and waiting at the clinic which may increase anxiety (Hutchinson *et al.* 2004; Young 2007; Angotti *et al.* 2009). Additionally, limited trust is indicated as part of the cause of poor acceptability especially in small knit rural communities where the local counsellors may be familiar with the VCT clients (Shin *et al.* 2007; Angotti *et al.* 2009).

Fear of someone known among the clinic staff because they may breach confidentiality is one of the deterrents to VCT use (Fylkesnes and Siziya 2004; Irungu *et al.* 2008; Makoae and Jubber 2008; Angotti *et al.* 2009). Confidentiality has been revealed to be a major factor, explaining the high acceptance rates that have been achieved when VCT has been offered at home rather than a medical facility (Fylkesnes and Siziya 2004; National AIDS and STI Control Programme 2008; Angotti *et al.* 2009), as portrayed by similar results for a Kenya pilot study where acceptance rates for home based HIV testing were high (National AIDS and STI Control Programme 2008). Confidentiality has also been proven to be crucial in reducing stigma (Furber, *et al.*, 2004). In addition, ease of access has been indicated to also contribute to the marked difference between the clinic based and household based VCT. Home based testing does away with barriers due to cost and accessibility (Matovu *et al.* 2002; Fylkesnes and Siziya 2004; Yeatman 2007; Thornton 2008).

New approaches to the delivery of VCT services have had positive effects on utilization. Using rapid tests and providing tests in locations that are convenient to clients such as home based testing, mobile VCT, work VCT, VCT at night and routine offer of testing in clinical settings have enhanced VCT utilisation (Pronyk *et al.* 2002; Obermeyer and Osborn 2007). New methods, such as finger-stick or salivary testing are being used, and services are being provided in innovative ways, including testing of entire families in health care facilities and homes. Testing and counselling services have been delivered at community and religious institutions, youth centres, and military barracks (De Cock *et al.* 2006) and, routine testing has been also advocated (De Cock *et al.* 2003; WHO 2003b; WHO and UNAIDS 2007a).

2.2.6. VCT- provider initiated as the way forward?

Given stigma, efforts to normalise HIV testing represented by the provider (opt out) strategy are increasingly employed (Creek *et al.* 2007; WHO and UNAIDS 2007a). However, this puts the process under the control of the provider when the clients may not be psychologically prepared for the test. Provider initiated testing has been reported to be in greater danger of meeting with lower responsiveness than client initiated testing done at VCT sites. Opt out strategies have been strongly criticised for putting a low focus on counselling with risk of undermining autonomy and reducing focus on preventative aspect of HIV testing (Obermeyer and Osborn 2007; Yeatman 2007; Maman and King 2008).

Routine or opt-out HIV testing

Routine HIV testing refers to HIV testing as an integral part of a preventive health service with default testing unless an individual decides not to have the test (De Cock *et al.* 2003). In 2001, the US Centres for Disease Control Prevention (CDC) recommended making an HIV test a routine part of Antenatal Clinics (ANC) (CDC 2001; Creek *et al.* 2007). Similarly, De Cock *et al*., (2003), WHO (2003b) and UNAIDS and WHO (2004) suggested having routine HIV testing to prevent MTCT including rapid HIV testing during labour for women whose HIV status is unknown, prevent STIs and advocated for diagnostic HIV testing. Routine HIV testing has been indicated to do away with "HIV exceptionalism[10]" that requires patients to discuss the decision to have an HIV test with a health care provider or counsellor before deciding to have a test as is the norm with VCT (Bayer 1991; Bayer 1999). Accordingly, there has been growing advocacy for increasing and normalising HIV testing in SSA to allow more patients living with HIV/AIDS to be detected and provide treatment opportunities (Bayer 1999; De Cock *et al.* 2003; WHO 2003b; Ole-Nguyaine *et al.* 2004; WHO and UNAIDS 2007a).

Nevertheless, concerns have been raised that HIV routine testing may deter people from seeking medical care and people tested when not ready may not return for their results, utilize care and treatment services or even dare disclose their HIV status to their partners. Routine

[10]HIV exceptionalism was proposed to distinguish the policies that had emerged in the face of the AIDS epidemic from more conventional approaches to public health threats like screening, reporting and partner notification (Bayer, 1991; Bayer, 1999).

antenatal clinic (ANC) testing would inevitably lead to more women than men being tested and knowing their status, making them potential victims of violence and psychological stress due to knowing their positive HIV status (Temmerman *et al.* 1995; Csete *et al.* 2004; Rennie and Behets 2006; Creek *et al.* 2007). Nonetheless, cases have been reported of increased testing rates of up to 80% for ANC routine HIV testing in Botswana with no incidences of domestic violence after disclosure is reported. However, the introduction of ARV therapy in Botswana in 2001 is indicated to have incredibly increased visits to VCT centres, even before testing in health facilities was made routine (Creek *et al.* 2006). Therefore, strong government commitment to HIV programs and increasing local availability of HIV care and treatment services, as portrayed in Botswana, may be crucial (Creek *et al.* 2007).

Likewise, the advent of ART in industrialised countries greatly increased motivation for people to be tested and greatly reduced the stigma associated with HIV/AIDS (De Cock *et al.* 2002). The prospect of ART could increase VCT uptake (Day *et al.* 2003), and more vigorous community education programmes on HIV care issues have been suggested to be essential to effectively promote uptake of VCT. Access to treatment is far from universal and testing in the absence of care and treatment may be unethical (Maman and King 2008).
Mandatory testing has also been indicated as an alternative but this has been largely ignored given the controversy of impinging on individual rights and probable threat of further marginalising people infected with HIV (De Cock *et al.* 2002).

Proponents of routine testing point out that the benefits of increased ART and prevention of opportunistic infections (OIs) will only be realised if routine diagnostic HIV testing is made standard practice in medical care (De Cock *et al.* 2002). Social justice has been indicated to be most relevant to the policy issue of how to increase access to effective HIV/AIDS treatment in Africa (De Cock *et al.* 2002) and probably not aspects of whether to test in absence of ART.

2.3. Methodology

2.3.1. Sample design

Data from the 2003 cross-sectional, population based Kenya Demographic and Health Survey (KDHS[11]) were used. A representative probability sample of almost 10,000 households was selected for the KDHS sample. This sample was constructed to allow for separate estimates for key indicators for each of the eight provinces in Kenya, as well as for urban and rural areas separately.

The survey utilised a two-stage sample design. The first stage involved selecting sample points ("Clusters") from a national master sample maintained by Kenya's Central Bureau of Statistics (CBS); a total of 400 clusters, 129 urban and 271 rural, were selected from the master frame. The second stage involved the systematic sampling of a household list of CBS updated in June 2003. All men and women aged 15-49 years who were either usual residents of the households in the sample or visitors present in the household on the night before the survey were eligible to be interviewed in the survey. In addition, in every second household selected for the survey, all eligible men and women were asked to give their informed consent to be anonymously[12] tested for HIV/AIDS by giving blood samples for HIV testing.

2.3.2. Sample size

A representative probability sample of 9,865 households was selected of which 96 percent of eligible households (8,561) responded to the KDHS and 94 percent of all eligible women (8,195) had a completed interview. The sub-sample (50%) of households selected for blood testing had 3,273 women (80% response rate). The individual test results were anonymously linked to the household questionnaire using bar-coded identification numbers.
Samples for testing were obtained by collecting blood drops from a sterile fingerstick onto a filter paper card. HIV testing was performed using two HIV enzyme-linked immunosorbent

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[11] Only KDHS was used given that Kenya has had a large expansion of VCT services compared to Uganda hence investigating the factors that determine use VCT would be important. Additionally, the KDHS data were available 6 months earlier than the Uganda AIS, hence the VCT paper was already prepared by the time cleaning of the Uganda AIS data had just began.

[12] Those tested did not get their HIV test results back. Instead, if they were interested in knowing their HIV status, they were given a voucher to access the nearest VCT centre for them to get tested.

assays in accordance with WHO guidelines and repeat testing was carried out for specimens with discordant results. Additional information about the KDHS methodology can be obtained from CBS *et al.* (2004).

2.3.3. Data analysis

Measures

The dependent variable is an individual's utilisation of VCT. All respondents indicated to have ever tested for HIV before the survey were assumed to have utilised VCT services at some point. Individuals with blood results confirmed positive were considered HIV positive. Participants that were either divorced or separated or had a partner but were not living together were considered to be separated/divorced and women that were currently married, cohabiting and living together were considered to be currently married. Women that were currently married to a partner with only one wife were considered to be monogamously married and women that were partners/spouses to a man having more than one wife at one time were considered to be polygynously married. Education was measured in terms of the highest education level attained. Women with no education, preschool and nursery were considered to have attained no education. Women with primary, post primary and vocational education were considered to have attained primary education; and women with higher education, college higher and university education were considered to have attained higher education.

The wealth index is a composite measure of household's cumulative standing and this was constructed using principal component analysis. It was calculated using data on household ownership of selected assets including televisions, bicycles; housing construction materials such as the type of floor, roof and walls; types of water access and sanitation facilities including the toilet. The wealth index places individual households on a continuous scale of relative wealth. The DHS separates all the covered households into five wealth quintiles (Rutstein and Johnson 2004).

Summary of the explanatory variables

- HIV status (HIV positive)
- Gender of household head (Male head)

- Age of household head in years
- Five year age groups (15-19, 20-24, 25-30, 31-34, 35-39, 40-44, 45-49: Reference 15-19) (Appendix A Table A.2) shows the model with age in years and age in years squared)
- Education attainment (no education, primary, secondary, and higher: control no education)
- Wealth index (poorest, poorer, middle, richer and richest; control poorest)
- Religion dummies (Muslim, Roman Catholic, Protestant/other and no religion; control Muslim)
- Region of residence dummies (Nairobi, Central, Coast, Eastern, Nyanza, Rift Valley and Western; control Nairobi)
- Marital status dummies (Never married, married polygynously, married monogamously, widowed and divorced/separated; control never married)
- Residence type (Urban residence)

Statistical Analysis

This study explored how different socio-demographic factors possibly affect the use of VCT services. The study also investigated the association of HIV sero-positivity with VCT. The socio-demographic factors included in the analysis were urban residence, marital status including never being married, being married monogamously or polygynously, being divorced or widowed, highest education level attained, age in years, religion, wealth status and region of residence dummies. Multivariate analysis using a probit model (equation 2.1) was conducted to assess how socio-demographic factors associated with utilisation of VCT. Regression coefficients and standard errors are maximum likelihood estimates accounting for clustering.

$$y_i \quad = \Phi(\alpha + x_i\beta) + u_i \tag{2.1}$$

where $\Phi,$ is the standard normal cumulative density is function (CDF), x and β denote the full set of explanatory variables and regression coefficients respectively (socio-demographic variables described above) and, $y = 1$ if VCT services were used and $y = 0$ otherwise. Marginal effects and standard errors adjusted for 400 clusters were obtained. Regressions were conducted using Stata 11.2 (2009 StataCorp).

2.3.4. Probit Analysis

The statistical analysis involves two models with use of VCT services as the dependent variable and socio-demographic factors as the explanatory variables. The difference between the two models is the inclusion of the HIV sero-positivity dummy (where 1 represents positive HIV status) in the first model, given that HIV status is likely to affect VCT use. The second model excludes the HIV sero-positive dummy since it is likely to be endogenous to use of VCT services. Enquselassie and Girma (2009) indicated that individuals with prior HIV testing through VCT were more likely to be HIV positive than clients that had never tested, hence reverse causality.

Additionally, the correlation between variables was checked. If such correlation is relatively high, there may be multicollinearity and the independent effect of model coefficients on the dependent variable may be affected (Wooldridge 2005; Greene 2008).

2.4. Results

2.4.1. Descriptive statistics

HIV prevalence for the women that were tested was 8.4 percent. The average age of the respondents and household head was 28 and 42 years old respectively. A majority of the households had male heads (66%) and resided in rural areas (66%). A great number of women knew of a place for HIV testing and wanted to be tested (64% and 66% respectively), however only 15 percent had ever used VCT for HIV testing. The majority of women were currently married (60%), 30 percent were never married and a minority were either separated/divorced or widowed (6% and 4% respectively). The average number of years of education was 7 years; the majority of the women had primary education (53%) and only 7 percent had higher education. The wealth index proportions were quite similar except for the richest where the proportion was 31 percent. Women that were part of a polygynous household were about 10 percent (but 17% of the currently married women) (See Table 2.1). Considering whether they had ever used VCT or not, 8 percent and 12 percent of women who had ever used VCT and never used VCT respectively were HIV positive (Table 2.1). A majority of women who tested were from Nairobi and Central regions (23% and 24% respectively); and 51 percent and 52 percent of the women who had ever tested were from the urban area and richest wealth quintile respectively. Only 15 percent and 5 percent from the rural areas and the poorest quintile had ever tested for HIV respectively as shown in Table .2.1

Table 2.1: Descriptive statistics of key variables; (Mean (SD) or %)

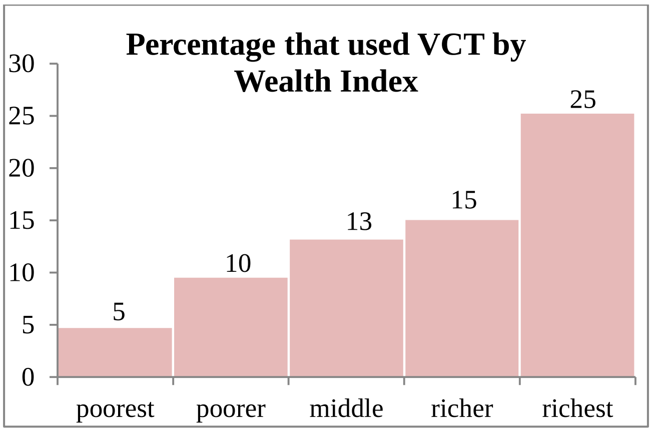
Variables	Whole sample (N=8195)	Ever used VCT (15 %) (N=1239)	Not used VCT (85%) (N=6811)
HIV positive (N=3271)	8.41	11.96***	7.93***
Age in years	28.07 (9.31)	28.68** (7.83)	27.99*** (9.55)
Age of head	41.95 (13.05)	39.89*** (12.88)	42.32*** (13.04)
Education attainment			
No education	15.75	5.08***	16.52***
Primary	53.06	41.49***	55.76***
Secondary	24.10	35.27***	22.49***
Higher	7.09	18.16***	5.23***
Urban residence	33.57	51.49***	14.21***
Male head	66.21	64.97	66.41
Know VCT place	64.00	100.00***	57.45***
Wanted to be tested[13]	66.32	-	66.32
Marital status			
Never married	30.09	23.00***	31.38***
Currently married	59.50	64.89***	58.46***
Married Monogamously	49.46	54.05***	48.59***
Married Polygynously	10.04	5.45***	10.91***
Widowed	4.11	4.11	4.08
Separated/Divorced	6.30	7.99**	6.08**
Wealth Index			
Poorest	16.79	4.92***	18.10***
Poorer	15.94	9.85***	17.02***
Middle	16.85	14.53**	17.44**
Richer	19.13	18.97	19.51
Richest	31.29	51.74***	27.93***
Religion dummies			
Muslim	12.52	4.94***	13.67***
Roman Catholic	23.45	25.16	22.93
Protestant/other	61.64	68.20***	61.16***
No religion/other	2.51	1.94	2.35
Region dummies			
Nairobi	14.26	28.23***	11.95***
Central	16.03	23.89***	15.30***
Coast	11.45	8.07***	12.16***
Eastern	12.12	9.36***	12.76***
Nyanza	12.51	10.25**	13.16**
Rift Valley	16.21	14.12	15.62
Western	12.09	7.99***	13.04***
North eastern	5.33	0.24***	6.02***

*** p<0.01, ** p<0.05, * p<0.10; values are mean (SD) or %. For mean, ttest assuming equal means; for proportions, chi squared test.

[13] This was a question posed to only individuals that had never been tested for HIV/AIDS

Figure 2.1 indicates the association between using VCT services and wealth status. The association between using VCT and wealth status was generally positive, with the richest having the greatest utilisation of 25 percent and the poorest having the lowest of 5 percent.

Figure 2.1: VCT services and wealth status



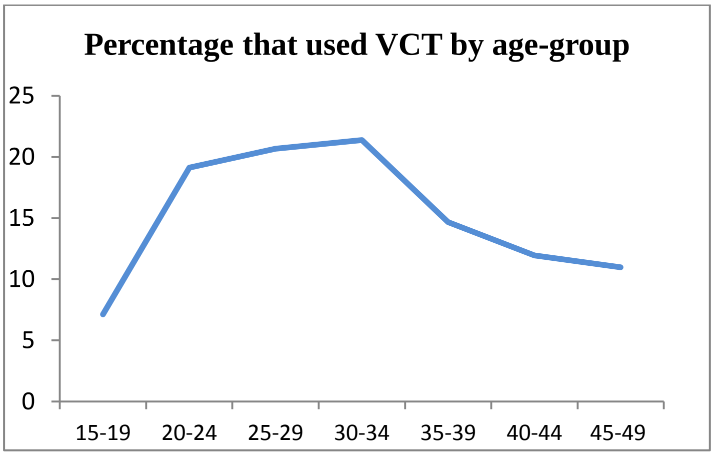
Utilisation of VCT services had a monotonically positive association with education attainment. Women that were more educated had the greatest use of VCT services, at least 40 percent from the richer and richest wealth quintiles. Of the poorest women only 5 percent used VCT services (See Table 2.2).

Table 2.2: VCT services and education attainment

Education attainment	No education	Primary	Secondary	Higher
% that used VCT	5	12	22	39

The association between use of VCT and 5 year age-groups is non-linear as indicated in Figure 2.2. The use of VCT initially increases with age until 30-34 after which it declines. This is probably due to the fact that women between the ages of 20-34 are the most reproductively active and inevitably use VCT health care services possibly in a bid to prevent MTCT.

Figure 2.2: VCT services and 5 year age groups



VCT services, socio-demographic factors and HIV status

VCT and HIV positive status

Bivariate association (Table 2.1) between use of VCT and positive HIV status indicated that HIV positive women were more likely to use VCT (P=0.006). However, taking other variables into account, the multivariate analysis (Table 2.3: Model 1) found no significant positive association between being HIV positive and use of VCT.

Age, education and gender of household head

Women aged 20-24 and 30-34 were 4.8 and 4.5 percent more likely to use VCT than the 15-19 year old group respectively. Women whose highest education level attained was either secondary or higher were significantly more likely (11% and 17% respectively) to use VCT services than women that had no education. Women from male headed households were 3.9 percent less likely to use VCT services (P<0.01).

Residence type and wealth category

All wealth categories, i.e. the poorer, middle, richer and richest were significant (at least at the 5% level of significance) and women from these wealth quintiles were more likely to use VCT than the women from the poorest wealth quintile. Use of VCT services increased with wealth, with the richest 10.4 percent more likely to use VCT than the poorest. Urban residence is not significant.

Religion and Region of residence

Roman Catholics and Protestants had a significantly higher probability, of 12 percent and 11 percent respectively, of using VCT services than Muslims. Regarding the region of residence, women from Nairobi, the capital, were more likely to use VCT services than women from all the other regions. Women from the western region were the least likely to use VCT, with a 10.4 percent lower probability than women from Nairobi. Women from the central region had 2.2 percent lower use of VCT than women from Nairobi. All the regions were significant at a 5 pecent level of significance except for Central region.

Marital status

All women who were currently married (monogamously or polygynously), widowed or separated/divorced were significantly more likely to use VCT than women that were never married. Widowed women had the greatest probability, about 12 percent more likely to use VCT than the never married. The divorced, polygynously married and monogamously married were about 12 percent, 6 percent and 12 percent more likely to use VCT than the never married, respectively.

Table 2.3: VCT multivariate analysis using age groups

Variable	Model 1 (with HIV status)		Model 2 (without HIV status)	
	ME	**RSE**	**ME**	**RSE**
HIV positive	0.019	(0.020)		
Age (Reference: 15-19)				
20-24	0.048**	(0.021)	0.068***	(0.014)
25-29	0.027	(0.024)	0.069***	(0.015)
30-34	0.045*	(0.025)	0.060***	(0.016)
35-39	-0.014	(0.028)	0.007	(0.018)
40-44	-0.029	(0.031)	-0.021	(0.020)
45-49	0.002	(0.034)	-0.018	(0.023)
Urban resident	0.030	(0.020)	0.044**	(0.013)
Education (Reference: no education)				
Primary	0.045	(0.026)	0.044**	(0.017)
Secondary	0.114***	(0.028)	0.109***	(0.019)
Higher	0.172***	(0.033)	0.179***	(0.021)
Male household head	-0.039**	(0.014)	-0.037***	(0.009)
Household head age	0.001	(0.001)	0.001**	(0.0004)
Wealth index (Reference: Poorest)				
Poorer	0.056**	(0.026)	0.046**	(0.017)
Middle	0.086**	(0.027)	0.075***	(0.017)
Richer	0.079**	(0.026)	0.074***	(0.017)
Richest	0.101**	(0.030)	0.097***	(0.019)
Religion (Reference: Muslim)				
Roman catholic	0.115***	(0.031)	0.085***	(0.018)
protestant/other Christian	0.108***	(0.029)	0.075***	(0.018)
No religion	0.010	(0.065)	0.036	(0.034)
Other religion			0.044	(0.058)
Region dummies (Reference: Nairobi)				
Central	-0.022	(0.023)	0.006	(0.015)
Coast	-0.047**	(0.023)	-0.075** *	(0.016)
Eastern	-0.058**	(-0.027)	-0.060***	(0.017)
Nyanza	-0.086**	(0.024)	0.059** *	(0.016)
Rift valley	-0.066**	(0.024)	-0.031**	(0.015)
Western	-0.104***	(0.026)	-0.083***	(0.017)
North Eastern			-0.226***	(0.051)
Marital status (Reference: never married)				
Married polygynously	0.062**	(0.029)	0.063**	(0.019)
Married monogamously	0.116***	(0.020)	0.101***	(0.013)
Widowed	0.124**	(0.037)	0.103***	(0.023)
Separated or divorced	0.124***	(0.027)	0.082***	(0.018)
Constant	-2.563***	(0.207)	-2.152***	(0.157)
Observations	3217		8040	

p-values * p<0.10, ** p<0.05, *** p<0.01; ME is marginal effects; RSE is Robust standard errors

VCT services excluding HIV status

The second multiple regression (Table 2.3: Model 2) analysis is similar to the first except that HIV status was excluded and other religion and north-eastern region (that had no HIV positive women) were included in the analysis. HIV status is excluded from the analysis because of possible reverse causality with VCT use (Enquselassie and Girma 2009). Also, exclusion of HIV status increases the sample size from about 3,200 to 8,040. This is because only a sub-sample of 50 percent of the households interviewed were selected for HIV testing, hence resulting in 3,273 women with the HIV status known. Exclusion of HIV status results in using the full sample of 8,195 women interviewed during the 2003 KDHS.

The results are similar to the first analysis with regard to the direction of the associations and significance except for a few changes.

In addition to the 20-24 and 30-34 age group, women aged 25-29 are also more likely (6.9%) to use VCT than the 15-19 year age group. Urban residence becomes significant at 5 percent with women from the urban area 4.4 percent more likely to use VCT than their rural counterparts. Similar to the first analysis the more educated women (secondary and higher educational attainment) including women with primary level education attainment were significantly more likely to use VCT than women with no education. Regarding religion, the additional variable of other religion was not significant.

Results for wealth status, marital status, region of residence were pretty similar to the first regression. Women from north eastern region were significantly less likely (23%) to use VCT services compared to women from Nairobi.

VCT and HIV Status: Causality

A third model was used to test causality. The model's dependent variable is HIV positive status and the explanatory variables include the VCT variable and other socio-demographic factors as shown in Table 2.4.

Table 2.4 reveals that individuals who have used VCT are more likely to be HIV positive, but this is insignificant, hence there was no sufficient evidence to claim causality in this sample.

Table 2.4: HIV positive status as the dependent variable

HIV positive	Marginal effect	P value
Used VCT	**0.066**	**0.473**
Age	0.198^{***}	<0.001
Age squared	-0.004^{***}	<0.001
Years of education	-0.020	0.069
male head	-0.098	0.253
Household head age	0.004	0.277
Wealth index (Reference Poorest)		
Poorer	0.292	0.055
Middle	0.392^{**}	0.006
Richer	0.602^{***}	<0.001
Richest	0.741^{***}	<0.001
Religion (Reference Muslim)		
Roman Catholic	0.716^{***}	<0.001
Protestant/other Christian	0.701^{***}	<0.001
No religion	0.693^{*}	0.047
Region (Reference Central)		
Nairobi	0.135	0.379
Coast	0.169	0.268
Eastern	-0.010	0.939
Nyanza	0.659^{***}	<0.001
Rift valley	0.010	0.942
Western	0.154	0.269
Marital Status (Reference Never married)		
Currently married	0.271^{*}	0.028
Widowed	1.407^{***}	<0.001
Separated or divorced	0.668^{***}	<0.001
Constant	-5.643^{***}	<0.001

Observations 3216

R-squared 0.138; * p<0.10, ** p<0.05, *** p<0.01

2.5. Discussion of Results

The analysis in this chapter reveals that the use of VCT services is low for women in Kenya despite the rapid scaling up of VCT sites in Kenya. Of women interviewed, 66 percent indicated their desire to be tested for HIV and yet only 15 percent had ever been tested using VCT services (recent research indicates 41.6% and 58.2% of women and men from Kenya have never tested for HIV respectively (KNBS and ICF Macro 2010)). The discrepancy between the two may be an indication of VCT services not being currently available or being geographically inaccessible because of limited health infrastructure. It might also be an indication of financial barriers to care given that health services in some cases are not entirely free with the introduction of user fees (Nuwaha *et al.* 2002).

Similar research has also indicated costs prevent youths who want an HIV test from having one. They may be more price sensitive to such services given that most of them most likely pay for such services themselves rather than being embarrassed by asking their guardians for money to pay for VCT services (Horizons-Program 2001). On the other hand, the low utilisation may be due to the poor responsiveness of the VCT services in terms of access, placement, waiting time for test results and confidentiality (Fylkesnes and Siziya 2004; Angotti *et al.* 2009; Njeru *et al.* 2009).

VCT and HIV positive status

There is some evidence that women who are HIV positive may be more likely to use VCT because such women use VCT to confirm their suspicion of being HIV positive after worrying experiences of, for example, miscarriages, loss of a child, having a very sick partner, having an opportunistic infection or death of a partner (Maman *et al.* 2001; Morin *et al.* 2006; Pignatelli *et al.* 2006; Vajpayee *et al.* 2009). It is likely however, that this causal mechanism is controlled for by inclusion of socio-economic and demographic characteristics of the individual including age, education attainment, marital status, religion and region of residence; hence it was not significant in the multivariate regression. This causality was further investigated using the HIV positive status model to ascertain the relationship between HIV status and VCT. The models shown in Tables 2.5 and 2.6 confirm that the positive association between HIV status and VCT is not significant.

Age, education and gender of head

VCT utilisation increases with age among younger women and declines as the women get beyond child-bearing age. VCT also increases with educational attainment. Older child bearing women have been indicated to be more likely to use VCT because of their perceived accumulated risk (Pignatelli *et al.* 2006) and have been reported to be more likely than younger women to develop a deeper level of interest in their offspring hence their greater participation in testing for HIV as a means of protecting their unborn child (Mahmoud *et al.* 2007; Okonkwo *et al.* 2007). Similarly, a study in Rwanda indicated that as women get older, they acquire more independence in making decisions that affect their health. Old age in many SSA countries is associated with wisdom and it may be that societal influence especially male dominance is less exerted on the older women than younger women, hence likelihood of using VCT more (Kowalczyk *et al.* 2002; Pignatelli *et al.* 2006).

As expected, educational attainment is positively associated with use of VCT. This is potentially due to the fact that educated women may have more understanding of the benefits of such services and are more likely to respond to health promotion messages (Hargreaves and Glynn 2002; de Walque 2006b; Kawichai *et al.* 2006; Zheng *et al.* 2010). On the other hand, the less educated have been reported to be less aware of VCT services, usually accepting VCT when free mobile services are in their vicinity of residence (Kabbash *et al.* 2010). Education has been indicated to have no effect on VCT use in some instances (Jerene *et al.* 2007).

Women from male headed households are less likely to use VCT services. This could be due to limitations due to gender related power differences for couples in decision making (Maman *et al.* 2001). Women may depend on men's approval to decide on testing hence limiting their use of VCT (PSI 2004; Matovu *et al.* 2005; Pignatelli *et al.* 2006; Hageman *et al.* 2010). Similar research in Kenya indicated fear of partners' reaction as the most mentioned barrier to testing by women (Maman *et al.* 2001). Uptake of VCT by women is lower despite having higher infection rates and hence higher vulnerability. This calls for engendering health services like VCT and hence an urgency to the need of incorporating women's sexual partners in VCT through targeting couples especially through community outreach (Painter 2001; Allen *et al.* 2007; Otwombe *et al.* 2007; Hageman *et al.* 2010).

Integration of VCT into other services like family planning and prevention and treatment of sexually transmitted infections and PMTCT has been suggested as another avenue to increase utilisation of VCT services since this encourages privacy and may address social stigma associated with HIV/AIDS (Painter 2001; WHO 2002b; Wolff *et al.* 2005). Infected women can also be encouraged to use VCT services if there is hope for them to survive through availability of treatment (Coovadia 2000). Accessing and scaling up antiretroviral drugs is imperative to enhance use of VCT services and save lives (Ferradini *et al.* 2006; Stringer *et al.* 2006; Weiser *et al.* 2006).

Residence type, region of residence and wealth category

As expected, urban residence including residing in Nairobi, the capital, and being wealthy are positively associated with use of VCT services. Urban women are significantly more likely to use VCT services, by 4.4 percent, than rural women - contrary to findings by Forsythe et al, (2002). Additionally, women from the capital Nairobi are more likely to use VCT as expected, given better access and more trained health personnel in Nairobi compared to all the other regions (Marum *et al.* 2006). Similar findings by de Walque (2006b), Chamla et al., (2007) and Johnson and Way (2006), emphasised that VCT services tend to be more available in urban areas.

Access to VCT services in rural SSA is challenging given limitation in facilities which increases transport costs, few trained personnel and limited health care funds (Coovadia 2000; Nuwaha *et al.* 2002; Marum *et al.* 2006). Lower rates of VCT utilisation may also be attributed to rural communities usually being much smaller with less anonymity which makes them prone to breaches of confidentiality, hence increasing the cost of stigmatisation from a positive test (Hutchinson and Mahlalela 2006).

Improving rural health infrastructure and scaling up VCT services in rural areas is imperative to improve VCT utilisation (Coovadia 2000; Iliyasu *et al.* 2006). Mobile VCT and incorporation of VCT at the rural PHC level have been proven as alternatives to deal with poor access and poor utilisation of VCT in rural areas (Pool *et al.* 2001; Pronyk *et al.* 2002; Marum *et al.* 2006; WHO *et al.* 2009). Likewise, community based VCT can be efficient in reaching the rural poor in addition to reducing the impact of stigma associated with VCT use (Allen *et al.* 2007; Baiden *et al.* 2007).

There is a possibility that the positive association of VCT and income is due to the out of pocket payments associated with private VCT services and informal out of pocket payments (informal user fees) made at most public hospitals to overpass the long waiting times at such public hospitals (Mbonye et al., 2009). Consequently, the poorest are inevitably less likely to use VCT. Strategies like removal of informal user fees, ensuring provision of quality care in public facilities (given that the poor utilise such services more) and ensuring availability of drugs for the poorest may encourage use of VCT and lead to better health outcomes for the poorest (Kiwanuka *et al.* 2008). Wealthier women are more likely to use VCT services than the poorest, as found by de Walque (2006b), de Walque (2006a) and Kiwanuka *et al*., (2008).

Marital status

The currently married, either monogamously or polygynously, widowed and divorced women are more likely to use VCT services than the never married. Such women, that are considered to be currently married or have ever been married, may have greater risk exposure to HIV than never married and are therefore more likely to use VCT. This may be due to perceived personal risk associated with marriage in their current or past relationships (Matovu *et al.* 2005; Siziya *et al.* 2008; Vajpayee *et al.* 2009; Kabbash *et al.* 2010). Likewise, a study by Maman et al., (2001) indicated that women described HIV testing as a means to confirm their positive HIV status or to check reproductive health problems especially fertility problems. The monogamously married women were more likely to use VCT services than the polygynously married despite polygyny having the greatest risk of HIV, probably due to lower risk of disclosure given monogamy (de Paoli *et al.* 2004). On the contrary, married women have been indicated to be less likely to use VCT because of perceived “safety” and low risk of HIV (Fabiani *et al.* 2007; Wringe *et al.* 2008).

Religion

Muslim women are less likely to use VCT services when compared to women from all the other religions. This may be due to the role of Islamic women and their decision making process in the use of such services. Furthermore, polygamy has been posited to increase the complexity of disclosing VCT results for Muslim women, increasing the risk of marriage dismissal hence making such women less willing to accept VCT (de Paoli *et al.* 2004). The interventions that were suggested to improve use of VCT to overcome gender inequality can also be effective in improving utilisation of VCT by Muslim women.

Checking for multicollinearity

High (though not perfect) correlation between two or more independent variables is referred to as multicollinearity (Wooldridge 2005). Multicollinearity can mean small changes in the data produces wide swings in parameter estimates, coefficients having very high standard errors and low significance levels even though jointly significant with a high R^2. Coefficients may have the wrong sign or implausible magnitudes. Concern is, ceteris paribus, the more highly correlated a variable is with other variables in the model, the greater the variance will be, due to multicollinearity. Given that non-experimental data is never orthogonal, multicollinearity is always present to some degree (Mansfield and Helms 1982; Grewal *et al.* 2004; Wooldridge 2005; Greene 2008).

The Variance Inflation factor (VIF), of each coefficient in the regression can be used as a diagnostic statistic. The VIF for a variable shows the increase in the variance that is attributable to the fact that the variable is not orthogonal to other variables in the model. Solutions suggested include obtaining more data; dropping variables suspected of causing the problem (which may lead to specification bias especially if the variable belongs to the model), using factor analysis, using information from prior research and using joint rather than individual hypotheses testing (Mansfield and Helms 1982; Grewal *et al.* 2004; Wooldridge 2005; Greene 2008). VIF however, is limited to ordinary least square (OLS) regressions, and is not appropriate for non-linear maximum likelihood models like probits.

The degree of multicollinearity is checked using Spearman rank correlation for variables that are suspected of being highly correlated. Urban residence and the wealth index are the variables of concern given that research indicates that the wealthy tend to reside in urban areas. Also, the first regression found the urban variable insignificant, but this became significant in the second regression; probably due to collinearity between these variables that makes disentangling the wealth effect and urban residence effect impossible in regard to how they affect VCT utilisation. Spearman rank correlations reveal that 74 percent of the richest women are more likely to be urban residents; while 79 percent of urban residents are in the richest wealth category (Table 2.5).

Table 2.5: Spearman rank correlation for urban residence and proportion of wealth categories in urban and rural residences

Wealth categories	Urban Rho (p)	Urban (N=2,751) Percentage (%)	Rural (N=5,444) Percentage (%)
Poorest	-0.27 (<0.001)	2.73	23.90
Poorer	-0.26 (<0.001)	2.73	22.61
Middle	-0.24 (<0.001)	4.11	23.29
Richer	-0.15 (<0.001)	10.98	23.25
Richest	**0.74 (<0.001)**	**79.46**	6.94

rho is the correlation coefficient and significant level indicated by P values

To investigate the correlation, a model is estimated excluding wealth quintiles and as suspected, the urban variable becomes significant at 1 percent (See Appendix A. Table A.1). This implies that it is difficult to separate out the independent effect of wealth index and urban residence on VCT utilisation once both variables are included in the model.

Dropping the variables would have been a remedy, but, exclusion of these variables is not practical given that there is evidence that they affect the utilisation of VCT, hence omitting them would produce specification bias (Farrar and Glauber 1967). Fortunately, the models did not exhibit most of the concerns related to multicollinearity such as sign swings and insignificant results, and hence this may not be a great concern in this case. Also, most of the solutions given mostly relate to linear estimations such as OLS and so may not apply to non-linear estimations, such as maximum likelihood regressions with probits. Therefore, results relating to wealth quintiles and urban residence may be interpreted with caution given the aforementioned.

Additionally, given that past literature indicates that those who are HIV positive are more likely to use VCT; this raises concerns of causality with HIV positive status. However, the multivariate analysis controls for several socio-economic and demographic variables that are suspected to affect VCT and hence HIV positive status has no significant association with VCT. Also, a third model is estimated with HIV positive status and VCT and no significant association is attained. An alternative would be to use instrumental variables for HIV positive status but appropriate instruments were not available for this analysis.

2.6. Conclusion and Implications

This chapter uses a Probit model to explore factors that affect the use of VCT for women in Kenya using the KDHS 2003 data. The results show that women from the poorest wealth quintile, women who reside in rural areas, women who are Muslim, women who never married, women who are part of male headed households or women who have no educational attainment are the least likely to use VCT. VCT is a key element in identifying HIV infected individuals and hence interventions aimed at improving VCT use must target such women for them to be effective.

The implications of the results mean that VCT access in rural areas must be improved given that most of the poorest women and women with no education attainment reside in rural areas. Improving access through new approaches like mobile VCT and may improve utilisation and do away with access costs that discourage VCT use in rural areas. A study by Thornton (2008) found monetary incentives of less than 10% of a day's wage to double the rate of result-seeking among respondents in Malawi, hence incentives can be provided to VCT users to improve utilisation and return for results.

Alternatively, community outreach through local communities and religious groups may do away with stigma associated with HIV testing. VCT testing has hardly involved the Muslim leaders (Imams) in encouraging their congregants in testing. Imams may encourage Muslim families to utilise HIV testing and this may make it more likely for Muslim women to use VCT. In cases where mobile VCT is used, having Muslim health workers may foster more acceptance of VCT use. In addition, community involvement targeting male involvement may improve VCT use for women that are part of male headed households. Inclusion of men in PMTCT-plus where treatment for both the child and parents is certain given HIV infection, and encouraging couple counselling may also improve VCT use for women.

The never married women are less likely to use VCT. The KDHS data indicates that only 17 percent of women that were interviewed had never been sexually active, implying that some of the never married women were probably sexually exposed, a potential risk to HIV infection. Routinizing of testing for HIV should be encouraged so that such women are able to know their status as early as possible. Normalising HIV testing through general clinics for all individuals will reduce potential vulnerability of women given that they are more likely to engage with health services given their role in child bearing. Routine HIV testing may also deal with HIV related stigma which is a major deterrent to VCT use.

There has been rapid scaling up of VCT in Kenya but the use of VCT by women is still low despite the considerable potential benefits. Dealing with barriers to use of VCT services by women especially due to limited gender roles, stigma, poverty, fear of partner's reaction and poor rural access is a prerequisite to improving VCT use by women.

Couple counselling, engendering services and ensuring stronger post testing services for coping support may be helpful in reducing women's vulnerability in case of disclosure. Additionally, improvement of access to VCT services especially in rural areas would require more investment in training of health personnel and infrastructure. Stigma associated with HIV/AIDS testing is still a "big issue" and a real challenge, so associating VCT with a broader range of health services and community outreach interventions may be useful in reducing such stigma and improving access to VCT.

New testing approaches like mobile VCT, door to door testing, home based testing and rapid testing should be encouraged especially for the hard to reach population that are also vulnerable to HIV infection. Such testing has been proven more responsive given that it does away with some of the barriers like access, transport costs, confidentiality concerns and the stigma associated with VCT testing sites located in general health clinics.

Additionally, following the current debate concerning routine and diagnostic HIV testing in health care facilities and increasing emphasis on universal knowledge of HIV status (Basset 2002; Forsythe *et al.* 2002; WHO 2003c; WHO 2003b; Frieden *et al.* 2005; Kim and Gilks 2005; Marum *et al.* 2006), policies in Kenya should encourage normalisation of HIV testing through routine and diagnostic testing to encourage more women to be tested. However, services must be established that link VCT and referral for care and support to counteract the negative events that may result from such women knowing their HIV status.

Resources in SSA are limited in terms of human resources, infrastructure and financial capacity (WHO 2003b) especially in the rural areas leading to lower VCT utilisation. The onus is on government to provide good quality testing and counselling services by investing in VCT infrastructure especially in resource constraint rural areas in order to reach the rural poor. Also, Government policies should support the private providers given that they are actively involved in VCT service provision and generally provide high quality and reliable services; this would reduce the gap due to public sector limitations. Limitation in the human capacity gap may be reduced by using community based organisations and PLWHA in matters of HIV testing, counselling and provision of social support, as exemplified by some service providers like TASO Uganda.

Knowledge is power; hence grass root communities especially in rural areas should be educated on the benefits of VCT and should be mobilized to support the widespread and routine utilisation of VCT which will perhaps normalise HIV testing in the long run. HIV/AIDS is complex; therefore, improvement in the use and access of VCT services implies different innovative approaches that will deal with the different social complexities associated with women especially the disadvantaged women who are more vulnerable to HIV infection. Importantly, ensuring scaling up of ARV will shine light at the end of the tunnel and bring hope to even those that seem hopeless and inevitably enhance the use of VCT.

Chapter 3 - Risk factors for HIV infection among women in Kenya & Uganda[14]

"AIDS is not just a serious threat to our social and economic development; it is a real threat to our very existence… AIDS has reduced many families to the status of beggars… no family in Kenya remains untouched by the suffering and death caused by AIDS… the real solution of the spread of AIDS lies with each and every one of us"

President Moi, 1999

3.1. Introduction

Past studies have identified different risk factors for HIV/AIDS in women in SSA particularly socio-economic status (SES) as risk factors to HIV infection. Several cross-sectional studies have found an association between HIV prevalence and high SES like urban residence, wealth, higher education, and employment (Bennell 2005; Wojcicki 2005; Bärnighausen *et al.* 2007; Lopman *et al.* 2007; Mishra *et al.* 2007b). However, there is also a general consensus that low SES women are more at risk for HIV infection which has implications for prevention

[14] This chapter forms part of a published paper Abimanyi-Ochom, J. (2011). The better the worse: risk factors for HIV infection among women in Kenya and Uganda – Demographic and Health Survey. *AIDS Care, 23(12),* 1545-1550.

and intervention policies in Uganda and Kenya (Hargreaves and Glynn 2002; Masanjala 2007).

Chapter 2 explored the factors that determine use of voluntary counselling and testing for HIV but the challenge is that the majority of PLWHA in SSA are not aware of their HIV status because a minority seek VCT services (Amornkul *et al.* 2009; Huchko *et al.* 2011). Given that SSA has the greatest burden of disease for HIV, another alternative to HIV prevention would be reduction of risk factors for HIV. Exposure of risk in SSA is mostly through heterosexual sex hence reduction of risk to HIV through sexual behaviour change is important in reducing exposure to HIV and hence important for HIV prevention. Also, this chapter focuses on women since they have been shown to be more vulnerable to HIV risk and are additionally important in the effort of preventing mother to child transmission of HIV. This chapter investigates HIV risk factors for women in Kenya and Uganda especially, SES. Many studies have indicated women to be more vulnerable to HIV than men; hence the focus of this chapter is women (Auvert *et al.* 2001; WHO 2011a).

The chapter is organised as follows: section 3.2 covers previous literature on risk factors for HIV especially in SSA, section 3.3 gives the methodology, the results and discussion are covered in section 3.4 and section 3.5 concludes the chapter.

3.2. Literature Review

3.2.1. Introduction

Exposure to HIV risk in SSA is mostly through heterosexual sex, unlike the developed world where it is mostly through injecting drug use and men having sex with men (MSM) (Temmerman *et al.*). Numerous studies in SSA have indicated several factors that are associated with risk to HIV. Notable of these is gender, with women in SSA having a greater risk than men and hence higher prevalence of HIV (CBS *et al.* 2004; MOH and ORC Macro 2006). Also, given that risk has been indicated mostly through heterosexual transmission (Piot *et al.* 2001), behavioural risk factors such as the number of sexual partners, not using a condom, age when first having sex, and marriage are the prevalent means of risk to HIV.

This section briefly discusses the HIV epidemic theory, women's vulnerability to HIV and further explores HIV risk factors under three broad categories: socio-economic and demographic factors[15] (age, marital status, education attainment, being employed, wealth and urban residence); sexual behavioural factors (age at first sex, age at first marriage, multiple sexual partners and partner type, and evidence of behaviour change); and other risk factors (alcohol consumption and STI's, and male circumcision).

3.2.2. HIV Epidemic Theory

The HIV/AIDS epidemic dynamics are such that infection increases at the initial stage, (probably because of lack of knowledge and information on the nature of HIV/AIDS) and starts declining in the later stage as HIV/AIDS information accumulates (Yamauchi and Ueyama 2008). It has been postulated that during the early stage of the epidemic, HIV risk is associated with higher socio-economic status and migration, but as the epidemic matures, the pattern may dissolve as the epidemic spreads in a given population (Piot *et al.* 2001; Hargreaves and Glynn 2002). On the other hand, it has been argued that as the epidemic matures, the pattern reverses with greater risk for the low socio-economic status population (Piot *et al.* 2001; Bärnighausen *et al.* 2007). Education has been used as an indicator of SES and its association has been shown to differ by the stage of the HIV epidemic. Studies conducted in the early stages of the epidemic have been shown to have a positive association with HIV infection possibly because the more educated had more partners in a given period of time, and due to more mobility and hence risky behaviour (Piot *et al.* 2001; Bärnighausen *et al.* 2007). As the epidemic matured, the more educated are reported to have adopted HIV risk reducing behaviour more quickly than the less educated given more exposure to health promotion messages and better response to such messages (Bärnighausen *et al.* 2007) hence vulnerability of HIV risk associated with low SES, inequality and migration (Carael *et al.* 1997; Piot *et al.* 2001). The epidemic in SSA including Uganda and Kenya has been argued to have shifted from those at risk to a generalised epidemic with the effect not only in urban, but also in rural areas (Piot *et al.* 2001).

[15] Also referred to as Socio-Economic Status-SES

3.2.3. Female vulnerability to HIV

Women have been shown to be more vulnerable to HIV than men because of biological and cultural factors (UHSBS 2006; Mermin *et al.* 2008; UNGASS Kenya Report 2007 2008; UNGASS Uganda Report 2007 2008); and notably, gender inequality has been argued as the main driver of the HIV epidemic for women (Heise and Elias 1995; Türmen 2003; WHO 2011a). Sex describes a biological distinction between men and women, but gender is a social construct that differentiates the power, roles, responsibilities and obligations of women from that of men (Türmen 2003). Women in many societies especially in SSA have been indicated to have a lower socio-economic status, hence earlier studies have emphasised the need to recognise women's low status as a critical obstacle to HIV/AIDS prevention (Heise and Elias 1995; WHO 2011a).

Gender inequalities, norms and roles

The cultural and social role of women, especially 'married' women, has been revealed to mean limitations to control over their sex lives and sex lives of their partners outside marriage, making such women vulnerable to HIV infection (Buvé *et al.* 2002; Chiao *et al.* 2009; Hageman *et al.* 2010). Gender norms related to masculinity have also been indicated to encourage men to have more sexual partners and older men to have sexual relations with much younger women, making such younger women more vulnerable to HIV infection than the younger men of the same age (Auvert *et al.* 2001; WHO 2011a). Norms related to femininity, dominance of patriarchal structures and subordination of females, for example requiring male consent to accept a VCT proposal, especially for young women, have been suggested to prevent women from accessing HIV information and services (Pignatelli *et al.* 2006; WHO 2011a) hence making them vulnerable to HIV.

Gender-related barriers in access to services have been reported to prevent women from accessing HIV prevention, treatment and care. Women have been indicated to face barriers due to their lack of access to and control over resources, especially financial resources given that men are usually the sole bread winners (Pool et al., 2001). Additionally, child-care responsibilities, restricted mobility and limited decision-making power have been revealed to limit women's access (WHO 2009a). Furthermore, women have been reported to have less knowledge of HIV/AIDS (UNAIDS 2008a; WHO 2011a), hence increased risk. Heise and Elias, (1995) argued that in large measure, women's vulnerability to HIV infection primarily derives from their low status in society. However, reducing such vulnerability has been indicated to require changing cultural beliefs and gender stereotypes that perpetuate the belief that women are inferior to men. One challenge however, is that fundamental social change takes time - time that women at risk today may not have (Heise and Elias 1995).

Violence against women

Women have been reported to experience physical, sexual and emotional violence worldwide and this has been indicated to increase their risk to HIV infection (WHO 2011a). Earlier studies have confirmed women infected with HIV to more likely have had a physically violent partner in their lifetime (Maman *et al.* 2002). Sexual violence through forced sex has also been indicated to contribute to HIV transmission due to tears and lacerations resulting from the use of force (Auvert *et al.* 2001; WHO 2011a). Women's inferiority has been shown to make them powerless to negotiate for safe sex and fear of violence has been pointed out as one of the deterrents of using VCT making such women vulnerable to HIV infection (Grinstead *et al.* 2001; Pool *et al.* 2001; De Cock *et al.* 2002; Porter *et al.* 2004; WHO 2011a). In addition, women have been stigmatised as the reason for transmission which makes them vulnerable to violence (Chiao *et al.* 2009).

Lack of education and economic security

Lack of education and economic security has been revealed to affect millions of women and girls, whose literacy levels are generally lower than that of men and boys (WHO 2011a). Numerous women, especially those living with HIV have been reported to lose their homes, inheritance, possessions, livelihoods and even their children when their partners die (WHO 2011a). Such loss and hardship has been reported to force many women to adopt risky survival strategies including transactional sex that increase their chances of contracting and spreading HIV (Buvé *et al.* 2002; Dunkle *et al.* 2004; Masanjala 2007; WHO 2011a).

Failure of HIV prevention programmes to address underlying gender inequalities

Global HIV/AIDS prevention strategies have consisted of emphasising behaviour change including reduction of the number of sexual partners and encouraging use of condoms. These strategies however have been shown to fail to meet women's protection needs given that many women often lack the power to negotiate the terms of sexual encounters and such strategies have been indicated to fall short to protect women from HIV infection (Heise and Elias 1995; Buvé *et al.* 2002; Chiao *et al.* 2009; Hageman *et al.* 2010).

Monogamy has been encouraged as a prevention strategy but this has been indicated as irrelevant to many women given that most are already monogamous. Usually, it is the sexual behaviour of women's partners that puts them at risk given evidence that men are more than twice as likely as women to have reported extramarital affairs and are more likely to have more lifetime sexual partners (McGrath *et al.* 1993; Heise and Elias 1995; Auvert *et al.* 2001).

Many cultures in SSA do not condemn polygamy for men; hence, inevitably, many women find themselves in polygynous relationships. Polygyny is a form of marriage in which a man has two or more wives at the same time. Polygyny is commonly practised in SSA and some authors have highlighted polygyny and concurrent relationships as the main reason for the high prevalence of HIV in SSA (Halperin and Epstein 2004). Concurrent relationships including polygyny have been shown to increase the overall probability of an uninfected partner's exposure to HIV infection since there are multiple partners involved (Helleringer. Stéphane *et al.* 2009; Mah and Halperin 2010). On the contrary, previous studies have highlighted the possibility of polygyny being protective against HIV transmission in that it reduces the need for men to seek extra marital sexual relations, thereby reducing the occurrence of casual sex (Mitsunaga *et al.* 2005). The evidence however is inconclusive with monogamists reported more likely to engage in extramarital sexual relations than polygynists in the previous week, whereas polygynists men reported to have more extramarital affairs over their lifetime (Mitsunaga *et al.* 2005). Polygynous men have been shown to more likely have extramarital sex than the monogamous men during their wife's pregnancy thereby increasing the risk of HIV to their spouses (Mitsunaga *et al.* 2005).

Many women are incapable of challenging and changing their partner's infidelity and challenging the partner has been reported to place their economic security and physical safety at risk, hence such women are at risk of HIV/AIDS through their steady sexual partners (Heise and Elias 1995; Kenya UNGASS Report 2010; Uganda UNGASS Report 2010). In contrast, non-monogamous women have been reported to have multiple sexual partners as a means of economic survival to enable them have access to resources that only men control. Offering alternative forms of income has been indicated to be essential for women to eliminate outside partners (Heise and Elias 1995). Partner reduction messages have been assumed that women are in control of when they have sex and with whom, but this is not always the case, given rape and coercive sex (Heise and Elias 1995; Buvé *et al.* 2002).

Condom use has been popularly promoted as a means of HIV prevention, but women may have no control over their use given that they have to negotiate using a condom to their potentially unwilling partner. Socioeconomic, cultural and emotional forces have been indicated to limit women's ability to negotiate successful condom use on their own behalf (Aboud *et al.* 2010). On the other hand, discussion of condoms has been shown to often raise painful issues of fidelity and trust that many sexual partners would rather not confront. Women have been reported to suffer abandonment, physical abuse and accusation of infidelity by bringing up condom use (Heise and Elias 1995; Aboud *et al.* 2010). In instances where women have been bold to raise the issue of condom use, they have been reported to often face entrenched male resistance to their use. Women's cultural conditioning has also been indicated to limit women's ability to assert dominance in the sexual realm, a domain largely controlled by men in most parts of the world, especially Africa (Aboud *et al.* 2010). Moreover, condom use in SSA has been reported to be low (Oster 2007) and is often among the high socioeconomic status group (Oster 2007; Uganda UNGASS Report 2010), which makes condom access to the ordinary woman difficult.

3.2.4. Socio-economic and demographic factors

Age

During the early stage of the HIV epidemic, younger individuals between 19-24 years old are reportedly the most vulnerable to HIV infection, but with progression of the epidemic, there has been a shift to older individuals with the highest prevalence among the 35-39 and 30-34 year olds in men and women respectively (UNGASS Kenya Report 2007 2008; UNGASS Uganda Report 2007 2008; Kenya UNGASS Report 2010; Uganda UNGASS Report 2010). Age difference between couples has been posited as a predisposing factor to HIV infection especially among young women who are sexually involved with older men (Auvert *et al.* 2001).

Marital status

Several studies have indicated being married, or having been married, as a risk factor for HIV infection compared to never being married (Auvert *et al.* 2001; Buvé *et al.* 2002; Mermin *et al.* 2008; Chiao *et al.* 2009), with the widowed shown to have the highest HIV prevalence. By contrast, some studies have reported being unmarried as a possible risk factor for HIV infection (Hattingh *et al.* 2009). Married women have especially been indicated as being more vulnerable due to limiting cultural roles (Chiao *et al.* 2009; Hageman *et al.* 2010) hence the recent campaign of empowering women through education and access to resources to change this (Wojcicki 2005).

Education attainment and employment

The evidence from previous studies of the association between HIV risk and education is ambiguous. Several studies conducted in SSA have found positive association of HIV risk and education (Hargreaves and Glynn 2002; de Walque *et al.* 2005; Brent 2006; Bunnell *et al.* 2008; Fortson 2008), others have reported a negative association (Bloom *et al.* 2002; Buvé *et al.* 2002; Hargreaves and Glynn 2002; Wojcicki 2005; de Walque 2006b; Bärnighausen *et al.* 2007; de Walque 2007; Hargreaves *et al.* 2008; Hattingh *et al.* 2009) while other studies have found no effect (Quigley *et al.* 2000; Fabiani *et al.* 2006). However, some have argued that the association between education and HIV risk depends on the stage of the epidemic (Bloom *et al.* 2002; Hargreaves *et al.* 2008). Hargreaves et al., (2008), Mishra et al., (2002) and Msisha et al., (2008) argue that prior to 1996, the more educated were at risk partly because they were more mobile and had multiple sexual partners. Since 1996, the educated had a lower risk of HIV infection, having adopted less risky behaviour including use of condoms and partner reduction as promoted by HIV prevention messages (de Walque 2007). Similar to education, being employed and HIV risk has had mixed evidence. Hattingh *et al.*, 2009 indicated unemployed women to be more vulnerable to HIV infection given greater likelihood of participating in transactional sex while professional, employed women have also been indicated to be more vulnerable to HIV (Mishra *et al.* 2007b; Msisha *et al.* 2008).

Wealth index and urban residence

There has been enormous debate on the association of wealth and HIV risk. From a wellbeing perspective, the poor were hypothesised to be worse off given that they are made vulnerable through limited resources, education and access to health services (Hargreaves and Glynn

2002; Masanjala 2007). In this regard, several studies concentrated on pathways of ensuring protection to the poor given their imminent risk of HIV and there was a general consensus that low SES individuals like the poor are more at risk. However, earlier evidence was contrary to the hypothesis indicating the wealthier to be more vulnerable to HIV (CBS *et al.* 2004; MOH and ORC Macro 2006), forcing scholars to investigate reasons for the contradiction to the hypothesis (Bingenheimer 2007; Gillespie *et al.* 2007). Past studies have explained the positive association in terms of the wealthier affording multiple partners, being more mobile, hence, separation from their usual sexual partner which exposes them to risky sexual behaviour including exchanging sex for money, inevitably, making them more vulnerable to HIV infection especially at the onset of the epidemic (Johnson and Way 2006; Gillespie *et al.* 2007; Mishra *et al.* 2007b). As the HIV epidemic matures, the wealthier are expected to be less vulnerable given adoption of less risky sexual behaviour (Bärnighausen *et al.* 2007; de Walque 2007; Gillespie *et al.* 2007).

Nevertheless, even after decades of the epidemic, wealth in some instances is positively associated with HIV risk. Affordability of better health choices such as ART and better nutrition have been posited to enable the wealthier to live longer with HIV/AIDS than the less fortunate poorer, resulting in a positive association with HIV/AIDS and wealth (Piot *et al.* 2001; Msisha *et al.* 2008). Given the ambiguity of the relationship between HIV infection and wealth, policy makers have been challenged to target all strata of the population to make prevention strategies effective (Msisha *et al.* 2008). Similar to wealth, several studies have discovered a positive relationship between HIV risk and urban residence, indicating urban residence as a key risk marker for HIV infection (Lopman *et al.* 2007). Urban residence is usually considered as an indicator of high SES (Wojcicki 2005; Mishra *et al.* 2007b) and reasons for its positive association with HIV infection is similar to other high SES factors including wealth and education (Wojcicki 2005; Johnson and Way 2006; Mishra *et al.* 2007b).

3.2.5. Sexual behavioural factors

Age at first sex and first marriage, multiple sexual partners and partner type

A large number of past studies have indicated having sex at an early age and early marriage as a risk factor for HIV infection (Asiimwe-Okiror *et al.* 1997; Pettifor *et al.* 2004; Zaba *et al.* 2004a; de Walque 2006b). Individuals who have early sex and marriage are more likely to have more lifetime partners, which makes them vulnerable to HIV. Women are reported to lack control over the decision to delay first sex, hence are at risk of HIV (Pettifor *et al.* 2004).

In addition, having multiple sexual partners, exchanging sex for money, self-reported symptoms of STIs and having risky sex without a condom have been shown to be positively associated with HIV risk (Green *et al.* 2006; Slutkin *et al.* 2006; Chen *et al.* 2007; Braunstein *et al.* 2009; Todd *et al.* 2009). Concurrent sexual partnerships have also been used to explain the disproportionately high prevalence of HIV and other sexually transmitted infections especially in SSA (Morris *et al.* 2009; Mah and Halperin 2010). Risk of HIV has been indicated to not only depend on the number of partners an individual has, but also on the kind of sexual partners they are involved with.

Casual partnerships, brief acquaintances, or commercial sex workers have been reported to be more risky and promiscuous given that their sexual history is unknown (Oster 2007). Such risky behaviour has been shown to be associated with work related factors, especially being a contract worker and being married but not residing with a regular sex partner. Men who live away from their wives are reported more likely to have multiple sex partners than those who live with their wives (Mbizvo *et al.* 1996; Kumwenda *et al.* 2002; Lurie *et al.* 2003) and more likely to be infected with STIs. Work related movement has been indicated to create a setting for acqusition of both HIV and STDs through disrupted sexual relationships (Buregyeya *et al.* 2008). On the other hand, women, if tested for HIV, have been reported to be less likely to engage in risky sexual behaviour, hence the importance of promoting VCT (Huchko *et al.* 2011).

Evidence of Behavioural change as HIV risk reduction strategy

Consistent with basic theories about transmission of sexually transmitted infections, sexual behaviour change by reducing the number of sexual partners, substituting away from risky partnerships, breaking up sexual networks and then reducing the chances of HIV transmission due to casual partners by using condoms, are all indicated to dramatically reduce sexual transmission of HIV in generalised epidemics (Oster 2007; Kirby 2008; UNAIDS 2011b). In the absence of a vaccine or cure, it is reported that changes in sexual behaviour, especially in SSA, are a major method to prevent transmission of HIV (Kilian *et al.* 1999; Stoneburner and Low-Beer 2004; Safren *et al.* 2007; Wabwire *et al.* 2008). However, sexual behavioural changes in Africa have been reported as extremely limited (Stoneburner and Low-Beer 2004; Oster 2007), with more responsiveness reported among the richer (Oster 2007).

HIV has been shown to be preventable if populations are willing to avoid risk (Mumoli *et al.* 2010), hence the reason for the abstinence, being faithful and condom use (ABC) strategy in many countries as a means of enforcing less risky behaviour including encouraging abstinence and faithfulness within marriage. The ABC strategy has been credited for bringing the HIV/AIDS epidemic under control in Uganda. By promoting abstinence, being faithful, and condom use, safe(r) behaviour has been identified as applicable to people in different circumstances (Cohen 2004; Shelton *et al.* 2004; Okware *et al.* 2005). Evidence of reduced number of sexual partners in recent years has been reported among men (Todd *et al.* 2009) but, several indicators have been shown to portray a temporary increase in risk taking behaviour, including an increase in casual partners with increased condom use (Oster 2007; Biraro *et al.* 2009).

On the positive side, there is evidence of an increase in reported median age at first sex for both young men and women with reported increase in the percentage of young men and women who reported primary abstinence and increased secondary abstinence for young men (Asiimwe-Okiror *et al.* 1997; Zaba *et al.* 2004a; Oster 2007). However, contrary observations have revealed increased risk taking among young women with no evidence of secondary abstinence among women (Biraro *et al.* 2009) and a small decrease in risky behaviour in response to HIV rate. There is evidence of movement away from the riskiest partner types, decrease in age of marriage, reduction of number of partners for men and a decline in HIV (Piot *et al.* 2001; Oster 2007; Todd *et al.* 2009; Gregson *et al.* 2010).

In urban Malawi, it is suggested that the reduction in the number of men with multiple partners contributed significantly to the reduction in incidence (Bello *et al.* 2011). Similarly, the recent downturns in prevalence observed in urban Kenya, Zimbabwe, and urban Haiti, like Uganda before them, have been attributed to reductions in risk associated with changes in sexual behaviour (Hallett *et al.* 2006). In contrast, evidence of prevalence trends in urban Cote d’Ivoire, Malawi, urban Ethiopia, and Rwanda have shown no signs of changed sexual behaviour (Hallett *et al.* 2006).

Uganda, Kenya, and Ghana have been shown to experience a more pronounced and unambiguous decline in premarital sexual activity with significant increases in age at first sex. Additionally, Uganda has been reported to have very short intervals between onset of sexual activity and marriage for both sexes hence reduced risky dating period (Zaba *et al.* 2004a). It is hypothesised that in places with higher HIV rates, age of marriage is expected to decrease more for recent marriage, relative to older marriages; and Oster (2007) confirmed a decrease in age of marriage for both men and women in response to HIV. Uganda has been reported to register positive changes in delay of sexual debut over time largely owing to concerted strategies targeting adolescents, youths and unmarried people (Buvé *et al.* 2001; MOH and ORC Macro 2006; Uganda UNGASS Report 2010).

Nevertheless, the practice of extramarital sex and multiple sexual partners has been reported to still be highly prevalent, prompting focus on programs that promote the ABC+ strategy to discourage infidelity. There is evidence that during 2007-2009, there were challenges to risk reduction in Uganda, particularly, apparent reversal in sexual behavior patterns especially among young people and men, including a decrease in primary abstinence, less condom use, increased multiple partners and risky sex without condom use (Mermin *et al.* 2008; Uganda UNGASS Report 2010; UNAIDS 2011b). Despite evidence of a reduction of HIV infection through condom use (Hanenberg *et al.* 1994; Laga *et al.* 1994; Rojanapithayakorn and Hanenberg 1996; Wilkinson 2002), barriers to condom use in SSA have been indicated to still exist including male partner's reluctance to use condoms regardless of HIV status, inability of female partners to negotiate condom use, and a desire to have children even among the risky group of discordant couples (Bunnell *et al.* 2005; Ngure *et al.* 2011).

3.2.6. Other Risk factors

Alcohol consumption, STI and HIV risk

Previous studies have shown alcohol consumption and risky drinking places to be associated with risk for sexually transmitted infections (STIs), including HIV (Rees *et al.* 2001; Ao *et al.* 2006; Kalichman *et al.* 2007). A study by Kalichman *et al.*,(2007) indicated greater quantities of alcohol consumption to predict greater sexual risks than frequency of drinking. Men are indicated to be more likely to drink and engage in higher risk behaviour while women's risk are shown to be often associated with their male partner's drinking, hence the importance of HIV interventions targeted at alcohol serving establishments (Kalichman *et al.* 2007).

Furthermore, heavy alcohol use has been reported to negatively impact the body's immune function, hence increased risk to HIV exposure. In addition, a combination of HIV infection and compromised immune system have been indicated to increase OI's and accelerate the progression of HIV to AIDS (Bryant 2006). Moreover, for PLWHA, problem drinking had been linked to delays in seeking treatment and poor adherence to ARVs (Berg *et al.* 2004).

Similarly, STIs like Herpes Simplex Virus (HSV) have been reported to increase susceptibility to HIV infection and increase the risk of an HIV infected person transmitting the virus to his or her sex partners through direct and biological mechanisms hence the importance of having STI treatment as part of a high quality comprehensive HIV prevention strategy (Wasserheit 1992; Fleming and Wasserheit 1999; Shah and Arunachalam In Press).

Male circumcision and HIV risk

In the last decade, three randomized controlled trials in Kenya, South Africa, and Uganda have shown that male circumcision (MC) can reduce the sexual transmission of HIV from women to men by 40-60 percent (Weiss *et al.* 2000; Auvert *et al.* 2005; Bailey *et al.* 2007; Milford *et al.* 2011). Accordingly, the World Health Organization (WHO) and UNAIDS issued a set of recommendations for the use of medical male circumcision (MMC) as an additional strategy to HIV prevention (WHO and UNAIDS 2007a; WHO and UNAIDS 2007b; Westercamp *et al.* 2011). These recommendations suggest programs should be implemented among populations where the prevalence of heterosexually transmitted HIV infection is high and the prevalence of MC is low (WHO and UNAIDS 2007b). Potential circumcision has also been shown to possibly have additional benefit of protection against STIs (Weiss *et al.* 2006).

However, given evidence of reduction of HIV incidence in circumcised men including Muslims (Gray 2004; Auvert *et al.* 2005; Bailey *et al.* 2007), there is concern that encouraging male circumcision would lead to behavioural disinhibition/risk compensation where circumcised men may engage in riskier sex; and reduce women's ability to negotiate for safer sex (Lukobo and Bailey 2007; Andersson and Cockcroft 2011; Grund and Hennink 2011). Conversely, several studies have shown no increase in sexual risk (Mattson *et al.* 2005; Gray *et al.* 2007), hence, the need to provide safe services for male circumcision as an additional HIV prevention strategy especially in areas of Africa where men are not traditionally circumcised (Weiss *et al.* 2000).

Nonetheless, it is shown that more needs to be done to raise awareness about the limitations of MC protection especially for women (Andersson and Cockcroft 2011), and to deal with constraints in the health system, especially concerning facilities, human resources and lack of knowledge to offer safe MC (Rain-taljaard *et al.* 2003; Mattson *et al.* 2005; Fieno 2008). Such constraints may deter scaling up MC in national health systems especially given evidence of high acceptance even in non-circumcising ethnic groups like the Luo of Nyanza, Kenya (Bailey *et al.* 2002; Rain-taljaard *et al.* 2003; Fieno 2008; Mshana *et al.* 2011). An estimated 2000 new HIV infections were reported to be averted through 2010 among men in Kenya's Nyanza province, after scale-up of voluntary medical male circumcision programmes (UNAIDS 2011b).

Despite being beneficial, other barriers to MC have been reported to exist and these include: circumcision not being part of the local culture affecting cultural identity, pain, delayed wound healing, sexual performance problems as well as sexual disinhibition (Waters *et al.* 2011; Westercamp *et al.* 2011). Adult circumcision is indicated to provide more immediate and rapid benefits to HIV infection than circumcision in infants and children, whose benefits are in the future and important for long term HIV prevention strategies (WHO and UNAIDS 2007b; Albert *et al.* 2011).

3.3. Methodology

Data

Individual level data from the cross sectional, population based Kenya Demographic and Health Survey (KDHS) of 2003 and the Uganda AIDS Indicator Survey (AIS) of 2004 were used to explore the risk factors that affect HIV status in women. The KDHS consists of 8,561 households and the Uganda AIS consists of 9,529 households.

The AIS and KDHS are nationally representative surveys involving 15-49 year olds for Kenya and 15-59 year olds for Uganda. Blood samples for testing HIV, HSV, and Hepatitis B were obtained. The individual test results were anonymously linked to the household questionnaire using bar-coded identification numbers. Further survey details can be obtained from CBS, MOH and ORC Macro (2004) and MOH and ORC Macro (2006).

Sample design

The sample design for the 2003 KDHS was given in section 2.3.1. For the 2004 Uganda AIS, a representative probability sample of 10,425 households was selected and an additional 12 households were added during field work to make a total of 10,437 households. The survey utilised a two-stage sample design. The first stage involved selecting clusters from a list of enumeration areas (EAs) covered in the 2002 Population Census. The second stage involved the systematic sampling of households from the census list of households in each cluster. All women and men aged 15-59 who were either permanent residents or visitors on the night before the survey of the households in the sample were eligible to be interviewed in the survey. All women and men who were interviewed were asked to voluntarily give a blood sample for testing (UHSBS 2006). Both the KDHS and AIS involved interviews using questionnaires.

Study subjects and size

The KDHS covered 8,561 households (96% response rate), 8,195 women (94% response rate) had a completed interview. A 50 percent sub-sample (every second household) of households was selected in which all eligible women and men in the selected households were asked to give their informed consent to be anonymously tested for HIV/AIDS. A total of 3,273 women (80% of intended sub-sample) had blood samples collected for HIV testing.

The Uganda AIS covered 9,529 households (96.8% response rate). All eligible men and women aged 15-59 years were interviewed and gave blood samples. A total of 10,826 (response rate 94.5%) women had a complete interview and about 94 percent of eligible women had a blood sample for HIV testing collected.

HIV testing was performed using two HIV enzyme-linked immunosorbent assay in accordance with WHO guidelines and repeat testing was carried out for specimens with discordant results. Additional information about the KDHS and Uganda AIS methodology can be obtained from CBS et al., (2004) and MOH and ORC Macro (2006).

The analysis investigates women's risk to HIV given that they have been shown to be more vulnerable biologically and, are limited by many cultural norms and roles that make them more at risk to HIV infection (Mermin *et al.* 2008; WHO 2011a).

The regions covered by the KDHS and Uganda AIS are shown in Figures B.1 and B.2 in Appendix B.

Measures

Individuals with blood results confirmed positive were considered HIV-positive; hence positive HIV status is the dependent variable. Participants who were formally married, cohabiting, and living together were considered married. Pre-primary education and no education were categorised as having no education; respondent's perceived risk of getting AIDS was considered as the risk of getting AIDS and women that indicated their occupation as professional, technical, and manager were categorised as professional women. Wealth-age interaction variables were included to explore how risk to HIV relates to wealth categories and increase in age.

List of explanatory variables

- Education attainment (no education, primary, secondary and higher; control no education)
- Professional (dummy=1 for professional occupation)
- Gender of household head (male household head)
- Age of household head in years
- Wealth index dummies (poorest, poorer, middle, richer, richest; control poorest)
- Religion dummies (Muslim, Roman Catholic, Protestant/other, No religion/other religion; control Muslim)
- Marital status dummies (never married, married, widowed, divorced; control never married)
- Risk of getting AIDS dummies (no risk, small risk, moderate risk, great risk; control no risk)
- Age group (19-20, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49; control 19-20)
- Wealth age in years interaction (Poorest*age, poorer*age, middle*age, richer*age, richest*age; control poorest*age)

- Type of residence (Urban residence)
- Region dummies (Central, Nairobi, Coast, Eastern, Nyanza, Rift Valley and Western for Kenya; and Central, Western, Kampala, East Central, Eastern, North Eastern, North Central and West Nile for Uganda: control for both Uganda and Kenya is Central) see Figure B.1 and B.2 for the regions covered for both surveys.

Empirical model

Univariate and multivariate analyses for each country were conducted to assess the factors associated with being HIV-positive. The multivariate model controlled for age, residence type, region of residence, and religion. Probit regressions were conducted using Stata 11.

The study included a comparison of Kenya and Uganda regarding risk factors that may affect HIV status in women. Factors that were analysed included demographic and socio-economic factors. A probit model (equation 3.1), was used for the analysis where the dependent variable indicated an individual's HIV status. Individuals with indeterminate HIV test results were excluded from the analysis.

$$y_i = \Phi(\alpha + x_i\beta)u_i \tag{3.1}$$

Where Φ, is the standard normal cumulative density function (CDF), x and β denote the full set of explanatory variables and regression coefficients respectively. The dependent variable is Y=1 for positive HIV status and zero otherwise.

Multivariate probit regression models were estimated for both countries. Regression coefficients and standard errors are maximum likelihood estimates accounting for clustering.

3.4. Results and discussion

3.4.1. Descriptive statistics

HIV prevalence was 8.4 percent and 6.8 percent for Kenyan and Ugandan women respectively, hence higher than the national prevalence for both countries (CBS *et al.* 2004; MOH and ORC Macro 2006). The higher prevalence rate in Kenya may be due to the Kenyan government not responding aggressively to the emerging epidemic at its onset in fear of the damage that the epidemic would do to the Kenyan tourism industry (AVERT 2009b). Uganda, on the other hand was very aggressive, especially through public awareness campaigns that helped in increasing peoples knowledge about HIV/AIDS and deal with stigma in the initial stages of the epidemic (AVERT 2009a).

Despite the relatively high prevalence rate, only 15.4 percent and 14.5 percent of the women from Kenya and Uganda respectively had ever had an HIV test prior to the survey. This emphasises what other studies have pointed out regarding the majority of PLWHA in SSA not knowing their HIV status (This has improved in recent years but 48% of women sampled in the 2008/2009 KDHS had never been tested for HIV (KNBS and ICF Macro, 2010)) (UNAIDS 2008a; AVERT 2009b). The majority of women were married (60% Kenya; 64% Uganda), a minority widowed (4% Kenya; 8% Uganda) or divorced (6% Kenya; 8% Uganda). Both countries had men as the dominant household heads (66% Kenya; 68% Uganda). Kenyan women were significantly more educated than the Ugandan women (Table 3.1).

Table 3.1: Sample characteristics of important variables (Mean (SD) or %)

	Kenya (8195)	Uganda (10826)	T-value
HIV positive[16]	8.41	6.82	2.91***
Urban residents	33.57	17.67	24.94***
Ever had HIV test	15.39	14.49	1.71*
Never married	30.09	20.78	14.56***
Married	59.50	63.67	5.85***
Widowed	4.11	7.53	10.19***
Divorced	6.30	8.02	4.60***
Male household head	66.21	68.25	2.97***
Poorest	16.79	19.10	4.13***
Poorer	15.94	20.89	8.82***
Middle	16.85	17.84	1.78*
Richer	19.13	17.89	2.18**
Richest	31.29	24.27	10.67***
No education	15.75	27.26	19.58***
Primary	53.06	54.52	2.00**
Secondary	24.10	15.15	15.29***
Higher	7.09	3.06	12.26***
Mean respondent age	28.07 (9.31)	30.00 (11.24)	12.95***
Mean household head age	41.95 (13.05)	41.89 (13.91)	0.31
Mean years of education	7.10 (4.30)	4.31 (3.82)	46.42***

*** $p<0.01$, ** $p<0.05$, * $p<0.1$; values are mean (SD) or %. For mean, ttest assuming equal means; for proportions, chi squared test.

[16] N=3271 for women tested for HIV given that half of the sample was tested for HIV unlike Uganda where all women were tested.

Table 3.2 gives the descriptive characteristics by HIV status and additionally indicates the HIV prevalence in each sub-group (figures in italics).

Considering HIV status; for educational attainment groups for HIV positive women, almost 60 percent of the HIV positive women had primary education attainment compared to 20 percent with no education and 3.5 percent with higher education for Uganda. For Kenya, 64 percent of HIV positive women had primary education compared to 7 and 6 percent for no education and higher education respectively. 38 percent of the HIV positive women were from the richest quintiles for both Uganda and Kenya; while 50 and 56 percent of the HIV positive women from Uganda and Kenya respectively were married, highlighting the risk of married women to HIV.

Generally, for both countries, professional women, women from the richest wealth quintile, widowed and divorced women, women who perceived themselves as having a great risk of getting AIDS, and women from the capital cities had high HIV prevalence, hence a potential greater risk of HIV transmission in these sub-groups. Women from Nyanza region of Kenya also had exceptional HIV prevalence of 17.2 percent and women from North Eastern Uganda had HIV prevalence of zero (since none of the women tested was HIV positive). Considering HIV prevalence and educational attainment, educated women had a higher prevalence of HIV than women with no education (8.2% for women with higher education compared to 5.0% for women with no education for Uganda; 9.85% for women with primary education compared to 3.9 for women with no education for Kenya).

Table 3.2: Comparison of variables for Uganda and Kenya by HIV status (Mean (SD) or %)

Variable	Uganda			Kenya	
	HIV +ve (N=693)	**HIV –ve (N=9467)**		**HIV +ve (N=275)**	**HIV –ve (N=2996)**
EDUCATION					
No education	20.23*** *5.04*	27.88		7.27*** *3.90*	16.46
Primary	59.68 *7.41*	54.66***		64.00*** *9.85*	53.74
Secondary	16.62 *7.69*	14.62		22.91 *8.24*	23.43
Higher	3.47 *8.22*	2.84		5.82 *7.73*	6.38
Prof	4.92 *13.49*	2.31***		5.09 *9.66*	4.38
Male head	50.22 *5.03*	69.34***		54.91*** *7.04*	66.59
Household head age	40.96 **(13.52)	41.98 (13.91)		40.03** (12.69)	41.97 (13.08)
WEALTH INDEX					
Poorest	11.40*** *4.0*	19.99		6.91*** *4.01*	17.96
Poorer	17.32** *5.62*	21.27		16.36 *7.69*	18.02
Middle	15.73 *5.95*	18.21		15.27 *7.02*	18.56
Richer	18.04 *6.8*	18.01		23.27 *10.02*	19.19
Richest	37.52*** *10.87*	22.52		38.18*** *11.77*	26.27
RELIGION					
Muslim	11.69** *5.79*	13.92		3.27*** *2.52*	11.63
Roman Catholic	41.56 *6.49*	43.85		25.82 *9.15*	23.56
Protestant-Other	45.45** *7.57*	40.64		69.45** *9.21*	62.93
No religion/ other religion	1.01 *10.77*	0.61		1.45 *7.41*	1.67
MARITAL STATUS					
Never married	7.65*** *2.54*	21.47		15.27*** *4.46*	30.01
Married	50.36*** *5.39*	64.70		56.00* *7.76*	61.08
Widowed	21.96*** *22.2*	6.40		14.91*** *30.15*	3.17
Divorced	17.03*** *14.37*	7.43		13.62*** *18.10*	5.74
RISK GETTING AIDS					
No risk	6.99*** *3.13*	15.60		21.90*** *5.18*	37.43
Small risk	12.24*** *3.66*	23.26		44.89** *9.77*	38.69
Moderate risk	45.28*** *7.72*	39.04		19.34 *10.43*	15.50
Great risk	35.49*** *10.39*	22.09		13.87*** *13.38*	8.38
AGE GROUP					
15-19	7.07*** *2.40*	21.05		9.09*** *3.42*	23.60
20-24	15.73 *6.06*	17.85		21.09 *8.48*	2089
25-29	20.20** *8.20*	16.56		22.91*** *11.75*	15.79
30-34	22.37*** *11.24*	12.93		19.64** *11.54*	13.82
35-39	13.28*** *13.28*	9.71		14.55** *11.24*	10.55
40-44	9.24 *7.85*	7.93		9.45 *8.87*	8.91
45-49	6.49 *7.40*	5.95		3.27** *4.46*	6.44
Urban residence	30.59 *12.25*	16.05		42.18 *11.82*	28.87
REGION					
Central	13.42** *9.79*	9.05		14.18 *7.47*	16.12
Kampala	16.88*** *11.72*	9.31	Nairobi	14.18 *10.99*	10.55
East Central	13.13 *7.35*	12.12	Coast	9.45 *6.77*	11.95
Eastern	7.50* *5.50*	9.44	Eastern	8.73* *6.28*	11.95
North East	6.49*** *3.52*	13.02	Nyanza	29.09*** *17.20*	12.85
North Central	13.56* *8.90*	10.16	Rift Valley	13.09* *6.35*	17.72

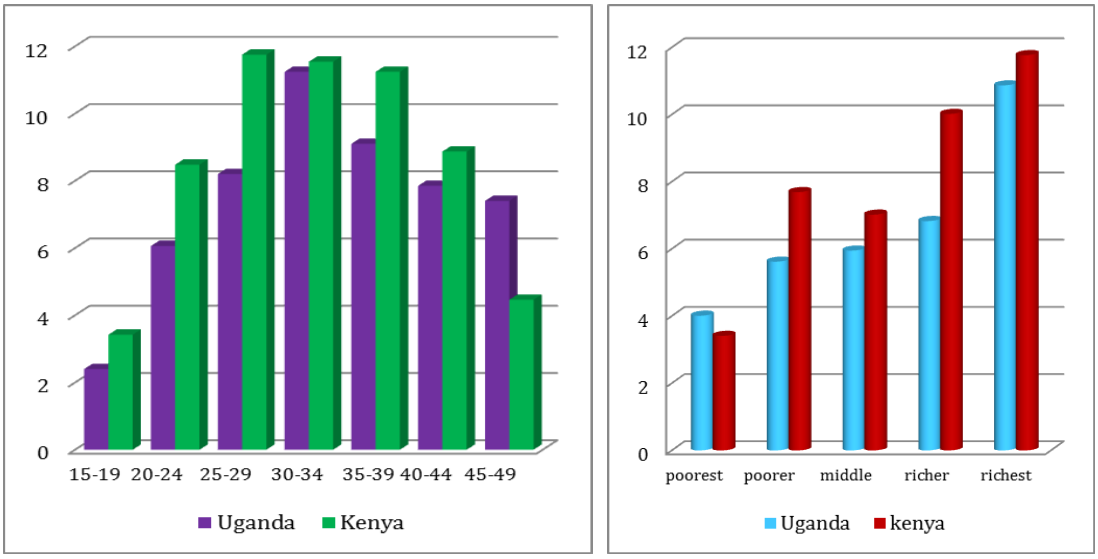
Western	12.12 *7.79*	10.50	Western	11.27 *6.98*	13.79
South West	11.40 *7.11*	10.90	North Eastern	0.00^{***} *0.00*	5.07
West Nile	5.48^{***} *2.52*	15.50			

* $p<0.10$, ** $p<0.05$, *** $p<0.01$; values are mean (SD) or %. For mean, ttest assuming equal means; for proportions, chi squared test. Figures in italics indicate HIV prevalence for each category.

Figure 3.1, indicates the percentage of women that are HIV positive by 5 year age groups and wealth categories. Kenya had a higher percentage of HIV positive women in almost all the five year age groups except the 45-49 age group; for both Kenya and Uganda, the highest wealth quintile had the highest percentage of those that were HIV positive.

Figure 3.1: Percentage of women that are HIV positive by:

5 year age group……………………………..Wealth categories



Condom use was associated with the wealthier women in both Uganda and Kenya as shown in Table 3.3– this is similar to previous research (Hargreaves and Glynn 2002; Lopman *et al.* 2007).

Condom use by women during risky sex was 31 percent for Kenya and 54 percent for Uganda, despite the huge campaign in both countries that emphasised condom use as part of the Abstain, Being faithful to one uninfected partner, and Condom use (ABC) strategy. The majority of women in Kenya (84%) had circumcised partners unlike Uganda (25%) (See Table B.1 in Appendix B). As evidenced in Table B, both countries still have low use of condoms highlighting the need for more targeted, aggressive condom promotion

(Bunnell *et al.* 2008). Moreover, cultural, social and gender roles of women limit their decision making in negotiation for safer sex using condoms (Heise and Elias 1995; Buvé *et al.* 2002; Aboud *et al.* 2010). Prevention programs in both countries must overcome women's limitations due to gender and power dynamics in couple relationships. Incorporation of women's partners in prevention strategies would attain better cooperation between sexual partners and achieve better prevention outcomes (PSI 2004).

Table 3.3: Bivariate analysis of condom use at last sex and wealth quintile for Uganda and Kenya women

Variable	**Kenya** (N=5678) Marginal Effects	P value	**Uganda** (N=7694) Marginal Effects	P value
Poorest (Control group)				
Poorer	0.036	0.019	0.025	0.049
Middle	0.034	0.029	0.019	0.157
Richer	0.060	0.000	0.045	0.001
Richest	0.109	0.000	0.137	0.000

3.4.2. Probit regression results

The probit estimates for Kenya and Uganda indicating marginal coefficients and robust standard errors are presented in Table 3.4.

Education attainment

Women with primary level education had a higher probability of being HIV positive compared to the control for Uganda. Higher education was not significant but it is worth noting that women with post-secondary, higher education had a lower probability of being HIV positive than those with no education for both countries. Education was both a risk factor (primary education) and protector (higher education) for HIV in both countries. Several studies conducted in SSA have found a positive association between education attainment partly due to more risky sexual behaviour (Bloom *et al.* 2002; Buvé *et al.* 2002; Hargreaves and Glynn 2002; Brent 2006; Pignatelli *et al.* 2006; Bärnighausen *et al.* 2007; de Walque 2007; Bunnell *et al.* 2008).

Table 3.4: Probability of HIV infection (Probit marginal effects)

Variable	Kenya	Uganda
EDUCATION (Reference group: no education)		
Primary	0.031 (0.021)	0.018 (0.007)**
Secondary	-0.003 (0.023)	0.011 (0.011)
Higher	-0.027 (0.033)	-0.019 (0.020)
Prof	0.021 (0.023)	0.031 (0.016)*
Male head	-0.011 (0.011)	-0.018 (0.007)***
Household head age	0.001 (<0.001)	0.0002 (<0.001)
WEALTH INDEX (Reference group: Poorest)		
Poorer	-0.069 (0.065)	0.040 (0.022)*
Middle	-0.126 (0.066)*	0.030 (0.023)
Richer	0.011 (0.058)	0.035 (0.025)
Richest	0.013 (0.058)	0.053 (0.023)**
RELIGION (Reference group: Muslim)		
Roman Catholic	0.077 (0.028)***	0.025 (0.010)**
Protestant-Other	0.076 (0.027)***	0.030 (0.010)***
No religion/ other religion	0.0838 (0.047)*	0.060 (0.027)**
MARITAL STATUS (Reference group: Never married)		
Married	0.031 (0.017)*	0.028 (0.012)**
Widowed	0.188 (0.027)***	0.130 (0.015)***
Divorced	0.088 (0.022)***	0.072 (0.013)***
RISK OF GETTING AIDS (Reference group: no risk)		
Small risk	0.028 (0.012)**	0.007 (0.012)
Moderate risk	0.027 (0.015)*	0.037 (0.010)***
Great risk	0.038 (0.017)**	0.050 (0.011)***
AGE GROUP(years) (Reference group: 19-20)		
20-24	0.034 (0.019)*	0.035 (0.011)***
25-29	0.048 (0.026)*	0.044 (0.011)***
30-34	0.016 (0.032)	0.062 (0.010)***
35-39	-0.010 (0.039)	0.038 (0.011)***
40-44	-0.047 (0.052)	0.035 (0.012)***
45-49	-0.133 (0.061)**	0.018 (0.013)**
Poorer*age in years	0.004 (0.002)	-0.001 (0.007)
Middle*age in years	0.006 (0.002)**	-0.001 (0.006)
Richer*age in years	0.002 (0.002)	-0.001 (0.001)
Richest*age in years	0.002 (0.002)	-0.002 (0.001)
URBAN (Reference: Rural residence)	0.027 (0.014)*	0.037 (0.010)***

REGION(Reference group: Central)				
Nairobi	0.004 (0.021)		Kampala	-0.029 (0.012)**
Coast	0.012 (0.021)		East Central	-0.017 (0.109)
Eastern	-0.011 (0.018)		Eastern	-0.032 (0.013)**
Nyanza	0.076 (0.017)***		North East	-0.043 (0.013)***
Rift valley	-0.0004 (0.018)		North Central	0.005 (0.011)
Western	0.010 (0.019)		Western	0.003 (0.014)
			West Nile	-0.054 (0.014)***
			South West	-0.014 (0.011)
Number of observations	3203			8452

* p<0.10, ** p<0.05, *** p<0.01; marginal effects reported and robust standard errors in parenthesis

Negative association between secondary education and HIV positive status has been shown to support the fact that increased educational attainment facilitates behavioural change in response to health promotion messages leading to lower risk of HIV infection. Higher education has also been associated with increased exposure to school based HIV prevention programmes, increased access to health services and later sexual debut and marriage for females (Hargreaves and Glynn 2002; de Walque 2006b).

Professional women

Professional Ugandan women were more vulnerable (3% more likely to be HIV positive) to HIV infection than non-professional women. For Kenyan professional women, this was insignificant. Professional women have risk exposure similar to wealthy women in being mobile and having wealthy sexual partners (Mishra *et al.* 2007b; Msisha *et al.* 2008).

Gender of household head

Ugandan women from male headed households were less likely to be HIV positive (male head variable insignificant for Kenya). This may be due to gender related socio-cultural norms that force women to be dependent on male partners who have rights and access to livelihood assets that enable them cope with economic shocks. Single or widowed women on the other hand face restrictions hence, lack access to such assets and are more likely forced by hardship into risky choices like transactional sex to survive, making them more vulnerable to HIV infection (Buvé *et al.* 2002; Masanjala 2007).

Wealth quintiles

Wealth was positively associated with being HIV positive for Uganda women with women from the poorer and wealthiest quintile 4 and 5 percent more likely to be HIV positive than women from the poorest quintile respectively. For Kenya, women from the middle quintile were 13 percent less likely to be HIV positive compared to women from the poorest quintile ($p=0.057$), and women from the richer quintiles were more at risk than those from the poorest quintile (though insignificant). Such wealthy women are perhaps sexual partners to wealthier men whose economic wellbeing enables them to be mobile and afford multiple sexual partners, increasing the risk of HIV/AIDS (de Walque 2006b; Johnson and Way 2006; Mishra *et al.* 2007b). Also, affordability of better health like ART and better nutrition may enable wealthier women to live longer with HIV/AIDS than poorer women, hence a positive association with HIV/AIDS (Piot *et al.* 2001; Msisha *et al.* 2008). Policies in both countries need to infiltrate not only the poor communities, but also the wealthy communities given evidence of their heightened risk to HIV.

Religion

Muslim women were less likely to be HIV positive than women from other religions for both countries (Table 3.4), perhaps due to Muslim norms such as male circumcision that has been shown to partially reduce the spread of HIV/AIDS (WHO and UNAIDS 2007a; Brent 2010).

Marital status and perceived risk

In both countries, the married, widowed and divorced women were more at risk of HIV/AIDS than the never married. Widowed women had the greatest HIV risk; 19 percent and 13 percent more likely to be HIV positive than the never married women for Kenya and Uganda respectively. Results confirm past results where women that had ever been married were more vulnerable than the never married (Auvert *et al.* 2001; Mermin *et al.* 2008). The cultural and social role of “married” women usually dictates limited control over their sex lives and sex lives of their partners outside marriage, making such women vulnerable to HIV infection (Buvé *et al.* 2002; Chiao *et al.* 2009). Individuals with increased perceived risk of getting AIDS were more vulnerable to HIV as reported in Johnson and Way, (2006).

Age group

For Uganda, women in all the other age-groups were more likely to be HIV positive than the 15-19 year control group. The 30-34 year-group had the greatest risk, 6.2 percent more likely to be HIV positive (P<0.001). Kenyan women in the 20-24 and 25-30 age-groups were more likely to be HIV positive than the control group. However, unlike Uganda, the 45-49 year-group for Kenya was 13 percent less likely to be HIV positive.

Urban residence and region of residence

Urban residence was positively associated with being HIV positive in both countries (Table 3.4), similar to other high SES factors like wealth and education.

Ugandan women from Kampala, Eastern, North Eastern and West Nile (least risk by 5.4%) regions were less at risk of HIV. Women from Central region are possibly more at risk given the transnational transport route from Kenya through Masaka and other Central region areas. On the other hand the most striking result was perhaps Kenya's Nyanza region, with women from this region having the greatest risk of HIV/AIDS; 7.6 percent more likely to be HIV positive than their counterparts from Central region. Nyanza and Central region of Uganda are similar in that they share the Lake Victoria fishing sites which have been indicated to have great risk of HIV transmission due to casual sex of migrant fishermen (Gysels *et al.* 2002).

Greater risk for HIV in Nyanza is also partly attributed to the extremely risky cultural practice of widow inheritance by the Luo people, who are mostly concentrated in Nyanza. Inheritance of a widow that has lost a partner to HIV/AIDS increases HIV risk for the new partner and his other spouses. Also, Nyanza is the main non-circumcising province in Kenya hence higher prevalence of HIV/AIDS in this region (Bailey *et al.* 2002). Recent studies have indicated high acceptance of male circumcision as a prevention strategy for HIV/AIDS in non-circumcising ethnic groups like the Luo of Nyanza (Bailey *et al.* 2002), which, will be important in reducing the high risk to HIV/AIDS in this region. The mentioned regions for Kenya and Uganda are shown in the appendix in Figures B.1 and B.2.

Wealth Age Interaction

The effect of the wealth*age interaction term is almost non-existent with only the middle*age variable significant for Kenya. However, the effect is small (<1%). Direction of the association is such that the better off and older someone becomes, the more risk there is of HIV compared to the younger and poorest reference group.

3.5. Conclusion and Implications

This chapter investigates risk factors for HIV for women in Kenya and Uganda using the 2003 KDHS and 2004 Uganda AIS data. It has been hypothesised that people from higher socio-economic status have a greater risk for HIV during the early stages of the epidemic, which translates to individuals from lower socio-economic status as the epidemic matures (Piot *et al.* 2001; Buvé *et al.* 2002; Bärnighausen *et al.* 2007; Masanjala 2007; Msisha *et al.* 2008). The HIV epidemic in Kenya and Uganda has existed for three decades, and is hence considered more of a mature than an early epidemic. However, contrary to the above hypothesis, results from this chapter indicate that women from higher socio-economic status, as proxied by wealth quintiles, education attainment, being a professional (for Uganda) and urban residence, had a higher probability of being HIV positive compared to women from lower socio-economic status. This underscores the need to take a broader perspective in HIV prevention programs in order to effectively target the different vulnerable groups in the fight against HIV/AIDS.

This chapter reveals that women from Uganda and Kenya had similar SES risk factors to HIV/AIDS. This suggests that harmonising of prevention policies that will deal with the limiting cultural and social roles of women to reduce HIV risk in both countries is vital. Furthermore, prevention policies in both countries should not regard HIV/AIDS as a *"disease of the poor"*. Mitigation measures need to be broad based and cut across all socioeconomic groups to deal with the contextual and socioeconomic, behavioural and psychological drivers of HIV risks. Also, policies to enhance condom use especially for risky sex need to be aggressively promoted to target the disadvantaged in both countries.

Notably, for Kenya and Uganda, Nyanza and Central regions need exceptional prevention policies to mitigate the high prevalence and risk of HIV/AIDS. HIV/AIDS prevention policies in these regions can include aggressive promotion of condom use especially during risky sex (which is common in fishing areas), discouraging multiple and concurrent sexual relationships; highlighting the importance of HIV risk reduction as a consequence of being faithful to one uninfected partner and encouraging male circumcision. For Nyanza, particularly, public discussions and exposure to unmask the risk of HIV infection through cultural practises like widow inheritance need to be addressed to reduce HIV transmission.

This chapter provides evidence that HIV/AIDS is multidimensional with demographic and socio-economic risk factors that can affect individuals' likelihood of becoming HIV positive. Both Kenya and Uganda have had the political will in the fight against HIV/AIDS but more needs to be done given that HIV prevalence rate is still high in both countries. Generally, prevalence rates are higher for Kenya potentially due to the delayed response of the Kenyan government at the onset of the epidemic compared to the aggressive response by the Ugandan government. One of the greatest challenges to both governments is to ensure that people use voluntary counselling and testing services to know their HIV status and seek early treatment. HIV prevention programs in East Africa therefore need to meet the unique needs of the different socio-economic and demographic groups in order to fulfil the global fight against HIV/AIDS.

Chapter 4 - The 2010/2011 Centre for Health Economics Uganda HIV Survey[17] (CUHS)

Being HIV positive is like being sentenced to death. Some people get stuck in the condemned cell and they cannot see their way out of it. But we are free to leave the cell and live a good life until the end

Hampton 1992

4.1. Introduction

Chapters 2 and 3 explore the determinants of VCT use and risk factors for HIV in women. While the previous chapters dwell on ways of reducing HIV infection, the rest of the thesis investigates aspects of people who are already infected by the HIV virus and to whom HIV treatment is crucial, referred to as Persons Living With HIV/AIDS (PLWHA). This chapter gives details of a survey of PLWHA that was undertaken by the author for her PhD in Uganda.

The survey purposively sampled from two antiretroviral therapy (ART) service providers namely, The AIDS Support Organisation (TASO) Uganda and Ministry of Health (MOH) Uganda Health Centres. TASO provides additional support in addition to ART while MOH

[17] Part of this chapter is published as a working paper, Abimanyi-Ochom, J., Lorgelly, P., Inder, B. and Hollingsworth, B. (2012). The 2010/2011 Centre for Health Economics Uganda HIV Survey (CUHS). CHE Working Paper (http://www.buseco.monash.edu.au/centres/che/che-publications.html). Melbourne, Monash University, Australia.

provides only ART.

PLWHA in Sub-Saharan Africa (SSA) consider children's school fees and nutritional support, especially with the advent of ART as one of their greatest challenge (Bailey *et al.* 2002; Tsai *et al.* 2011). Consequently, social support programmes have been established by some ART service providers to mitigate the impact of HIV/AIDS on clients through child and nutritional support, sustainable livelihoods and other discrete projects (TASO Uganda 2008; TASO Uganda 2011b). The importance of ART for PLWHA has been well articulated by the global commitment in provision of ART. ART has improved lives of people affected by HIV/AIDS (UNAIDS, 2008). However, little is known about the additional benefits of social support programs in addition to ART, therefore, the development of the 2010/2011 Centre for Health Economics Uganda HIV Survey[18] (CUHS), which was a survey developed for this PhD research.

Given the constraints faced by PLWHA, it is important to investigate whether additional support makes a difference to PLWHA. The 2010/2011 Centre for Health Economics Uganda HIV Survey (CUHS) sought to collect data to investigate this issue. The CUHS is a cross sectional survey that was undertaken in Uganda from October 2010 to January 2011. The survey's objective was to obtain information that would enable a comparison of individuals from households that have a PLWHA on ART and receiving additional support, with individuals from households with a PLWHA on ART only, with a control group of individuals from households without known persons with HIV/AIDS (non-PLWHA). Information on various household resources (labour, income, education) were collected to investigate the effect of "antiretroviral treatment packages[19]" (ARTP) on household resource allocation decisions for children and adults. The PLWHA households (households with at least one PLWHA) are further compared with households without any known PLWHA (non-PLWHA).

The allocated resources of interest include: children's labour allocation especially for child work; children's schooling, adult labour allocation especially for wage labour including investigating the gender aspect of labour allocation within the household and how the balance

[18] My PhD survey was funded by the Centre for Health Economics, Monash University; hence the survey's being named the Centre for Health Economics Uganda HIV Survey (CUHS).

[19] ARTP included ART-plus and ART-only described in detail later in the chapter.

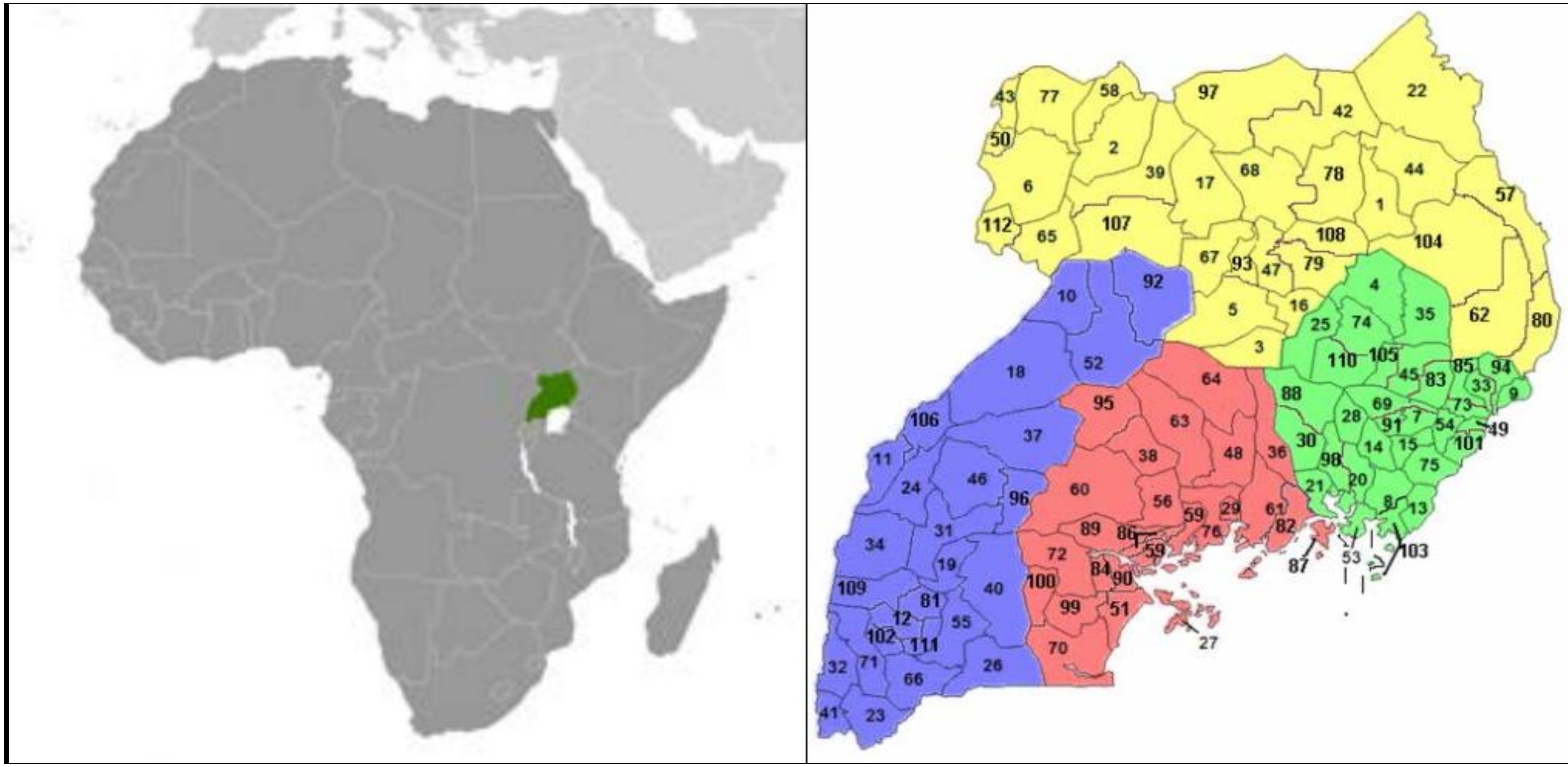
of power within the household affects wage labour supply within the household. The survey gathered information at the individual, household and health clinic level. The health clinic data includes clinical information that relates to the PLWHA including the CD4 cell count, weight at ART initiation, months on ART and WHO HIV stage at ART initiation.

4.2. Survey Design

4.2.1. ART service provider selection

The region considered for the CUHS was Central Uganda given that approximately 40 percent of ART clients reside or obtain their care from facilities located in the Central region (MOH 2008) (see Figure 4.1). Two major ART service providers were purposively selected based on their level of coverage and the nature of the services provided: TASO and MOH Health Centres (HCs), mostly HC IIIs and HC IVs (see 4.2.3 for HC definitions). MOH HCs were selected given that MOH is the major provider of ART in Uganda (ACP MOH 2010), however they only provide ART to PLWHA. TASO, on the other hand (a non-governmental organisation with considerable coverage. see Figure 4.2) provides other support in addition to ART, by way of a Social Support Program that seeks to mitigate the impact of HIV/AIDS on clients through sustainable livelihoods, child and nutritional support (Hampton 1992; TASO Uganda 2008; Russell and Seeley 2010).

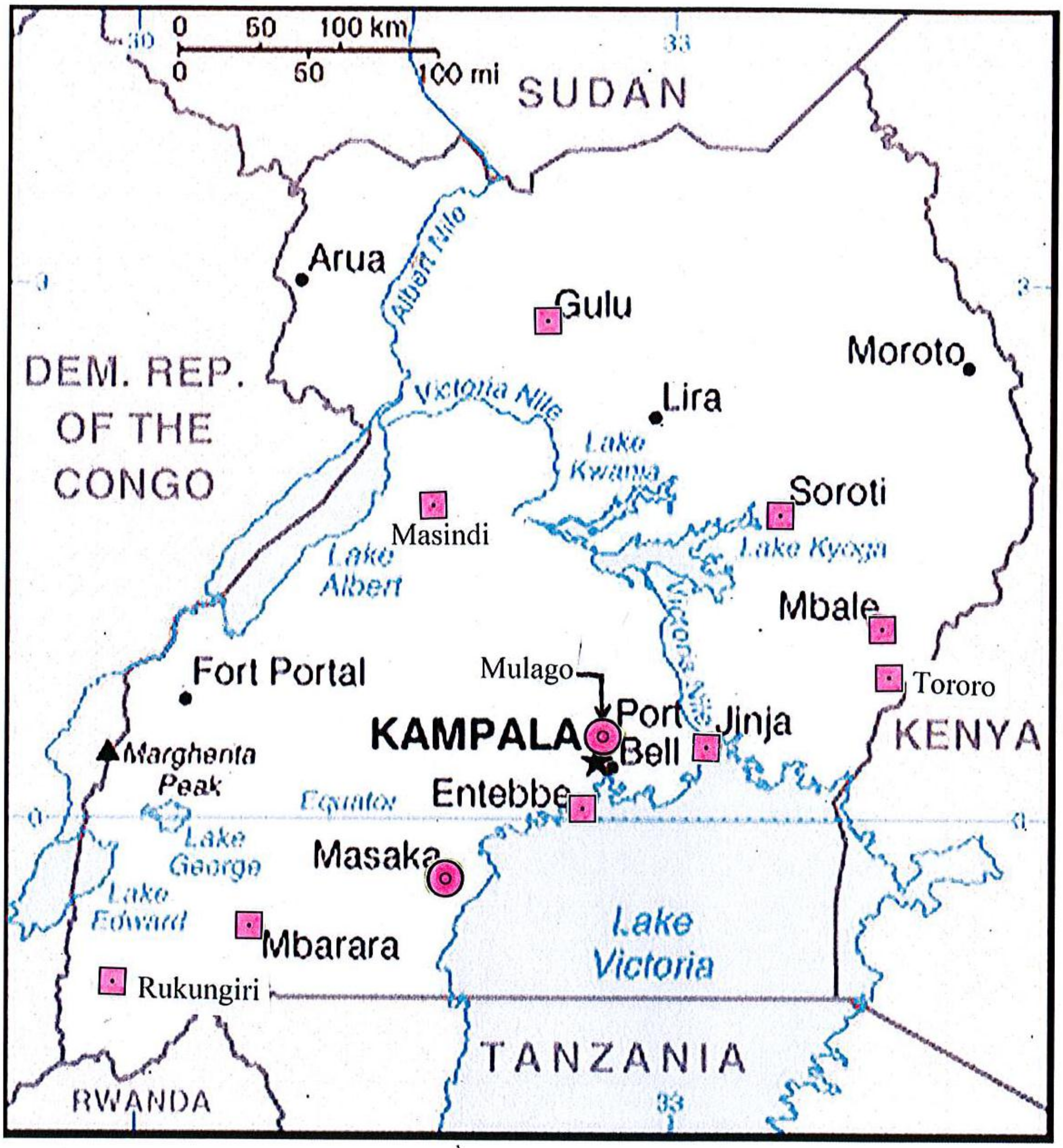
Figure 4.1: Map of Africa, indicating location of Uganda; and map of Uganda indicating the regions in Uganda



Region
Pink-Central Uganda
Green-Eastern Uganda
Yellow-Northern Uganda
Purple-Western Uganda

Source: Google images

Figure 4.2: Location of TASO Centres including TASO Mulago and Masaka where the CUHS was undertaken



TASO Centres

TASO centres covered by CUHS

Map modified by Julie Abimanyi-Ochom to include all TASO Centres and Survey locations.

4.2.2. The AIDS Support Organisation (TASO), Uganda

TASO is one of the largest indigenous non-governmental organisation providing HIV/AIDS services in Uganda, and Africa, It was founded in 1987. It cares for more than 100,000 people annually through HIV counselling, ART medical care as well as social support. TASO also supports over 5,000 orphans and vulnerable children both in school and out of school. TASO centres provide services to clients within a radius of 75 kilometres and beyond. Services provided include ART clinic services, counselling and medical home visits, ART outreach clinics and community activities (Hampton 1992; Ashton *et al.* 2005; TASO Uganda 2008; Russell and Seeley 2010; Yager *et al.* 2011). TASO clients are mostly women - TASO Masaka had 6,727 active clients in January 2011, of which 27 percent were male, 73 percent were female, with 8.5 percent being children (TASO Uganda 2011a).

Clients served by TASO face a number of challenges, children's education and nutritional needs have been highlighted (Baylies 2002). This lead to the establishment of TASO's social support programme to minimise the social problems caused by HIV/AIDS (TASO Uganda 2008; TASO Uganda 2011b). These services include home based care and health outreach clinics, social support including group income generating activities (for example group chicken rearing, goat rearing, pig rearing, vegetable gardens and heifer projects), child support and the nutritional program (TASO Uganda 2008; TASO Uganda 2011b). Home based care is a service provided to bedridden clients. TASO trained community volunteer nurses or staff provide home caregivers with adequate basic knowledge to enable provision of home nursing and emergency care. Additionally, TASO trained AIDS Community workers (ACWs) offer support to home-caregivers by providing simple nursing care, first aid, and hospital referrals (Busisiwe 2005; TASO Uganda 2008; TASO Uganda 2011b). Health Outreach Clinics on the other hand are community outreach clinics at selected sites. These are run once month to support clients who cannot afford to travel to the health centres (TASO Uganda 2011b).

Child support involves counselling the biological or dependent children of the clients and supporting them through provision of basic education, or education resources like scholastic materials and life skills training to enable them to live meaningful lives. This is referred to as Education Related Assistance in Chapter 7 and mostly includes provision of scholastic materials including exercise books, pencils and pens. TASO did have an apprenticeship program for children 14 years and older but this was halted due to funding constraints. Their nutritional program was established to ensure adequate nutrition, which is critical for maintaining and replenishing the immunity of PLWHA (Ashton *et al.* 2005; Rawat *et al.* 2010). A nutritional support contract with ACDI/VOCA was established to provide food support to 7,000 TASO registered clients in centres that have been especially affected by war or draught, mostly in North and Eastern Uganda. These include TASO centres in Gulu, Soroti and Kaberamaido districts (TASO Uganda 2008; TASO Uganda 2011b). ACDI/VOCA is an economic development organization that fosters broad-based economic growth, raises living standards and creates vibrant communities. Based in Washington, D.C, ACDI/VOCA has worked in 145 countries since 1963. For this thesis, social support is defined in terms of the additional support services provided by TASO as described above including mutual support from the TASO group income generating activities.

The CUHS sampled PLWHA from two centres, namely; TASO Mulago and TASO Masaka as shown in Figure 4.2 above. PLWHA that received social support were recruited from these centres and questionnaire-based interviews were undertaken at the PLWHA household or any location preferred by the PLWHA. Additional support for TASO Mulago clients was mostly home based care for clients that needed it, group income generating activities like piggery and poultry projects and assistance with children's education needs mostly scholastic materials. TASO Masaka had similar projects to TASO Mulago and additionally, included livelihood security programs through provision of heifers, agricultural tools, agricultural inputs and agricultural training to promote local food production (TASO Uganda 2008; TASO Uganda 2011b; TASO Uganda 2011a).

Figure 4.3: TASO Mulago-Sign and waiting area for clients seeking treatment

http://faculty.cbpa.drake.edu/root/uganda_pictures_07.htm

Source: http://www.one.org/blog/category/non-governmental-organizations/taso/

4.2.3. Ministry of Health (MOH), Uganda

The MOH provides leadership for the health sector for provision of both public and private health services in Uganda. The MOH is the largest health care service provider in Uganda, owning 75 percent of health care facilities in Uganda (GOU MOH 2010). The provision of public health services in Uganda has been decentralised with districts and sub-districts being involved in management of health services. The public health services are structured into National Referral (NRHs) and Regional Referral Hospitals (RRHs), general hospitals, health centre IVs, HC III and HC IIs (GOU MOH 2010).

The HC I's have no physical structure but consist of a team of people (the Village Health Team (VHT) which works as a link between health facilities and the community. HC II's are at the parish level operating as out-patient clinics that treat common diseases and offer antenatal care; HC III is at the sub county level, with a general outpatient clinic, maternity ward and laboratory, while HC IV is at the county level and has all the facilities of a HC III but additionally includes inpatient facilities with wards for men, women and children (Kavuma 2009; Nsereko *et al.* 2011). Ideally, each district is supposed to have a hospital (general hospital) which consists of all the facilities of a HC IV and specialised clinics for mental health, dentistry and consultant physicians. The highest level of the health care system is the NRH. Uganda has three NRHs namely, Butabika (mental health referral hospital), Mbarara, and Mulago; Mulago hospital is the largest NRH in Uganda with the greatest level of health care services (Kavuma 2009). There are 2,242 health centres and 59 hospitals in the whole of Uganda owned by the government and these provide free health services given the abolishment of user fees for public services in 2001 except for public private wings of hospitals (GOU MOH 2010).

The Government of Uganda started providing free ART services in June 2004 (MOH *et al.* 2007). Provision of ART services for public[20] health facilities is from the HCII's (0.2%), HC IIIs (5%), HC IVs (81%) and from the general hospitals, RRHs, and NRHs (100%) with services basically including ART to PLWHA. Unlike TASO which incorporates social

[20]Percentage of ART provision: HCIII-5%; HCIV-81%; General hospitals, RRH and NRH-100%

support services to mitigate the negative impact of HIV, MOH public health facilities do not have social support services (MOH 2008; ACP MOH 2010; GOU MOH 2010).

Figure 4.4: Sign Post for MOH Health Centre-Kitebi HC III

Photo: Julie Abimanyi-Ochom

Figure 4.5: Frontal view of Kitebi Health Centre III

Figure 4.6: Kitebi HC III-HIV/AIDS treatment and care section

Photos: Julie Abimanyi-Ochom

4.2.4. Endogenous treatment

TASO is one of the longest serving non-governmental organisations to provide HIV treatment in Uganda. It has built a strong reputation, based on 25 years of HIV prevention, care and support to people living with HIV/AIDS (TASO Uganda 2012a). Unlike ART centres that fall under the public health sector that have been marred by corruption and misuse of HIV related funds (Platas and Mwenda 2009; Mwesigwa 2011), TASO is known for being passionate about excellence, transparency, integrity and ensuring value for money for the funds they have received (TASO Uganda 2012a). As such, TASO has been a second principal recipient for the Global Fund grants in Uganda. TASO has determined best practice and designed concepts to provide an integrated package of services such that they are a one stop centre for HIV/AIDS. Additionally, TASO is popular for its hard working human resource base that has enabled continued client appreciation of the services offered by TASO (TASO Uganda 2012a; TASO Uganda 2012b).

As a result there is a perception that TASO offers better quality services, such that there is a high likelihood of clients self-selecting into TASO compared to MOH for this reason. This self-selection, potential endogeneity, if not taken into consideration would lead to bias due to some observable and unobservable treatment effects associated with TASO clients.

Observable effects

TASO centres are more widespread than the MOH health centres, which may imply higher transport costs and longer travelling times for TASO clients compared to MOH clients. It is likely that PLWHA accessing TASO services are less poor than those accessing services by MOH, hence a higher likelihood that TASO has wealthier and probably more educated clients than the MOH HC. Additionally, given the community perception that TASO is better equipped than public health centres, has more experience and a repetition for having dealt with HIV for a longer time period, there is likely to be a belief that sicker patients can be better handled by TASO than the MOH[21], hence the likelihood of TASO having sicker clients. Furthermore, TASO has programs that involve the PLWHA including drama groups that encourage clients to live positively with AIDS and these have been a great attraction especially to women, hence a higher likelihood that the TASO sample may have more

[21] Note that this was the perception of some of the PLWHA interviewed for the CUHS.

women than the MOH sample (TASO Uganda 2008).

Comparing PLWHA households to non-PLWHA households, there is no difference in occupation, wealth status, savings, occupation types or age. However, adults from non-PLWHA households are more likely to be married, educated and own land. Adults from non-PLWHA households are also less likely to experience shocks, are less likely to be widowed and are less likely to reside in the urban area (see Table 6.1).

Non-observable effects

The general community perception in Uganda is that non-governmental health organisations provide better services than government owned health organisations, so there is a high likelihood that clients will self-selecting into TASO to obtain better quality services (Kiguli *et al.* 2009). Also, given that TASO provides a one-stop centre for HIV/AIDS, this may attract PLWHA to TASO compared to MOH centres where some services like CD4 cell count machines are missing (TASO Uganda 2012b). Moreover, TASO has built a reputation of having greater experience in HIV care in Uganda and attracting independent funds through grants like the Global Fund, thereby creating greater client confidence in service coverage and delivery, hence greater attraction of PLWHA to TASO than MOH (TASO Uganda 2012b). The above unobservable effects of TASO may attract individuals more to TASO than MOH hence leading to bias. Therefore, the subsequent analysis of the CUHS data which compares TASO and MOH clients need to be interpreted with caution. A further discussion on how bias due to endogenous treatment is controlled for is elaborated on in the proceeding chapters. Similarly, there is also a possibility of bias due to unobservables between the PLWHA households (from TASO and MOH) and the non-PLWHA households.

4.2.5. ARTP and other treatments

The CUHS was designed to cover two main "antiretroviral treatment packages" (ARTP) namely, ART-plus, where clients receive support in addition to ART and ART-only whereas only ART is obtained for MOH clients. TASO and the MOH also care for PLWHA who do not yet receive ART (for reasons of choice or they were not yet ill enough), they are managed with Co-trimoxazole Preventive Therapy (CPT) or septrin,[22] we referred to these clients as being on the waiting list (WL). While both TASO and MOH had WL clients, the PLWHA on the WL at TASO, like their ART counterparts, received additional support, while those on the WL with the MOH did not. Thus among the surveyed PLWHA there are four groups, two from TASO: one receiving ART and additional support (TASOART), one on the WL, receiving septrin and additional support (TASOWL); and two from the MOH, one receiving ART (MOHART), one on the WL receiving septrin (MOHWL). As such there are four groups of PLWHA: TASOART, TASOWL, MOHART and MOHWL.

Study treatment levels

To provide a control for these treatment groups (ART and WL) households without a known PLWHA (non-PLWHA group) but residing in the same area as the TASO or MOH households were included. Non-PLWHA households were randomly selected according to location; the second house (household) next to or opposite every PLWHA household was approached to be interviewed, depending on availability and consent to participate in the survey. In case of absence or refusal, the next house (hold) would be approached. For every three PLWHA households interviewed, one non-PLWHA was interviewed. The survey research framework is outlined in Appendix C….

4.2.6. Selection based on rural urban divide

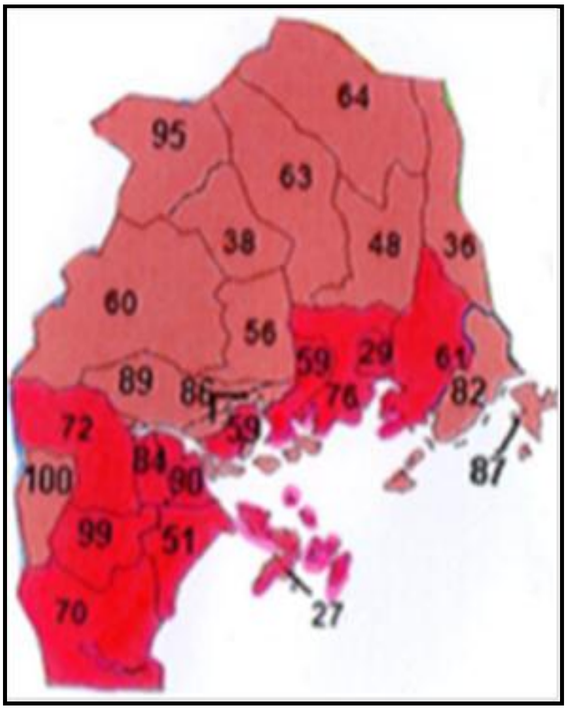
Given that most of Ugandans live in rural areas (UBOS 2006; UBOS 2010), 70 percent of the ART clinics were sampled in rural areas (24 health clinics) and the rest (10 health clinics) from the urban areas as outlined in Table 4.1.

As TASO was an identified service provider, the target rural area was the former greater Masaka region (using TASO Masaka records), while the target urban areas were communities that fell under TASO Mulago in Kampala. Individuals served by TASO through Community Drug Distribution Points (CDDPs), a common location that serves clients based on their

[22] CPT is a fixed-dose combination of sulfamethoxazole and trimethoprim, a broad spectrum antimicrobial agent that targets a range of organisms including fungi and protozoa used for the treatment of opportunistic infections of HIV/AIDS in patients. Individuals with severe adverse reaction to co-trimoxazole or other sulphur drugs are prescribed dapsone WHO (2006b). *Strengthening health services to fight HIV/AIDS:* Guidelines on Co-Trimoxazole Prophylaxis for HIV-related Infections among Children, Adolescents and Adults. *Recommendations for a Public Health Approach*. Geneva, Switzerland, World Health Organization .

residential area. MOH HCs that were in close proximity to the TASO CDDPs for both the rural and urban areas were considered for the CUHS. Figures 4.7 maps the location of the eleven districts covered during the survey.

Figure 4.7: Map of Central Uganda indicating the eleven districts where the 2010/2011 CUHS was undertaken.



Key:**Number**	**District**
27	Kalangala
29	Kampala
51	Masaka
59	Mpigi
61	Mukono
70	Rakai
72	Sembabule
76	Wakiso
84	Bukomansimbi
90	Kalungu
99	Lwengo

Map modified by Julie Abimanyi-Ochom to indicate districts surveyed for the CUHS.

Table 4.1: List of health units that were covered for the survey

TASO Health Unit Name		District	MOH Health Unit Name		District
TASO CDDPs-Urban			**MOH Centres-Urban**		
1	Makerere-Kivulu	Kampala	1	Kitebi	Kampala
2	Nankulabye	Kampala	2	Kawaala	Kampala
3	Namulonge	Wakiso	3	Mukono	Mukono
4	Wakiso-Mende	Wakiso	4	Wakiso	Wakiso
5	Mukono	Mukono	5	Kisenyi-Mengo	Kampala
CDDPs –Rural			**MOH Centres-Urban**		
1	Kiseka-Kyamaganda	Lwengo-Kyotera	1	Kyanamukaka	Masaka
2	Magato	Lwengo	2	Kiyumba	Masaka
3	Ndagwe	Lwengo	3	Butenga	Kalungu
4	Kingo	Lwengo	4	Kitovu mobile	Masaka
5	Katwe-Butego	Masaka	5	Kalangala	Kalangala
6	Kisiita	Bukomansimbi	6	Sembabule	Sembabule
7	Buwunga	Masaka	7	Ntuusi	Sembabule
8	Lukaya	Kalungu	8	Lwengo	Lwengo
9	Kibiinge-Kisojo-Maleku	Bukomansimbi-Kalungu	9	Kyazanga	Lwengo
10	Buwunga-Lambu	Masaka	10	Kalungu	Kalungu
11	Kabonera	Masaka	11	Kakuuto	Rakai
12	Bukoto	Masaka-Sembabule	12	Bukulula	Kalungu

Source: Compiled by Mugambwa Robert, the survey Team Leader

Figure 4.8: Data filing room and Sembabule HC IV waiting area

Photos: Robert Mugambwa

4.2.7. Strategy for sampling

The targeted sample size was 600 households (given the desired analyses and the constraints of the survey budget), this comprised of 75 percent PLWHA households (approximately half from TASO and half from MOH) and 25 percent non-PLWHA households. To achieve the desired sample size given the number of clinics involved (N=34) and the requirement for some PLWHA to be on either ART or septrin (again given the desired subsequent analyses desired to conduct), each clinic surveyed had to have at least nine clients on ART and five on prophylactic septrin. The average sample size for each clinic in the urban areas was 16 households, while the average sample size for each rural clinic was 19 households. To achieve the appropriate proportion of non-PLWHA households for each rural clinic five households were required, while for each urban clinic, three households were set out to be recruited and interviewed.

The complete survey covered 596 households (126 urban, 21% and 470 rural, 79%) including one child headed household from 11 districts in Central Uganda. The survey comprised of 226 households from the MOH, 224 from TASO and 146 from non-PLWHA households. The survey included 1,474 children and 1,206 adults with about 57 percent of the households having male household heads.

4.2.8. Study participants

From the TASO programme enrolment list, CDDPs that received social support in addition to ART for the last five years were considered. CDDPs that had less than 15 clients were excluded given that nine clients on ART and five on prophylactic septrin were needed for each CDDP for the study to achieve the desired sample size. In most cases, the CDDPs recorded clients on ART but not septrin. Through the CDDPs Community ART Support Agent (CASA), contact details of clients on septrin were obtained. Eligibility criteria were TASO clients that had been on prophylactic septrin for not longer than five years and had received some form of additional support from TASO. TASO clients that were eligible were invited to be interviewed.

For the MOH clients, the ART register for clients who were enrolled in the past five years was used. Selection from the list was random, conditional on clients being currently active, accessibility and having a physical address or mobile phone for easy contact. Unlike TASO, where the CASAs know where the majority of their clients are physically located, MOH staff do not have the resources to reach the clients at the community level and it is up to the clients to always make it to the HC. Therefore, once clients lose contact, the MOH staff usually cannot trace the clients back to their home, especially for those that come from areas that are distant to the HC. Some HCs remedy this by having a chairman for the PLWHA group associated with the HCs, but clients can only be identified if they choose to be a part of this group. Most of the MOH waiting list households in this survey were households that were involved with the PLWHA group or resided near the HC, that is, a convenience sample. A number were also identified through snowball sampling, by fellow PLWHA that had already been interviewed.

4.2.9. Randomisation strategy

The TASO CDDPs were purposively selected based on their having received any additional support. For the CDDPs to be considered in the survey, they needed to have at least 12 people on ART and 8 on septrin. If many CDDPs had the desired number of people, they were allocated numbers and these were randomly drawn to determine the CDDP that would be included in the survey. MOH clinics were purposively selected based on proximity to the TASO CDDPs.

A list of ART participants in each CDDP/clinic was made and numbers allocated to each name. The numbers were randomly drawn to obtain individuals for the sample. The randomly picked individuals were first checked for eligibility before they are actually confirmed to be in the sample. Children below 18 years, non-active PLWHA, having been on ART for duration of more than 5 years, and spouses of those already selected PLWHA were excluded from the sample.

4.2.10. Survey Instruments

The survey instrument consisted of two questionnaires namely; the household and clinic level questionnaires. The household level questionnaire generally looked at chronic disease treatment packages (in this case ART packages for HIV/AIDS as a chronic disease), intra-household resource allocation, and quality of life. The questionnaire consisted of thirteen main sections including demographics, access to services, children and adult activities, food and non-food consumption, presence of acute or chronic disease, EQ5D (a five item questionnaire comprising of quality of life questions on mobility, self-care, usual activities, pain/discomfort and anxiety/depression), visual analogue scale (VAS) index, ownership of assets, transfers, loans, savings, shocks and anthropometric measurement for children 18 years and younger.

The clinic level questionnaire collected information relating to the PLWHA including the CD4 cell account for the last three health clinic visits and at first diagnosis of HIV, the duration on ART, the WHO HIV stage on diagnosis and other demographic characteristics. The survey questionnaires are attached in Appendix C.1 and C.2.

4.2.11. Training and collection of data

The survey research team was supervised and coordinated by the author in Uganda. The research team consisted of six research assistants and one driver. The author led the research team and oversaw all the PhD research activities in the field. This included training the survey research team through the questionnaire for two weeks, pre-testing (or piloting) the questionnaire (one day) and making corrections and revisions (two days). The study questionnaire was finalised during the training. Household visits were carried out by the research assistants (four men and two women) who were fluent in English and at least one of the other local languages (Luganda, Runyankore, Rukiga, Runyarwanda and Kiswahili). The survey team leader with the help of the author booked the households to be interviewed a day before with the health clinic guide. The guides included clinic nurses, PLWHA volunteers, CASAs, and TASO CDDPs field officers. The clinic data was collected and entered in Microsoft Excel by Robert Mugambwa, the survey team leader.

All of the survey participants provided signed informed consent and were assured that their HIV status and identity would remain anonymous in the survey results. All participants were given an appreciation gift after completion of the survey questionnaire. The author developed the data entry template in Microsoft Access and data was entered by the data entry team headed by the team leader. The author developed a data cleaning syntax in Stata and this was used to clean the data having converted the data file from Microsoft Access to Stata using Stata converter.

4.3. Ethics Approval

The author applied for ethics to a number of organisations for this PhD research approval including Monash University (Project Number CF10/1036 - 2010000543), The AIDS Support Organisation (TASO), Ministry of Health (MOH) Uganda and the Uganda National

Council of Science and Technology (UNCST) (Reference HS 821). The research was approved by the Monash University Human Research Ethics Committee which reviews all research involving human participants and primarily considers issues that constitute integrity, respect for persons, beneficence, justice, consent, research merit and safety. In Uganda, ethics approval was obtained from the MOH, TASO and UNCST, which is the national ethics body in Uganda (Ethics Approval letters attached in Appendix C.3).

4.4. Household Wealth Index

A key explanatory variable in the analysis of household resource allocation decisions is household wealth. In this type of setting this is difficult to measure with one variable, as such a composite measure is derived. The household wealth index was constructed using principal component analysis and comprises of indicator variables including household assets (excluding ownership of land and financial assets to avoid collinearity) and utility services (Rutstein and Johnson 2004; McKenzie 2005; Vyas and Kumaranayake 2006). The components in the development of the wealth index are listed in the table below. The index was divided into thirds to represent high, average and low wealth.

Table 4.2: Components used for the Wealth Index

Particular	Aspects included
Physical Assets	livestock (local chicken, pigs, goats, cattle)
	Mortar and pestle
	Bicycle
	Charcoal stove
	Radio
	Mobile phone
	Drum
	Axe
housing characteristics	Toilet type (non ventiolated or ventilated)
	Floor type (Concrete; mud)
	Roof type (Iron sheet; grass)
	Wall type (burnt bricks; mud/wattle)
	Ligting used (candle; kerosene; electricity)
Drinking water source	Communial water pipe
	Dam/pond
	Bore hole
	Metred

4.5. Motivation for undertaking my own survey

My first interest in HIV/AIDS was triggered by my personal experience of HIV/AIDS in my family as is common in many families in SSA. I lost a maternal aunt aged 29 years old, to HIV in 1993 and had been involved in caring for her during my school holidays of primary seven and first year of secondary school when she was bed ridden. Given the lack of medication then, it was awful to watch a loved one waste away and being unable to do anything about it.

As more people became infected and died of HIV/AIDS, I was curious whether hope will ever be revived for the dying with HIV/AIDS. Thankfully, ARVs were developed and the emergence of generics made it possible for the dying to have hope and look beyond the grave.

However, through my involvement in research surveys especially in rural areas in Uganda, I discovered that despite access to ARVs, PLWHA have many daily struggles other than access to medication that deter them from benefiting fully from ARVs. Hence, my interest in intrahousehold resource allocation for households affected with HIV/AIDS, accounting for treatment and, given access to social support or not. This was the conception of my PhD research and hence my undertaking of primary data collection to try and answer the question of how additional support in additional to ART can impact on household resource allocation. Available secondary data sources failed to capture this adequately. I believe that going beyond medication is important if we are to maximise benefits from ART for communities and families affected by HIV/AIDS.

4.6. Analysis in subsequent chapters

The subsequent chapters use data from the CUHS to explore different aspects relating to People living with HIV/AIDS (PLWHA). Chapter 5 compares PLHWA from TASO or MOH to explore whether social support in addition to ART gives better outcomes. Chapter 6 explores children’s resource allocation by comparing child work for children residing in households with a PLWHA and households without a known person living with HIV/AIDS (non-PLWHA). Chapter 7 examines the relationship between formal assistance given to PLWHA households and schooling outcomes of children from such households. Additionally, Chapter 7 explores the association between the antiretroviral package (ARTP) and schooling outcomes. Finally, Chapter 8 investigates the relationship between ARTP and adult labour hours for individuals; males and females; and couples.

Chapter 5 - Does social support in addition to ART make a difference? Comparison of TASO and MOH PLWHA[23]

Struggling with ARVs amid food shortage

"**I only take whenever I get what to eat**. You see these **drugs are too strong,** so if you take them **without food you get weaker**. But there are days when **I'm forced to take drugs** even without having anything to eat; especially **when I get seriously sick**".

"During days that I do not take the medicine, I feel too weak. I have even started developing some complications, which I believe are a result of my inconsistency in taking the drugs".

"I am afraid that this boy may have his life shortened due to lack of enough food because I no longer have enough breast milk to feed him. I struggle to feed him on cow's milk which is also very scarce".

Sarah Arawo, age 36, mother of eight, lost ninth child immediately after birth, tested HIV+ve 2006, on ARVs since Oct 2007
Source: Monitor Online News, October 2009 and (Malinga and Ford, 2009)

"Taking antiretroviral drugs on an empty stomach is like digesting razor blades"

AVERT 2011

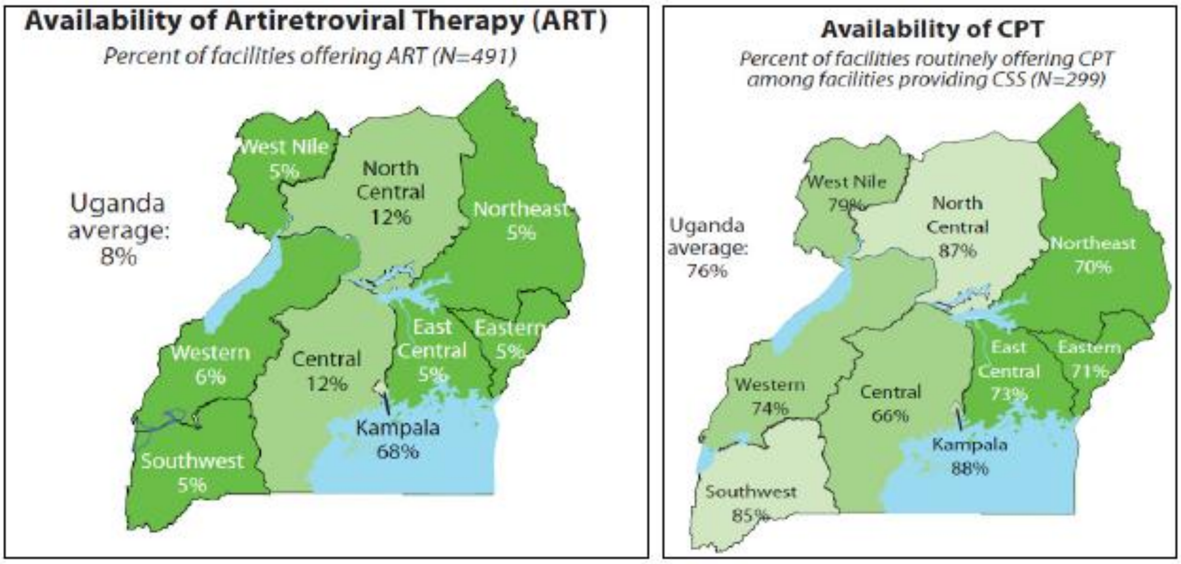
[23] Part of this chapter is under review as a paper to AIDS Care Journal, and the paper was presented at the 34th African Studies Association of Australasia and the Pacific Conference at Flinders University, Adelaide (December 2012).

5.1. Introduction

The previous chapter describes the 2010/2011 Centre for Health Economics Uganda HIV Survey (CUHS) which surveyed households with Persons Living With HIV/AIDS (PLWHA) that accessed ART services from The AIDS Support Organisation (TASO) and Ministry of Health (MOH). In addition to antiretroviral therapy (ART), TASO clients receive additional support as detailed in Chapter 4. This chapter investigates whether; obtaining such additional support, in addition to ART is beneficial to households of clients who receive additional support. However, not all HIV/AIDS clients are eligible for ART (MOH *et al.* 2007). The WHO 2006 guidelines recommended initiating ART at CD4 cell count of ≤200cells/mm^3 or at WHO defined clinical stage 3 or 4 irrespective of the CD4 cell count (WHO 2006a). However, given evidence of reduction in disease progression with early initiation of ART, the WHO revised ART initiation at CD4 cell count ≤ 350 cells/mm^3 (WHO 2010). This revision is indicated to increase the people on ART by 49 percent, increasing the cost and ART exposure, and reduce HIV related mortality by 20 percent (WHO 2010).

In Uganda, national guidelines for initiation of ART are based on the level of HIV immune suppression as assessed by WHO HIV stage (presence or absence of certain HIV-related symptoms) or a CD4 cell count (MOH *et al.* 2007). Hence, initiation of ART in Uganda is recommended at CD4 cell count of 200cells/mm3, and individuals with CD4 cell count greater than 200cells/mm3 but less than 350cells/mm3 are usually given prophylactic septrin (CPT) to minimise opportunistic infections while their CD4 cell is monitored (MOH 2008). Figure 5.1 indicates the availability of ART and CPT for different regions in Uganda. As expected, availability is highest in Kampala, the capital, at 68 percent and 88 percent for ART and CPT respectively (MOH *et al.* 2007).

Figure 5.1: Availability of ART and CPT[24] in Uganda



Source: MOH *et al.* 2007; CSS is Care and Support Services

The importance of the global commitment to making ART available in resource poor countries have started to be realised, with the number of people receiving ART increasing more than 10 fold in only six years, reaching three million by the end of 2007 (UNAIDS 2008a). ART has saved lives, improved quality of life and contributed to rebuilding of households, communities and entire societies (MOH *et al.* 2007; UNAIDS 2008a). In 2009, an estimated 33.3 million people globally were living with HIV/AIDS, there were 2.6 million new infections including 370,000 children and 1.8 million HIV related deaths. Sub-Saharan Africa (SSA) remains the region most heavily affected by HIV; accounting for 67 percent of all PLWHA, 70 percent of new infections and 72 percent of AIDS deaths in 2009. WHO and UNAIDS estimated that 14.6 million people were in need of ART in 2009 and 5.25 million people in low and middle income countries like Uganda had access to ART by the end of 2009 (UNAIDS 2010).

5.2. Influence of Social support

The impact of HIV/AIDS goes beyond the individual PLWHA and affects the lives of the family, friends and communities of the infected person (Lyons 1997; Zaba *et al.* 2004b; Jayne *et al.* 2005). PLWHA are limited by physical, social and economic constraints to meet their

[24] Co-trimoxazole Preventive Therapy (Septrin)

health and other essential needs including children's education (Bazant and Boulay 2007; TASO Uganda 2008; Nyanzi-Wakholi *et al.* 2011; TASO Uganda 2011b). Consequently, social support programmes have been established by some ART service providers to reduce the impact of such challenges to PLWHA households (AVERT, 2011; TASO Uganda, 2008).

Provision of social support to PLWHA has been indicated to lead to better medicine adherence (Edwards 2006; Knowlton *et al.* 2006; Luszczynska *et al.* 2007; Amico *et al.* 2009; Beyene *et al.* 2009) which increases resistance to infection and improves body energy, hence making PLWHA stronger and more productive (Gonzalez *et al.* 2004; Ashton *et al.* 2005; Luszczynska *et al.* 2007; Malinga and Ford 2009). Additionally, social support to PLWHA has been indicated to improve the quality of life of the PLWHA, their families and the communities they are involved with (Okero *et al.* 2003; Gonzalez *et al.* 2004; Luszczynska *et al.* 2007; Reich *et al.* 2010; Yadav 2010; Ilebani and Fabusoro 2011).

Furthermore, community based care has also been shown to lead to better adherence and improvement in wellbeing of PLWHA, which intensifies their efforts and therefore make them more productive (Johnson and Khanna 2004; Koenig *et al.* 2004; Ilebani and Fabusoro 2011). Community based support has also been shown to use a grass root approach which reaches clients at the lowest level of the community, which helps reduce stigma in communities and enhances testing for HIV (Johnson and Khanna 2004). Given the evidence of benefits of additional support, UNAIDS recognised the value of such support in 2001, calling for strategies to strengthen community based support to people with HIV/AIDS (UNAIDS, 2002. Report on the Global HIV/AIDS Epidemic in (Bazant and Boulay 2007) and advocated for expanding services to PLWHA through community based organisations (Sidaction *et al.* 2005).

Additional support in the form of nutritional support has been shown to enhance quick recovery from an illness and hence reduce the family's burden of caring for the sick and loss of earnings due to inability to work (WHO and FAO 2002). Nutritional care and support has also been indicated to promote well-being, self-esteem and a positive attitude for PLWHA and their families (WHO and FAO 2002). As a result, the benefits of support for TASO clients are expected to accrue not only to the individual, but also to the household of which the PLWHA is a member (Gonzalez *et al.* 2004; Byron *et al.* 2008; Ilebani and Fabusoro 2011).

Past studies have consistently linked social support to improved health outcomes (Cohen, 1985) especially for perceived social support but there is limited literature on the association between received social support and physical health outcomes (Barrera, 1986; Holt-Lunstad, Smith, & Layton, 2010; Uchino, 2009). Additionally, some of the earlier studies have investigated social support as social relations from family, friends and community ties (House, Umberson, & Landis, 1988; Taylor, 2011) rather than as formal from institutions like TASO (Hogan, Linden, & Najarian, 2002). This chapter aims at exploring the association between received social support (from TASO formal support) and physical health outcomes. Households with a PLWHA benefiting from TASO ART and social support are expected to have superior physical health outcomes than households with a PLWHA from Ministry of Health (MOH) ART without formal received social support.

5.3. ART service providers in Uganda: case of TASO and MOH

5.2.1. The AIDS Support Organisation (TASO)

As detailed in Chapter 4, TASO is one of the largest providers of HIV/AIDS services in Uganda. Clients served by TASO face a number of challenges with children's education and nutritional needs (Baylies 2002) hence, the establishment of TASO's social support programme to minimise the social problems caused by HIV/AIDS (TASO Uganda 2008; TASO Uganda 2011b). Further details of TASO services are described in Chapter 4.

TASO's provision of additional support is delivered mainly in two formats; at the individual level and group level. For group delivery, clients are required to form groups of five or more people and the additional support is offered to the group. Such assistance includes provision of income generating assets like pigs, goats and cattle. In some cases, it may involve provision of agricultural inputs like improved seed for vegetables, which can be cultivated by the group and the produce sold to give the group members income.

On the other hand, most of the support given for children's needs and home based care support is mostly at the individual client level. Children's support includes scholastic materials such as books and pencils; help with tuition fees for client's children; and nutritional support by provision of a monthly food basket to the TASO client. Details of additional social support offered by TASO are outlined in Chapter 4.

5.2.2. Ministry of Health (MOH), Uganda

The MOH is the government department that leads health services in Uganda including provision of ART as detailed in Chapter 4. Unlike TASO that provides additional support, the MOH health centres majorly provides ART to its clients. MOH centres, as public health centres are plagued by a number of problems that limit health service provision. Most of the government health centres including the most popular National Referral Hospital, Mulago, are underfunded. This makes provision of basic utilities such as water and electricity unachievable, and provision of basic drugs impossible (GOU MOH 2010). With the MOH centres struggling to just survive, the provision of additional support for patients receiving HIV care may seem a distant priority. Allocation of resources is usually to critical areas of health care like maternal and child health, malaria and ART (GOU MOH 2010).

Besides, provision of additional support for the MOH centres would probably be handled by the procurement and supplies system. However, this has been affected by bureaucracy which leads to delays in procurement and has been responsible for expiry of essential drugs leading to losses of up to 4.8 billion Uganda shillings (Platas and Mwenda 2009; Mwesigwa 2011). Worse still, the procurement system and MOH has been overwhelmed by corruption which has led to disappearance of drugs, leaving the intended health centres in dire need (Mboizi 2008). The lack of a comprehensive monitoring and evaluation system in the Uganda MOH (GOU MOH 2010) has led to huge losses of funds (for example in 2005, 150 billion Uganda Shillings from the Global Alliance for Vaccines and Immunisation (GAVI) and the Global Fund disappeared through corruption (Mwesigwa 2011)). As a result, resources are diverted to other unplanned uses leaving the sector in a poor state. Lacking a proper channel in which implementation of projects can be undertaken makes it difficult to undertake projects within the MOH.

Finally, given that the MOH owns 75 percent of health care facilities in Uganda, supervision and monitoring of projects would be a challenge given resource constraints and reported high levels of corruption (GOU MOH 2010; Mwesigwa 2011). The MOH has other overarching problems like poor quality infrastructure, understaffing, lack of drugs and an already limited health budget, limiting the feasibility of provision of additional support to their centres.

5.4. Methods

5.4.1. Data

The data for this analysis is a sub-sample from the 2010/2011 Centre for Health Economics Ugandan HIV Survey, a cross sectional survey that was undertaken in central Uganda. The detailed description of the survey methodology is outlined in Chapter 4. The data comprise of 450 households, 224 from TASO and 226 from MOH covering a total of 908 adults; 482 from TASO and 426 from MOH. The analysis seeks to explore whether individuals from a household with a TASO client (henceforth referred to as TASO household) are superior in terms of physical health outcomes compared to individuals from a household with a MOH client (referred to as MOH household). The non-PLWHA sample is not included in this analysis.

Multivariate regression analysis is employed with either a probit or ordinary least squares (OLS) model (depending on the nature of the dependant variable) controlling for a number of confounding variables.

5.4.2. Dependent Variables

The physical health outcomes are investigated directly in terms of the occurrence of a chronic or acute disease; and indirectly as better health which translates to higher productivity as measured by more hours of non-wage work (which is not limited by work), and better productivity also leading to better income (measured as cash at hand in Uganda Shillings and a dummy for the presence of household savings). (The outcome variables in the analysis include;

- Direct physical health outcomes
    - whether an individual had a chronic disease (1 if yes and 0 otherwise)
    - whether an individual had an acute disease (1 if yes and 0 otherwise)
- Indirect physical health outcomes through productivity
    - Individual non-wage labour hours per week (hours).

- whether a household had savings (1 if yes and 0 otherwise)
- Household total cash at hand (Uganda shillings)

The outcomes are compared for individuals from TASO and MOH households.

5.4.3. Explanatory Variables

The main explanatory variable is whether an individual is from a TASO or MOH household (Control MOH).

Other explanatory variables include following;

- Age and gender of the individual (age in years; male=1)
- Individual years of education (years of education)
- Whether the household resides in the urban area (urban=1)
- Marital status of the individual (married if monogamously or polygynously married; separated/divorced; widowed; single: -Control married);
- Education attainment of the household head (no education if years of education are less than 7; primary education attainment if at least 7-11 years of education were completed; secondary plus education attainment if at least 12 years of education were completed: -Control no education)
- Household composition (number of children less than 6 years in the household; number of children 6-18 years old; number of individuals in the household)
- Occupation of the individual (agricultural related, non-agricultural related and [25]other occupation)
- Number of assets
- Household savings (Savings-1)
- Whether a household received assistance or not (1 if household received informal assistance from family, friends, neighbours or informal community groups including gifts, transfers, loans or any kind of help).
- Individual health (whether had an acute disease; or whether had a chronic disease)

[25] Other occupation includes being a housewife, doing housework, being a student, being too sick to work and being a village elder

5.4.4. Regression model

A probit model is used to explain chronic and acute disease, the existence of savings, health and income shocks while OLS is used for the other outcomes (cash at hand and non-wage labour per week). The general probit and OLS models are given below.

Probit model

$$y_i = \Phi\ (\alpha + x_i\beta) + u_i \tag{5.1}$$

Where Φ, is the standard normal cumulative density function (CDF), x and β denote the full set of explanatory variables and regression coefficients respectively. Probit analysis is undertaken for the occurrence of an acute or chronic disease and having savings. Marginal effects and standard errors are adjusted for household level clusters. Regressions are conducted using Stata 11.2 (2009 StataCorp).

OLS model

$$y_i = \beta_0 + \mathrm{X}_1\beta_1 + \cdots + \mathrm{X}_k\beta_k + \mu \tag{5.2}$$

Where y_i are the dependent variables including individual non-wage labour hours per week and household total cash at hand. The Xs are linear regressors, βs are the coefficients and μ is the error term. Variables that had very few observations were dropped for the analysis and this included household heads who are single.

5.5. Results and Discussion

Descriptive statistics summarising the TASO and MOH samples are presented in Tables 5.1 and 5.2. The regressions table (Table 5.3) has different sample sizes given the variation in the number of missing values for the different variable used in the analysis. Descriptive statistics show that 43 percent of the adults had a chronic disease (other than HIV/AIDS) in the six months prior to the survey, 42 percent and 10 percent had experienced a health shock and income shock respectively and 21 hours per week were spent on non-wage labour.

Comparing the sample characteristics for TASO and MOH households is one way of addressing the endogenous treatment problem for the observables. As shown in Tables 5.1 and 5.2, TASO households have significantly more cash at hand than the MOH households. There were no differences between TASO and MOH households for the other outcome variables. However, for education years, adults in TASO households have significantly more years of education than their counterparts from MOH households (7.01 compared to 5.77 years), individuals from TASO households are less likely to be married, more likely to be widowed and more likely to have more stock of wealth than individuals from MOH households. Therefore, widows/widowers, the better off in terms of cash at hand and the more educated are more likely to self-select into TASO compared to MOH.

Table 5.1: Sample characteristics of Adults' (>18 years) outcomes and individual level factors (mean (SD) or %)

Outcome Variable	Overall Sample	TASO	MOH
Chronic disease	43.06	43.36	42.72
Acute disease	32.41	30.77	34.27
Savings	23.61	26.79	20.44
Household cash at hand	386,459 (570,107)	445,696* (683,003)	325,500* (415,859)
Non-wage labour per week	21.19 (19.91)	21.86 (21.56)	20.43 (17.89)
Adult individual characteristics			
Age in years	37.42 (13.56)	37.34(14.14)	37.51(12.88)
Education years	6.43 (4.28)	7.01*** (4.42)	5.77*** (4.02)
Married	39.10	29.88***	49.53***
Single	23.68	30.50***	18.99***
Separated/divorced	14.21	12.45	15.26
Widowed	23.02	27.18***	18.31***
Main occupation other	15.97	17.84	13.85
Agricultural occupation	63.77	64.73	62.68
Non-agricultural occupation	19.71	16.60**	23.24**
Male	35.13	35.27	34.98
Stock of wealth	262,409 (705,809)	336,910**(850,698)	161,374** (421,124)

***p<0.01, **p<0.05, *p<0.1; values are mean (SD) or %. For mean, ttest assuming equal means; for proportions, chi squared test.

Table 5.2: Household level sample characteristics (Mean (SD) or %)

Household factors	Overall Sample	TASO	MOH
Head age	43.91 (10.85)	45.57*** (10.5)	42.26*** (10.97)
Head male	41.33	33.04***	49.56***
Head married	38.44	29.91***	46.90***
Head separated	18.22	15.63	20.80
Head widowed	40.89	52.23***	29.65***
Head single	2.44	2.32	2.65
Head monogamous	32.89	24.55***	41.15***
Head polygynous	5.56	5.36	5.75
Head-agricultural occupation	75.33	82.59***	68.14***
Head non-agricultural	21.78	16.07***	27.43***
Head other occupation	2.89	1.34*	4.42*
Head education years	5.41(3.53)	5.73* (3.48)	5.09* (3.56)
Head no education	30.67	23.21***	38.05***
Head primary education	52.67	54.91	50.44
Head secondary plus	14.89	20.98***	8.85***
Number of females	3.08 (1.84)	3.38*** (1.85)	2.77*** (1.77)
Number of males	2.37 (1.60)	2.50* (1.58)	2.23* (1.61)
Household number	5.44 (2.69)	5.88*** (2.65)	5.01***(2.68)
Number of children	3.24 (2.22)	3.49** (2.18)	3.00** (2.23)
Number children<=5 years	0.85 (1.01)	0.83 (1.02)	0.87 (1.00)
Number children 6-18 years	2.56 (1.97)	2.89*** (1.89)	2.24*** (2.00)
Experienced shock	86.86	85.27	88.44
Urban residence	27.11	27.23	27.00

***p<0.01, **p<0.05, *p<0.1; values are mean (SD) or %. For mean, ttest assuming equal means; for proportions, chi squared test. Head is household head

5.5.1. Regression results for TASO and MOH households

The analysis reveals that individuals from TASO households are 6 percent more likely to have had a chronic disease than individuals from MOH households - contrary to our hypothesis of expecting them to be less likely to have a chronic disease (Table 5.3-model 1). TASO households had significantly more cash at hand (143,871.7 UGX (57.55 USD)), hence possibly better wellbeing, (Table 5.3-model 4) and undertook almost three more hours of non-wage labour per week compared to individuals from households that had MOH clients (Table 5.3-model 5). There was no difference in outcomes of having had savings and occurrence of an acute disease for TASO households relative to MOH households (Tables 5.3-models 2 and 3).

5.5.2. Explanatory variables

Being male is associated with better health outcomes (16% and 10% less likely to have had a chronic or acute disease respectively), and undertaking fewer household non-wage labour hours per week (16 hours less per week). Fewer hours correspond to the gender roles of men in SSA which usually exclude household domestic work hence less household non-wage labour hours for men, which inevitably means more working hours for women (de Lange 2009).

Individuals from households with more dependent children are likely to have greater non-wage labour hours; 5 hours and 2 hours per week for a greater number of children less than six years and a greater number of children 6-18 years respectively, as expected from previous studies, given that dependants have been shown to increase household chores which constitute most of the non-wage labour (Gornick and Meyers 2003; Baxter *et al.* 2008).
A larger household (that is more members) is associated with better health outcomes but a lower likelihood of having savings and less hours of non-labour wage. This is similar to Webbink *et al*., (2010) finding that individuals from extended families work less housework hours.

Adults whose main occupation is agricultural or non-agricultural are more likely to have savings compared to individuals with other occupation. Interestingly, urban residence is associated with poor health outcomes despite better access to health services (Johnson and Way 2006; Chamla *et al.* 2007). Widowed household heads are found to have less cash at hand (-170,805 UGX (68.32 USD)) compared to married household heads. This is similar to earlier studies that indicated single headed households to be more disadvantaged economically, as compared to non-single headed households (Mueller and Cooper 1986; Lichter *et al.* 2003). Confirming earlier findings (Glewwe and Hall 1998), educated household heads (secondary-plus) have better income; are 9% more likely to have savings, and have and 67.5 USD more cash at hand; primary educated headed households also have more cash at hand (44.6 USD) than uneducated headed households.

Table 5.3: Multivariate regression results – Physical Health Outcomes

Outcome	Physical Health outcomes				
	(Direct)		(Indirect)		
Variable	(Model 1) Chronic (ME)	(Model 2) Acute (ME)	(Model 3) Savings (ME)	(Model 4) Household‡ Cash at hand§	(Model 5) Non-wage labour‡ (hours per week)
TASO (Ref: MOH)	**0.060***	<-0.001	0.017	**143,871.7****	**2.546***
	(0.034)	(0.032)	(0.023)	(73,005)	(1.399)
Male	-0.157***	-0.102***	0.025	-26533.2	-15.902***
	(0.030)	(0.033)	(0.023)	(37,339)	(1.260)
Age	0.008***	0.002	0.001	-1138.7	-0.129***
	(0.001)	(0.001)	(0.001)	(1,275)	(0.047)
Number of children <6 years	0.017	-0.004	0.029*	14,892.9	5.041***
	(0.024)	(0.023)	(0.016)	(51,334)	(1.114)
Number of children 6-18 years	0.036*	0.026*	0.040***	-7,818.0	2.090***
	(0.019)	(0.015)	(0.013)	(50,311)	(0.659)
Household number	-0.045***	-0.036***	-0.033***	-1,840.0	-2.700***
	(0.016)	(0.013)	(0.011)	(42,172)	(0.608)
Agricultural (Ref: Other-occupation)	-0.037	0.034	0.214***	-3,753.3	7.803***
	(0.050)	(0.050)	(0.057)	(66,023)	(2.685)
Non-agricultural occupation	0.058	0.017	0.243***	129,199.9	3.236
	(0.056)	(0.056)	(0.060)	(85,170)	(2.673)
Urban residence	0.064*	0.087**	0.049**	-79,032.3	7.802***
	(0.038)	(0.035)	(0.025)	(84,089)	(1.770)
Years of education	-0.007	-0.003	0.013***	9,917.4	-0.022
	(0.005)	(0.004)	(0.003)	(7,299)	(0.200)
Head separated (Ref: Married)	-0.084*	-0.066	-0.050	-128,029	-0.350
	(0.050)	(0.047)	(0.035)	(85,879)	(2.106)
Head Widowed	-0.104***	-0.036	-0.037	-170,805.2**	-0.702
	(0.036)	(0.035)	(0.026)	(79,124)	(1.387)
Head primary (Ref: No education)	-0.046	-0.005	0.035	111,486.2**	-1.159
	(0.042)	(0.041)	(0.029)	(56,088)	(1.678)
Head secondary-plus	-0.012	-0.053	0.091**	168,668.4*	-0.394
	(0.059)	(0.061)	(0.042)	(97,494)	(2.371)
Savings	0.073	-0.029			3.957*
	(0.046)	(0.048)			(2.128)
Number of assets	0.046***	0.028**	0.029***	39,541.2*	-0.312
	(0.013)	(0.012)	(0.007)	(21,008)	(0.468)
Received assistance	0.067	0.068*	0.020	88,899.8	-4.078**
	(0.046)	(0.041)	(0.028)	(74,927)	(1.828)
Acute disease			-0.005	-80,159.1**	1.955
			(0.023)	(36,759)	(1.271)
Chronic disease			0.039*	-118436.7**	5.760***
			(0.022)	(53,761)	(1.343)
N	892	891	891	765	884

$^{***}p<0.01$, $^{**}p<0.05$, $^{*}p<0.1$; ME is marginal effects; Ref is reference group; marginal effects reported for probit model; clustering at household level; ‡ shows OLS regressions; § in Uganda Shillings (UGX), (1USD=2500 UGX); Head refers to household head.

The number of assets (a proxy for wealth) is negatively associated with better health outcomes (which is puzzling given the wealthier healthier hypothesis) and positively associated with better income (productivity) as expected. Having a chronic or acute disease is negatively associated with cash at hand, possibly because of the demands of treatment or reduced productivity due to being unwell (WHO and FAO 2002; UNDESA 2004). Receiving any form of informal assistance reduces housework by 4 hours per week and this may free up women's labour for more productive work, given that it is mostly women that are involved in housework (Hersch and Stratton 1994; World Bank 2006; de Lange 2009).

5.6. Conclusion and Implications

This chapter has investigated whether the benefits derived by TASO households (who received additional support as well as ART or septrin) are superior to the outcomes of MOH households (who receive only ART or septrin). OLS and probit models on a sub-sample of the CUHS data were used to investigate physical health outcomes (directly and indirectly). The findings from this chapter extend the discussion on the effect of social support to PLWHA given that additional support has been shown to lead to better health outcomes for PLWHA (Adato & Bassett, 2008; WHO, 2003). The results give mixed evidence as to whether TASO households are better off. In terms of non-wage labour allocation and household cash at hand they benefit more, but in terms of having a chronic disease, they are found to be at greater risk. The greater likelihood of TASO clients having a chronic disease may be due to the fact that sicker PLWHA, (who are more likely to have a chronic disease) self-select into TASO, given the perceived better treatment for HIV offered by TASO compared to MOH.

The findings suggest that additional support to TASO PLWHA possibly makes them better off in terms of productivity (and quality of life), which translates to the household as greater non-wage labour allocation hours and cash at hand. This implies that ART service provision may need supplementation with other services for PLWHA to maximise the benefits from ART (Ashton *et al.* 2005; Rawat *et al.* 2010). Furthermore, given that some outcomes were indifferent; this may be an indication that the mode of providing additional support for TASO clients may need revision to be more effective. It is possible that better (indirect) physical health outcomes will be realised at the household level if additional income generating assets are delivered to the individual household of the PLWHA rather than to a group of PLWHA (Roopnaraine *et al.*

2011). Alternatively, the challenge would be to develop strategies that would ensure proper nutrition for individual clients given that nutritional support has been proven to directly improve health outcomes in PLWHA (Rawat *et al.* 2010; Sztam and Ndirangu 2010; Yager *et al.* 2011). PLWHA have higher energy requirements and hence patients on ART have complained about the fact that the ART drugs make them eat a lot more (given specific nutritional and health care needs of ART Patients) leading to poor adherence due to lack of food (WHO 2003a; Hardon *et al.* 2007; Malinga and Ford 2009). Additional support in the form of nutritional support is vital for optimal adherence level and better health outcomes for PLWHA and may possibly reduce occurrence of disease (especially opportunistic infections) in clients (WHO 2003a; Sztam and Ndirangu 2010). Alternatively, unconditional cash transfers may be considered as additional support given that they have been proven to increase food consumption, reduce hunger, increase average meals per day and increased dietary diversity in beneficiary households (Adato and Bassett 2008).

Adoption of lessons from community based programs that tailor responses to the specific needs of specific households or communities would be helpful (Johnson and Khanna 2004; Thurman *et al.* 2007; Osawa *et al.* 2010). Intervention to community identified needs that encourage self-sufficiency through provision of training and community capacity building rather than giving direct resources would deal with the sustainability challenge and also promote local expertise (Johnson and Khanna 2004; Thurman *et al.* 2007).

As already practised by TASO, partnership with other stakeholders like Community Based Organisations (CBO), ACDI/VOCA, World Food Program (WFP) and Food and Agricultural Organisation (FAO[26]) reduces human and material resource constraints at TASO and enhance the outcomes of TASO programmes (Wouters *et al.* 2008). However, any additional support, whether in the form of cash transfers, nutritional supplement through food aid or child care is usually in partnership with projects that are short term and unsustainable (Yager *et al.* 2011). TASO support is definitely limited by budgetary constraints, which may become even more restrictive given the fear of Global Fund and PEPFAR funding reductions (Daily Monitor 2011; New Vision 2011; PEPFAR 2011). This is similar to other additional support programs including community based home care that have funding constraints (Johnson and Khanna 2004; Bazant and Boulay 2007).

[26] FAO and WFP are Un Programmes. ACDI/VOCA is a development non-governmental organisation based in the USA

Since the majority of additional support programs are short term, the challenge to ART service providers and stakeholders is to develop integrated HIV and livelihood programmes[27] (IHLP) that would make benefits from additional support sustainable to households impacted by HIV/AIDS in order to maximise the benefits from ART. The findings from this chapter have implications for ART service providers in presenting a dilemma in resource allocation to either ART or additional support given limited health care resources in countries like Uganda.

However, the study has some limitations. The use of cross sectional data limits causal relationships. A longitudinal study is required to further confirm the benefits of additional support for the health of PLWHA and other individuals in their household. There are possible endogenous treatments effects due to observable (education, income and number of assets) and unobservables (experience) that favour self-selection into TASO. However, this is partly dealt with by controlling for the observable effects for both TASO and MOH.

The nature of the data meant that is was not possible to separate out the effects of the various types of social support. It is likely that specific nutritional support may be more important for direct health outcomes (acute and chronic disease), while income generating activities are likely to be more important for indirect health outcomes, like labour productivity. A more in-depth study, specifically focussing on TASO, could shed light to this issue.

Despite its limitations, the study provides evidence that social support in addition to ART is important in giving better physical health outcomes in terms of productivity (more non-wage labour allocation and household cash at hand) for PLWHA households. The findings highlight the importance of additional support to HIV/AIDS clients and have implications for service providers in presenting a dilemma in resource allocation to either ART or additional support given limited health care resources.

[27]IHLP: These are programs that promote food and livelihood security through provision of agricultural inputs and training to promote rural livelihoods, local food production and promote income generating activities.

Chapter 6 - Resource Allocation among Children[28]

6.1. Introduction and Background

HIV/AIDS adds a new dimension to the child labour problem (ILO 2003) especially in Sub-Saharan Africa (SSA) where the burden of the disease is greatest. Children residing in households that have a Person Living with HIV/AIDS (PLWHA) are vulnerable given that HIV/AIDS affects adults in their productive prime who are often required to constrain their income generating activities.

HIV/AIDS is argued to be associated with child labour by: increasing the number of vulnerable children, especially orphans and HIV infected children; placing an increased burden on girls, who often have to provide care and household services for the entire family when a parent becomes ill or dies; and putting pressure on children to work to assist their families to obtain a livelihood and survive (Tumushabe 2000; Rau 2002; ILO 2003; Nyamukapa and Gregson 2005; Engle 2008; Desmond 2009).

[28] Part of this chapter was presented at the 33rd Australian Conference of Health Economists at Melbourne (October 2011) as a paper entitled "Factors that influence child work for households with PLWHA in Central Uganda".

In Africa, including Uganda, children have always traditionally worked within their family, extended family and the community, participating in cooking, washing, fetching firewood and water. This is said to prepare them for the roles expected of them during adulthood. Such child work was devoid of exploitation and permissible (Tumushabe, 2000). However, with the advent of HIV/AIDS, the traditional expectation of child work has been replaced by the struggle of survival on the children's part, which has been made worse by HIV/AIDS, hence making such children more vulnerable (Tumushabe 2000; UNICEF 2000b; Kesby *et al.* 2006; Kuo and Operario 2010). There is evidence that children affected by HIV/AIDS including orphans taken into other homes, are often treated badly and are more vulnerable to rights violations and exploitation by relatives (Tumushabe 2000; UNICEF 2000b; Le Breton and Brusati 2001; Kesby *et al.* 2006; Harms *et al.* 2010). There is also evidence at the household level that children shoulder a large portion of household responsibilities (UNICEF 2000b; Bauman *et al.* 2006), with girls spending more time on domestic work and boys spending more time on subsistence family employment. Girls are expected to shoulder most of the household chores as well as carry out a wide range of farm activities, while boys are mainly required to participate in farm and income generating work (Tumushabe 2000; UNICEF 2000b). Children carrying out such domestic tasks in the family are usually not regarded as economically active (Bhukuth 2008; de Lange 2009) but their potential exploitation by carers and the potential interference with their education makes them vulnerable and may affect their future welfare (Hazarika and Sarangi 2008).

Children affected by HIV/AIDS are vulnerable and at risk given that HIV/AIDS in parents has been shown to increase child labour and increase poverty, which may induce more child labour; and illness of children's caretakers has been indicated to trigger economic difficulties and uncertainty about the future (Le Breton and Brusati 2001; Richter 2004; Kesby *et al.* 2006; Russell and Seeley 2010). Despite their vulnerability, little attention has been paid to the situation of children affected by HIV/AIDS who reside in households with a PLWHA (Foster and Williamson 2000; UNICEF 2007). Several studies have explored the association between child labour and HIV/AIDS (Foster and Williamson 2000; Tumushabe 2000; Le Breton and Brusati 2001; Rau 2002; ILO 2003) but little is known about which factors may affect such vulnerable children's labour participation, especially for children residing in a household with a PLWHA. Domestic work done by children is often neglected in official statistics and empirical studies (Bhalotra and Heady 2003) and yet the impact of HIV/AIDS begins by impacting adult domestic labour and hence children's labour within the household.

This chapter explores the association between a child's labour participation and labour hours for family farm work and domestic work in a typical week during the school term for children living in households that have a PLWHA, and comparison households without a known person living with HIV/AIDS (non-PLWHA). The study explores how the individual child and household characteristics influence child labour for family farm and domestic work for children aged 4-18 years old. The study addresses the knowledge gap regarding the link between HIV/AIDS and child work. The study additionally includes the 15-17 year old children who are usually regarded as adults in several studies (including Demographic and Health Surveys (DHS), Living Standards Measurement Survey (LSMS), United Nations General Assembly Special Session (UNGASS) progress reports, Uganda National Household Surveys (UNHS) and UNAIDS reports), but are excluded in childhood analysis (Foster and Williamson 2000). This provides information not only for rural households as common in past research, but considers the role of urbanisation (Le Breton and Brusati 2001).

6.2. Data

The data for this analysis is a sub-sample from the 2010/2011 Centre for Health Economics Uganda HIV Survey (CUHS). Detailed information of the survey is outlined in Chapter 4. The data comprises of 1,474 children aged 4-18 years old living at home during the school term, from 452 households, with 349 households having a PLWHA.

Variables

The outcomes of interest are children's labour participation and the level of labour participation in hours for domestic and family farm work (separately), i.e. there are four dependent variables. Domestic work includes fetching water and firewood, cleaning and cooking. Family farm work on the other hand encompasses looking after poultry, livestock and gardening. The reference period for labour allocation is a typical week during the school term.

The primary explanatory variable is whether the child resides in a household with a PLWHA. Other covariates include the child characteristics and household level characteristics. Child level factors include the age (Age) and gender of the child (Girl), whether the child is enrolled in school (Enrol), orphan status (Orphan/maternal orphan), whether the child's mother resides in the household (mother resident) and whether the child had a disease for more than six months in the past, 12 months prior to the survey (chronic disease).

Household level characteristics include the age of the household head (Household head age), the household head's gender (male head), maximum educational attainment (none, primary or secondary plus), religion (Muslim, Anglican, Catholic and other Christian), marital status (married, widowed and separated) and main occupation (other, agricultural or non-agricultural); the total number of adults, total number of children younger than five years old and total number of adult females in the household; household wealth index (high, average and low wealth), whether at least one person in the household has savings (got savings) or a loan (got loan), whether the household experienced at least one shock (shock) in the past 12 months (shock ranged from illness or death of a household member or relative, loss of a job by a household member or supportive relative; property loss to theft; farm loss due to harsh weather conditions; crops and livestock loss due to pests and diseases; and unfavourable market conditions including increased input prices and low output prices), whether the household owns land (own land) and type of residence (urban). Other variables included are the child's participation in either domestic work or farm work and interaction between PLWHA and being enrolled in school.

6.3. Empirical Approach

All analyses are performed using Stata 11 (StataCorp, 2009). Associations between labour allocation for child work (domestic work and own farm work), PLWHA and the different child and household level characteristics for children aged 4-18 years are investigated using a two-part model.

The two-part model is given by:

$$f(y/x) = \begin{cases} Pr[d = 0/x] & if\ y = 0, \\ Pr[d = 1/x]\ f(y/d = 1, x) & if\ y > 0. \end{cases} \tag{6.1}$$

Where *d* is an indicator binary variable for a child's labour participation, *x* are regressors and *y* is the level of labour participation in hours. The model for the analysis is a probit model that indicates whether or not a child participated in labour allocation for domestic work or farm work during a typical week of the school term, so

$$Prob[d = 1|x] = \Phi(x_1' \beta_1) and\ Prob[d = 0|x] = 1 - \Phi(x_1' \beta_1), \tag{6.2}$$

where Φ represents the standard normal cumulative distribution function; and OLS model for labour allocation hours given that labour was supplied, so

$$\mathrm{E}[y|x] = \Phi(x_1' \beta_1)[x_2' \beta_2 + \sigma_2^2] \tag{6.3}$$

(Cameron and Trivedi 2005).

The specific model specification is given below;

$$Prob(farm\ work > 0) = \alpha + \beta_1\ PLWHA + \ \beta_2\ CHLD + \ \beta_3\ HHD + \ \beta_4 PART + \ \mu \tag{6.4}$$

$$\mathrm{E}[farm\ hours] = \ \alpha + \ \gamma_1\ PLWHA + \ \gamma_2\ CHLD + \ \gamma_3\ HHD + \ \gamma_4 PART + \epsilon \tag{6.5}$$

where PLWHA is a child from a household with a person living with HIV/AIDS, CHLD are child level variables, HHD are household level variables, PART is the (alternate) labour participation variable (in this instance domestic work for equations 6.4 and 6.5), α is the constant term, $\beta s\ and\ \gamma s$ are the coefficients in the probit and OLS models respectively and $\mu\ and\ \epsilon$ are the error terms.

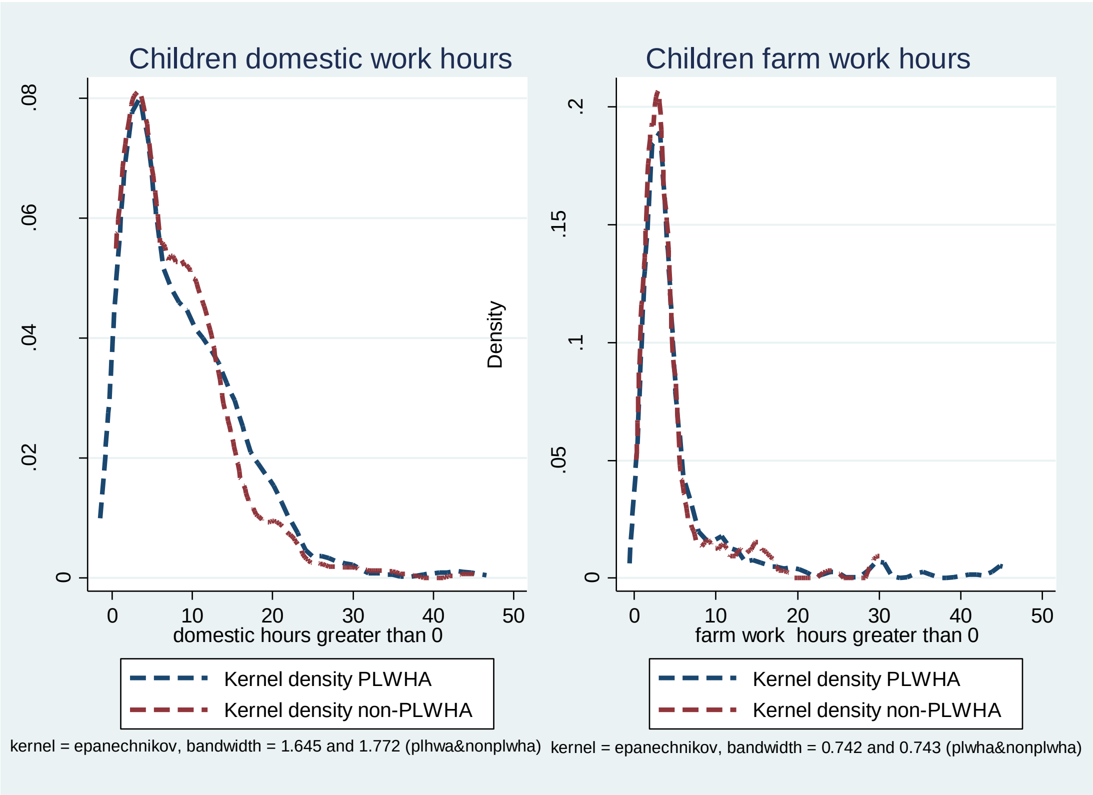
Four models are used for both family farm work and domestic work. Model 1 is a binary regression with PLWHA as the only regressor. Model 2 adds in child specific characteristics (PLWHA, CHLD), model 3 adds the household characteristics (PLWHA, CHLD, HHD), and model 4 adds the alternate child work participation variable as a test for substitution effect (PLWHA, CHLD, HHD, PART). All models are clustered at the household level. To ensure identification in the participation model, the own land variable is excluded in the OLS family farm work equation and whether a household had a loan, variable, from the OLS domestic work equation. The Heckman selection model was used to test for the independence of the Probit and OLS regression equations (Results in Table D.1 Appendix D) and the LR test of independent equations (rho= 0) could not be rejected, hence justified in using a two-part model.

6.4. Results and Discussion

Figure 6.1 illustrates the distribution of child work hours for both domestic and family farm work for both PLWHA and non-PLWHA households. The distribution of child work hours is quite similar for both PLWHA and non-PLWHA.

Descriptive statistics summarising the survey sample according to their PLWHA status are presented in Table 6.1. As is typical of African culture, the results indicate children work within their family even during the school term. The overall sample indicates that 51 percent and 81 percent of children participate in family farm, and domestic work respectively, with an average of 5.6 and 8.6 hours for family farm work and domestic work per week.

Figure 6.1: Kernel densities for children domestic and farm work hours for both PLWHA and non-PLWHA



The table below shows that, children from a household with a PLWHA participate significantly more in family farm work than the non-PLWHA households, 52 percent and 44 percent respectively. The average hours per week for farm work are about six and five for children from

PLWHA and non-PLWHA respectively. As expected, households with a PLWHA have a significantly higher incidence of orphans, children with a chronic disease and household heads that are widowed compared to the non-PLWHA households (Table 6.1).

Table 6.1: Descriptive Statistics (Mean (SD) or %) of variables in the models

Outcome Variable	Overall Sample		PLWHA		Non-PLWHA	
Farm work participation	1,474	50.54	1,152	**52.34***	322	**44.10***
Farm work hours (>0)	745	5.61 (7.26)	603	5.78 (7.63)	142	4.87 (5.43)
Domestic work participation	1,474	80.53	1,152	81.51	322	77.02
Domestic work hours (>0)	1,187	8.64 (7.08)	939	8.84 (7.18)	248	7.87 (6.60)
Child individual characteristics						
Age in years		10.82 (4.10)		10.80 (4.03)		10.92 (4.34)
Girl child		52.17		54.26		56.52
Enrolled in school		86.41		86.62		85.67
Orphan		37.16		40.20***		26.42***
Maternal orphan		10.40		9.09*		6.54*
Mother resident in household		68.58		68.30		69.57
Chronic disease		17.01		18.14*		12.90*
Household characteristics		**N=452**		**N=349**		**N=103**
Household head age		44.48 (11.03)		44.31 (10.54)		45.02 (12.58)
Household head married		43.36		37.82***		62.14***
Household head separated/divorce		16.15		17.77*		10.68*
Household head widowed		40.49		44.41***		27.18**
Household head-agricultural occupation		59.73		59.60		60.19
Household head non-agricultural		35.40		34.96		36.89
Household head other occupation		1.99		2.01		1.94
Household head education years		5.68 (3.62)		5.44**(3.44)		6.49**(4.08)
Household head no education		58.85		62.46***		46.60***
Household head primary education		37.61		35.53*		44.66*
Household head secondary plus		4.42		2.87***		9.71***
Number of adult females		1.45 (0.80)		1.48 (0.83)		1.35 (0.67)
Number of adult males		0.84 (0.82)		0.81*(0.83)		0.96*(0.79)
Number of adults		2.30 (1.18)		2.30(1.19)		2.31(1.13)
Number children<5 years old		0.85 (0.98)		0.833 (0.98)		0.90 (0.96)
Low wealth		27.43		30.95		28.16
Average wealth		34.07		32.38		33.98
High wealth		38.50		36.68		37.86
Savings		25.78		25.29		27.45
Loan		26.39		28.65**		18.63**
Experienced shock		85.56		87.39**		79.21**
Own land		65.93		63.90**		74.76**
Urban residence		22.79		24.93**		15.53**
Household head Muslim		15.06		14.90		15.53
Household head Catholic		54.65		54.44		55.34
Household head Anglican		20.80		20.06		23.30
Household head other Christian		9.51		10.60		5.83

$^{***}p<0.001$, $^{**}p<0.05$, $^{*}p<0.10$; values are mean (SD) or %. For mean, ttest assuming equal means; for proportions, chi squared test.

Two-part Model Results

PLWHA households

The analysis reveals that children from households with a PLWHA are 8-11% more likely to participate in family farm work compared to children from the non-PLWHA households (Table 6.2). This relationship was found to be robust in the presence of household level characteristics (Table 6.2, model 3) and with inclusion of the alternate labour participation variable (Table 6.2, model 4). There was no significant evidence of the effect of being a resident in a household with a PLWHA on child domestic work participation (Table 6.3), nor on the magnitude of child domestic and family farm participation hours (Tables 6.2 and 3; OLS regression models 1, 2 , 3 & 4).

Child Characteristics

Model 2, in Tables 6.2 and 6.3 shows that older children (6-12 years old and 13-18 years old), including older girls (Appendix D Table D.2) are more likely to participate in family farm work (47% and 56% respectively) and domestic work (33% and 34% respectively) compared to the younger children of 4-5 years old. Older children work at least four hours more per week for domestic work compared to the younger children of 4-5 years old. Older children are even more vulnerable to child work through heightened participation and more hours of work. This confirms other research which shows older children are more likely to participate in labour allocation and are at greater risk of abandoning school given that they are more physically mature and can take on more tasks (Foster and Williamson 2000; Gillespie and Kadiyala 2005; Moyi 2011). Older children have also been indicated to be penalized relative to their younger siblings in terms of all categories of work (Fafchamps and Wahba 2006).

Table 6.2: Two-Part Model: Family Farm Work

	Model 1		Model 2		Model 3		Model 4	
	Probit	OLS	Probit	OLS	Probit	OLS	Probit	OLS
PLWHA	**0.082***	0.909	0.068	1.124	**0.111*****	0.691	**0.113*****	0.689
	(0.044)	(0.771)	(0.043)	(0.746)	(0.039)	(0.764)	(0.038)	(0.722)
Age 6-12 years			0.473***	-0.916	0.443***	-1.173	0.277***	0.001
			(0.057)	(3.764)	(0.054)	(3.228)	(0.060)	(2.787)
Age 13-18 years			0.556***	0.220	0.510***	0.102	0.341***	1.321
			(0.056)	(3.477)	(0.055)	(2.943)	(0.062)	(2.533)
Girl child			-0.073***	-0.316	-0.037	-0.305	-0.054***	-0.178
			(0.028)	(0.621)	(0.026)	(0.622)	(0.025)	(0.634)
Enrolled in school			0.125***	-8.829***	0.108**	-8.665***	0.075*	-8.721***
			(0.046)	(1.903)	(0.045)	(1.826)	(0.042)	(1.799)
Orphan			0.063*	-0.569	0.083**	0.029	0.075**	0.001
			(0.036)	(0.841)	(0.039)	(0.756)	(0.035)	(0.751)
Chronic disease			0.042	-1.095*	0.063*	-1.256*	0.049	-1.269**
			(0.037)	(0.630)	(0.034)	(0.648)	(0.031)	(0.623)
Mother resident			-0.077**	0.992	-0.015	0.514	-0.018	0.505
			(0.036)	(0.650)	(0.034)	(0.719)	(0.032)	(0.706)
Male househod head					0.109	-0.555	0.113	-0.709
					(0.099)	(1.132)	(0.092)	(1.060)
Age household head					0.004**	-0.027	0.004**	-0.034
					(0.002)	(0.028)	(0.002)	(0.028)
Head separated					0.084	-0.551	0.070	-0.491
					(0.102)	(1.937)	(0.096)	(1.876)
Head widowed					0.064	-1.781	0.056	-1.714
					(0.103)	(1.397)	(0.095)	(1.338)
Head agricultural					0.247***	0.024	0.267***	-0.283
					(0.091)	(1.167)	(0.085)	(1.174)
Head non-agricultural					0.190**	1.791	0.232***	1.238

					(0.094)	(1.332)	(0.088)	(1.285)
Head primary					-0.050	-0.613	-0.041	-0.614
					(0.034)	(0.969)	(0.033)	(0.941)
Head secondary+					0.142*	-1.372	0.090	-1.147
					(0.075)	(1.119)	(0.068)	(1.084)
Number children<5yrs					-0.003	0.331	-0.006	0.297
					(0.018)	(0.309)	(0.016)	(0.298)
Number adult males					-0.028	0.046	-0.031	0.128
					(0.023)	(1.055)	(0.021)	(0.560)
High wealth					0.195***	1.685	0.176***	1.618
					(0.046)	(1.639)	(0.046)	(1.596)
Average wealth					0.189***	-0.190	0.169***	-0.106
					(0.044)	(1.380)	(0.042)	(1.382)
Savings					0.047	-0.317	0.092**	-0.655
					(0.038)	(0.921)	(0.036)	(0.898)
Loan					-0.013	0.465	-0.026	0.526
					(0.038)	(0.959)	(0.036)	(0.952)
Experienced shock					0.021	1.750*	0.019	1.817*
					(0.049)	(1.038)	(0.047)	(1.046)
Own land					0.095**		0.099***	
					(0.038)		(0.036)	
Urban residence					-0.092*	0.820	-0.119**	0.988
					(0.051)	(1.433)	(0.047)	(1.398)
Head Catholic					-0.004	-1.242	-0.011	-1.075
					(0.048)	(1.889)	(0.046)	(1.796)
Head Anglican					0.022	-2.897	-0.003	-2.639
					(0.061)	(2.004)	(0.058)	(1.903)
Head Other Christians					-0.096	-4.039**	-0.076	-3.721*
					(0.071)	(1.978)	(0.063)	(1.894)
Domestic participation							0.400***	-5.088***
							(0.035)	(1.391)
Constant	-0.148	4.874***	-1. 594***	12.900***	-4.119***	14.475***	-5.054***	18.668***
N	1,474	745	1,304	640	1,296	640	1,296	640

Robust SE in parentheses; Probit model used for family farm work participation; the dependent variable is a dummy that takes value of 1 if a child participated in farm work and zero otherwise. OLS used for family farm work hours; marginal effects are reported for the probit model; models clustered at household level; *p<0.1, ** p<0.05 and *** p<0.01. Head is household head

Table 6.3: Two-Part Model- Domestic Work

	Model 1		Model 2		Model 3		Model 4	
	Probit	OLS	Probit	OLS	Probit	OLS	Probit	OLS
PLWHA	0.043	0.965	0.026	1.124	0.009	1.086	-0.011	0.850
	(0.029)	(0.708)	(0.028)	(0.748)	(0.026)	(0.713)	(0.025)	(0.713)
Age 6-12 years			0.328***	3.978***	0.334***	3.781***	0.241***	3.105**
			(0.027)	(0.907)	(0.027)	(0.954)	(0.026)	(0.910)
Age13-18 years			0.336***	5.420***	0.341***	5.633***	0.232***	4.779***
			(0.029)	(0.970)	(0.031)	(0.998)	(0.031)	(0.989)
Girl child			0.013	0.867*	0.027	0.681	0.039**	0.764
			(0.021)	(0.455)	(0.020)	(0.441)	(0.020)	(0.447)
Enrolled in school			0.104***	-5.721***	0.098***	-5.443***	0.066**	-5.530***
			(0.028)	(1.257)	(0.028)	(1.287)	(0.026)	(1.282)
Maternal orphan			-0.010	-2.450	-0.001	-2.104	0.059	-1.870
			(0.145)	(1.715)	(0.123)	(2.195)	(0.120)	(2.059)
Chronic disease			0.036	-1.094**	0.030	-1.360**	0.007	-1.459***
			(0.029)	(0.536)	(0.027)	(0.536)	(0.025)	(0.528)
Mother resident			-0.023	-0.559	-0.001	-0.444	-0.019	-0.386
			(0.026)	(0.578)	(0.024)	(0.537)	(0.023)	(0.531)
Male household head					-0.027	0.391	-0.048	0.203
					(0.046)	(1.069)	(0.040)	(1.043)
Age household head					0.002	0.049	0.001	0.047
					(0.001)	(0.033)	(0.001)	(0.033)
Head separated					0.008	1.262	-0.023	1.087
					(0.054)	(1.257)	(0.051)	(1.240)
Head widowed					0.016	0.102	-0.012	-0.317
					(0.047)	(1.104)	(0.039)	(1.088)
Head agricultural					-0.118*	-2.456	-0.148***	-3.001*
					(0.061)	(1.552)	(0.057)	(1.540)
Head non-agricultural					-0.137**	-0.628	-0.152***	-1.049
					(0.061)	(1.604)	(0.058)	(1.5587)
Head primary					-0.042*	1.079	-0.030	1.171*
					(0.025)	(0.696)	(0.023)	(0.690)
Head secondary+					0.082	0.859	0.047	0.756

					(0.073)	(1.582)	(0.069)	(1.581)
Number children<5yrs					0.013	0.116	0.016	0.133
					(0.013)	(0.279)	(0.012)	(0.279)
Number adult females					-0.019	-0.934**	-0.024*	-0.958**
					(0.017)	(0.412)	(0.013)	(0.418)
High wealth					0.031	-0.498	-0.016	-0.884
					(0.033)	(0.839)	(0.032)	(0.837)
Average wealth					0.038	-0.609	-0.004	-1.040
					(0.034)	(0.777)	(0.032)	(0.787)
Savings					-0.084***	-1.017	-0.099***	-1.191
					(0.029)	(0.710)	(0.027)	(0.712)
Loan					0.031		0.030	
					(0.029)		(0.028)	
Experienced shock					-0.010	3.407***	-0.014	3.329***
					(0.034)	(0.784)	(0.032)	(0.769)
Own land					-0.009	-0.210	-0.025	-0.429
					(0.026)	(0.641)	(0.024)	(0.642)
Urban residence					0.077**	-1.313	0.091***	-1.038
					(0.037)	(0.815)	(0.034)	(0.816)
Head Catholic					-0.002	-0.233	0.005	-0.248
					(0.029)	(0.778)	(0.028)	(0.786)
Head Anglican					0.041	-0.296	0.044	-0.348
					(0.037)	(0.899)	(0.036)	(0.891)
Head Other Christians					-0.092*	0.934	-0.056	0.991
					(0.054)	(1.238)	(0.047)	(1.246)
Farm participation							0.240***	1.810***
							(0.023)	(0.565)
Constant	0.739***	0.708***	0.807***	8.799***	-0.600	7.121**	0.784	8.247***
	(0.093)	(0.621)	(0.177)	(1.609)	(0.494)	(3.160)	(0.555)	(3.130)
N	1,474	1,187	1,312	1,046	1,304	1,039	1,304	1,039

Robust SE in parentheses; Probit model used for domestic work participation; the dependent variable is a dummy that takes value of 1 if a child participated in domestic work and zero otherwise. OLS used for domestic work hours; marginal effects are reported for the probit model; models clustered at household level; *p<0.1, ** p<0.05 and *** p<0.01. Head is household head

Girls are 5-7 percent less likely to participate in family farm work (Table 6.2) and 4 percent more likely to participate in domestic work (Table 6.3, model 4), consistent with earlier research (Tumushabe 2000; de Lange 2009; Moyi 2011). Girls have been indicated to shoulder most of the household chores and compensate for household labour loss, especially in an event of having a sick adult (Foster and Williamson 2000; Yamano and Jayne 2005; Moyi 2011).

Children enrolled in school are significantly more likely to participate in both family farm work and domestic work (8-13% and 7-10% respectively), but work significantly fewer hours per week (9 hours for farm work and 5 hours for domestic work) compared to children who are not enrolled in school. This suggests that children enrolled in school are made less vulnerable by working fewer hours than children who are not enrolled in school. Results indicate no evidence of children from PLWHA households who are enrolled in school being more vulnerable (Appendix D Table D.3) through increased hours of work, contrary to past studies (UNICEF 2000b; Bauman *et al.* 2006).

Orphan children are more likely to participate in family farm work compared to non-orphans (Table 6.2), similar to previous research that has highlighted the vulnerability of orphan children (Richter 2004; Harms *et al.* 2010). Children with a chronic disease work one hour less compared to children with no chronic disease (Table 6.2 & Table 6.3).

Children who reside with their biological mother are 8 percent less likely to participate in family farm work at the 10 percent level of significance (Table 6.2; Model 2), again this is contrary to similar studies where parents indicated that farm work was beneficial to their children (Fafchamps and Wahba 2006), arguing that it complements adult labour and ensures survival on agriculture. We find, as with Moyi (2011), some evidence to suggest parents influence children's time allocation.

Household Characteristics

Model 3, in Tables 6.2 and 6.3, includes household variables. The coefficients and statistical significance of the child level characteristics results are similar to those in model 2 except that children with a chronic disease participate significantly more in family farm work (Table 6.2), while being a female child and having a biological mother resident in a household are now insignificant determinants. Importantly, children from a household with a PLWHA are 11 percent significantly more likely to participate in family farm work (cf. model 6.2 with models 1 and 3 in Table 6.2).

Compared to a household head whose occupation is other occupation, children from households where the household head's main occupation is agricultural or non-agricultural are significantly more likely (25% and 19% respectively) to participate in family farm work (Table 6.2, model 3), but less likely to participate in domestic work (12% and 14% respectively) (Table 6.3, model 3). This significant finding, irrespective of the main occupation of the household head being non-agricultural or agricultural, is possible given that agriculture has been proven to increase child labour participation, even when the household head is not a farmer (Fafchamps and Wahba 2006). This finding is independent of whether the household is HIV/AIDS affected or not because agriculture can be key to survival, as indicated by Kaler *et al*., (2010) in '*Living by the hoe*'.

Primary level education of the household head compared to no education reduces children's domestic work participation by 4 percent (Table 6.3), similar to Fafchamps & Wahba (2006) findings, but secondary education of the household head increases children's family farm work participation by 14 percent (Table 6.2, model 3), contrary to Ray (2000) where education level was negatively associated with all forms of child labour.

Having more female adults means children work about one hour less per week on domestic work (Table 6.3). This confirms previous studies (Fafchamps and Wahba 2006), where children from households with more adults were reported to work less. Contrary to past studies, there was no evidence of increased child work due to the number of children younger than five years old in the household (Le Breton and Brusati 2001; Moyi 2011).

Children from wealthier households are 20 percent more likely to participate in family farm work compared to children from poorer households (Table 6.2). Contrary to earlier studies (Fafchamps and Wahba 2006; Moyi 2011), wealth is positively associated with more family farm work participation for children, possibly because wealthier families usually possess vast agricultural land and are more likely to not only rely on hired labour but also depend on family labour including child labour to make their own labour more productive (Barrows and

Roth 1990; Lastarria-Cornhiel and Melmed-Sanjak 1999; Jensen 2000; Basu and Tzannatos 2003; Bhalotra and Heady 2003; de Lange 2009). This reaffirms the fact that the relationship between household wealth and child labour is paradoxical, especially in rural Africa given that more wealth has been indicated to increase rather than reduce child work hours (Bhalotra and Heady 2003; de Lange 2009). The wealth paradox has been explained in terms of land and labour market imperfections (Bhalotra and Heady 2003) and the fact that child labour has an inverted-U shaped relationship with land wealth (Basu *et al.* 2010).

Household shocks are found to significantly increase child work, by 2.0 and 3.4 hours more per week for family farm work and domestic work respectively, similar to earlier findings where agricultural shocks increased child labour (Jensen 2000; Beegle *et al.* 2006). This suggests that shocks may lead to an increase in labour demand within the household to possibly compensate for the loss due to the shock. Cheap and readily available labour from children within the household can provide a means of minimising the effect of the shock on the household.

As expected, owning land significantly encourages family farm work participation for children by 10 percent (Table 6.2); comparable to previous studies that have affirmed the fact that children from agricultural households are more likely to be engaged in agricultural farm work to make such assets as land more productive (Fafchamps and Wahba 2006; de Lange 2009; Kaler *et al.* 2010).

Children residing in an urban area are less likely to participate in family farm work (Table 6.2) but more likely to participate in domestic work (Table 6.3). It has been argued that child labour allocation is essential to enable the guardians or parents to cope with the multitude of demands upon their time especially for the women in rural areas (Fafchamps and Wahba 2006; de Lange 2009; Kaler *et al.* 2010). As indicated by de Lange, (2009), it can be argued that the unequal rural labour distribution between adults can contribute to an increase in child labour hours, family farm work in this case. Children who combine work and school have been shown to be found mainly in rural areas (Moyi 2011).

Having savings reduces children’s vulnerability through reduced domestic work participation (Table 6.3), but increases family farm work participation (Table 6.2). In most agrarian economies like Uganda, increased savings leads to increased investment in farming as a means of expanding farm land for both subsistence food production and cash crop production. This implies that savings per se may be necessary but not sufficient to stop children from working during the school term. Possibly, the challenge is not only about having savings or not, but the magnitude of savings that can be sufficient to discourage all forms of working for children especially during the school term. The data lacked more detailed information on the level of savings, given bias and challenges related to collecting income data, hence only an indicator of its existence or not was included in the analysis.

Participation in other work

The final model, model 4 in Tables 6.2 and 6.3, incorporates domestic participation in the family farm work model and family farm work participation in the domestic work model. Results for the child level and household level characteristics are quite similar to those presented in models 6.2 and 6.3 except that children from a household where the household head's main occupation is agricultural work three hours less per week on domestic work; the household head secondary education effect on family farm work becomes insignificant and; household savings significantly increases children's family farm work participation by 9 percent.

Children who participated in domestic work are 40 percent more likely to participate in family farm work but work about five hours less per week compared to children who do not participate in domestic work (Table 6.2). Conversely, children who participated in family farm work are 24 percent more likely to participate in domestic work, and work about two hours more per week compared to children that do not participate in family farm work (Table 6.3). These findings suggest that children's family farm work participation and domestic work participation are complementary to each other; while the effect of a child's domestic work participation on farm work hours would seem to be a substitution effect (participation in domestic work has a negative effect on hours worked on the farm). Conversely, a child's family farm work participation increases domestic work hours, implying complementarities between them, which is contradictory to the former result. This implies that reducing a child's vulnerability to child work through say domestic work can indirectly help reduce the amount of time they spend working on the family farm, making such children less vulnerable (assuming that farm work is more physical).

6.5. Conclusion and Implications

The aim of this chapter was to investigate factors that influence child work for family farm work and domestic work, for households with a PLWHA relative to non-PLWHA households using a two-part model. The analysis provides evidence that children from households with a PLWHA are more vulnerable, in that they participate more in farm work. Strategies to reduce labour deficits for family farm work for example, through use of "Munno Mukabi" self/mutual help groups for labour allocation in such households may help reduce child vulnerability.

The findings further suggest that policies that protect female children and orphans, especially in households with PLWHA, are needed to reduce the impact of child work. This would help relieve the female child who may be disadvantaged and overwhelmed by cultural roles of care and housework provision.

Having savings or credit for households with PLWHA may be beneficial in reducing domestic work for children and possibly free up time for more school related activities, improving the quality of education, and therefore leading to better future outcomes for such children. This implies that policies such as provision of credit and cash transfers that boost a household's economic standing may be imperative as practiced in some SSA countries such as Botswana and South Africa (Richter 2010).

Alternatively, the ability to enhance savings, possibly through local based Rotating Savings and Credit Associations (ROSCAs), and Community Based Income Generating Activities (CBIGA) may enhance children's condition and reduce vulnerability through reduced domestic work participation. Also, the development of a locally based "health care" system at the community level may aid in cushioning children from the increased need for labour for households with a PLWHA.

Households with PLWHA residing in rural areas are just as likely as the non-PLWHA households to rely on farm output given that agriculture is their main source of survival and income (Gillespie and Kadiyala 2005; UBOS 2006; Kaler *et al.* 2010; Russell and Seeley 2010; UBOS 2010). It is essential to increase agricultural productivity, which will enhance farm income and possibly make such households less vulnerable. This may require improving community services such as road access and improving the functioning of rural markets especially land, labour and credit markets.

Approaches to reduce the impact of shocks on households may make children less vulnerable to increased hours of child work. Empowering households and communities to reduce the impact of shocks for households, especially with a PLWHA, is vital. Communities should be encouraged to look to their own resources, including social capital through community trust and social networks for example self/mutual help groups to assist vulnerable households through provision of household farm labour. As indicated by other studies, communities are willing to make investments of their own, but often need facilitation to prioritize responses (Kibua *et al.* 2009; Foster *et al.* 2010).

Ensuring enrolment of children in school is important to reduce child vulnerability through fewer hours worked. Education For All (EFA) in Uganda increased enrolment but has been overshadowed by increased crowding and poor facilities which encourage school drop outs especially for older children vulnerable to more child work (Deininger 2003; Nakanyike *et al.* 2003). Expansion and improvement of the quality of the education system is imperative to ensure that older children stay in school and remain less vulnerable to longer working hours.

Numerous studies have indicated that alleviating poverty may possibly combat child work (Ray 2000; Basu and Tzannatos 2003; Emerson and Souza 2003; Edmonds 2005). The study findings suggest that dealing with poverty per se may not guarantee less working hours for children especially for agrarian households. This suggests that the solution to limit child labour probably goes beyond the core problem of poverty and it may be more important to understand the intricacies in the way different forms of wealth impact upon child work (the wealth paradox) in order to design effective policies.

This chapter reveals that it is important to invest in children's education, enhance household savings and devise strategies to reduce the impact of household shocks as means of effectively reducing children's vulnerability to child work. Importantly, policies are needed to reduce vulnerability of children through greater family farm work participation for households with a PLWHA.

While this study is novel, it has some limitations. The analyses use cross sectional data and estimates may fail to capture important lifecycle effects like intergenerational persistence and harmful effects of child labour within families (child labour trap) (Emerson and Souza 2003). It is possible that using the household heads occupation, household land ownership and the household wealth index as explanatory variables may be affected by multicollinearity but the variance inflator factor for the OLS regressions was low (less than 3.6 for both family farm and domestic work models), which suggests this is not a problem. Additionally, there is possible bias due to endogenous treatment effects that results from TASO clients' possible self-selection into TASO due to the reasons mentioned in Chapter Four. This has been partly controlled for by the inclusion of the observables that favour selection into TASO. However, it is important to note that the unobservable effects including TASO's reputation and experience, have not been controlled for in the analysis and may still lead to bias hence results need to be considered with caution.

Chapter 7 - Schooling of vulnerable children given formal assistance

7.1. Introduction and Literature Review

Education challenges for children affected by AIDS

Children's responsibilities and work within and outside the household increase dramatically when parents or caregivers become ill or die (Hunter and Donahue 1997; Gilborn *et al.* 2001; Kendall and O'Gara 2007). The burden of caring for the sick parent usually falls on children especially the girls (Tumushabe 2000; Nyamukapa and Gregson 2005; Engle 2008), forcing many to drop out of school and take on adult roles (Connolly and Monasch 2003; Case *et al.* 2004; Mishra *et al.* 2007a). Child labour is common and studies have indicated children's labour contributions as an important component of household income (Rammohan 2000; UNICEF 2000a; Richter 2004).

Children in households affected by HIV/AIDS have been shown to have reduced school attendance or increased school dropouts, given that their labour is required for subsistence activities (Müller and Abbas 1990; Ayieko 1997; Gilborn *et al.* 2001; Bloom *et al.* 2006). Such children, if still in school are reported to have poor academic performance due to low class attendance, lack of school materials, poor diet and appalling living conditions (Ayieko 1997). HIV/AIDS related sickness in adults leads to reduction in disposable income due to reduced labour and increased medical expenditure, which competes with education related expenses like children's school fees and spending on food, with poor food intake resulting in malnutrition for children (Ayieko 1997; Richter 2004). Children in

PLWHA households may also avoid school due to stigma from peers and teachers (Bloom *et al.* 2006).

Importance of Education

Education is one source of hope for such vulnerable children's futures and the future of the communities they belong to (Kendall and O'Gara 2007). Schooling has been reported to retain children's connectedness to peers, familiar adults and to an institutional identity. Schooling provides children with future knowledge and skills and is indicated to prevent vulnerability of older children to HIV infection (Richter 2004).

On the global scale, education has been recognized as a cornerstone of economic and social development. There is theoretical and empirical evidence that investment in formal education plays a crucial role in economic development (Psacharopoulos 1988; Haddad *et al.* 1990; Barro 2000; Sterens and Weale 2004) with higher education suggested as a pathway to assist African countries with technological catch-up, and improve the potential for faster growth (Bloom *et al.* 2006). Additionally, increased education of parents, especially the mothers has been shown to impact child health (Boyle *et al.* 2006) and reduce fertility (Drèze and Murthi 2001) at all levels of economic development (Haddad *et al.* 1990; Barro 2000; Drèze and Murthi 2001; Sterens and Weale 2004; Boyle *et al.* 2006). Improved child health and nutrition additionally plays an important role in school achievement and attainment, hence the importance of women's education in breaking the vicious cycle of poverty that results from poor child health and low levels of education (Haddad *et al.* 1990; Moock and Leslie 1998). In relation to HIV prevention programs, education is important for HIV risk reduction since the more educated have been indicated to adopt less risky behaviour (Gregson *et al.* 2004; de Walque 2007). Furthermore, community collective education attainment is a protector for individual HIV/AIDS risk (Ishida *et al.* 2012).

Education for All

The global community recognises the rights of all children[29] by supporting Education for All (EFA)[30], the Millennium Development Goals and child survival targets. To meet these standards and goals, education and adequate care for vulnerable children must be assured.

[29] Office of the United Nations High Commissioner for Human Rights, Convention on the Rights of the Child http://www2.ohchr.org/english/law/crc.htm

[30] UNESCO, http://www.unesco.org/education/efa/ed_for_all/, WB http://go.worldbank.org/I41DLBA8C0

In Africa, strong family and kinship networks function as the traditional social support systems ("safety net") in times of need (Gilborn *et al.* 2001; Foster 2002b). This extended family support system has been reported to form the basis of orphan care and education in SSA including East Africa. However, with the changes in labour migration, demographic changes, urbanisation and the advent of HIV/AIDS, the extended family support system has been weakened and overburdened (Foster and Williamson 2000; Foster 2004). Studies have indicated that most of the guardians and caregivers are in poor health, some of which are infected by HIV/AIDS themselves (raising concerns about their long-term ability to care for orphans) (Gilborn *et al.* 2001); and others are poor elderly caregivers with no source of income, in need of support themselves (Ayieko 1997; Gilborn *et al.* 2001). Increasingly, orphans have been reported heading a household or belonging to a household headed by an older sibling under the age of 18 (Gilborn *et al.* 2001). Consequently, extended families have been reported to be unable to assist children affected by HIV/AIDS because they are uncertain of the future of their own children and survival given overstretched household resources and immense HIV related deaths in the community (Seeley *et al.* 1993; Ayieko 1997).

A study by Gilborn *et al*., (2001) indicated that 48 percent of guardians doubted their ability to feed children well and 70 percent worried about their ability to send them to school portraying *a safety net with holes* as illustrated by Seeley *et al.*, (1993).
Despite the weakened safety net, less than 10 percent of children orphaned by AIDS receive any structured state social support (UNICEF and UNAIDS 2005; Kendall and O'Gara 2007; Foster 2010). EFA eliminates barriers to schooling such as school fees and significantly influences the ability of vulnerable children to attend school, particularly for girls and rural children (Deininger 2003; Kendall and O'Gara 2007; Grogan 2009; Essama-Nssah 2010). However, studies indicate little support from schools to improve the experiences of vulnerable children in school. Such studies have shown schools to be inadequate and seldom acknowledge the effects of AIDS in the lives of their teachers and students (Bicego *et al.* 2003; Mishra *et al.* 2007a).

Vulnerable children have particular needs (Gilborn *et al.* 2001; Mishra *et al.* 2007a) but their families have to rely on the charity of income-poor relatives and community members (Foster 2007; Foster 2010). Vulnerable children are less likely to attend and achieve in school and, are less likely to receive the care, socialisation and support they need while they grow up (Case *et al.* 2004). Orphaned, fostered children and children of HIV-infected parents are disadvantaged in schooling compared with children of non-orphaned and non-HIV infected parents (Bicego *et al.* 2003; Case et al., 2004; Monasch and Boerma 2004; Case and Ardington, 2006; Mishra *et al.* 2007a). A study by Nyamukapa and Gregson (2005), reported maternal orphans to have lower primary school completion rates than non-orphans in rural Zimbabwe. Moreover, schooling may be affected before a parent dies, probably during the time when a parent is sick, hence the impacts of child schooling before parents die of AIDS are also of high priority (Ainsworth and Filmer 2001; Gilborn *et al.* 2001). Consequently, Gilborn *et al.*, (2001) advocated for the need to assist children affected by HIV before they become orphans given that children living with HIV-positive parents have been demonstrated to need as many support services as orphans who live with guardians.

Given the challenges associated with schooling for children affected by AIDS, it is necessary to go beyond the EFA framework to achieve EFA and social stability in countries and households that are heavily affected by HIV/AIDS (Kendall and O'Gara 2007). It is noteworthy that the Botswana government now provides some external support to such disadvantaged children (Foster 2010).

Schooling outcomes, Formal Assistance and PLWHA households

The introduction of appropriate interventions both in and out of school may significantly reduce the impact of the HIV epidemic on the education of directly affected children (Bennell 2005). Formal assistance from government, non-governmental organisations and faith based organisation has been shown to play a critical role in resourcing vulnerable children and their families (Agadjanian and Sen 2007; Kendall and O'Gara 2007) including poor households that had suffered an adult death (Lundberg *et al.* 2000). However, most of the support provided to households has been reported to occur through weak and burdened informal activities of community members (Foster 2002a). Few official programs have focused on preparing and supporting willing guardians to take on additional child-care responsibilities (Hunter and Williamson 2000; Foster 2007) in the face of HIV/AIDS challenges. It has been argued that the role of community safety nets remains largely under the radar of governments, non-governmental organizations and international bodies (Foster 2007).

Given the evident 'holes' in the safety net, it is crucial that formal assistance from outside the community is evaluated in terms of the potential to assist struggling households affected by HIV/AIDS. Here, the effect of formal assistance on schooling outcomes of children in PLWHA households is investigated. Studies that have investigated schooling outcomes in Uganda have considered school enrolments (Deininger 2003; Reinikka and Svensson 2005; Oleke *et al.* 2007; Nishimura *et al.* 2008; Grogan 2009; Essama-Nssah 2010) and participation, attendance or repetition (Hyde *et al.* 2001; Deininger 2003; Bennell 2005), but few have explored outcomes in terms of school progression (Yamano *et al.* 2006). Additionally, as indicated by Yamano *et al*., (2006), the majority of the studies focus on children aged 7-14 for primary level and ignore older adolescents aged 15-18 for secondary level. Such adolescents have been shown to be important for HIV/AIDS education targeting.

Here, Children's schooling outcomes among PLWHA in Central Uganda are investigated with particular emphasis on the associations with formal assistance; including Home Based Care (HBC), Education Related Assistance (ERA) (mostly books and writing materials) and Health Out-Reach (HOR), in the context of ART treatment packages. This is to establish whether children from households with a PLWHA that had received formal assistance in terms of HBC, HOR and ERA have better schooling outcomes than children from PLWHA households that did not receive such assistance.

7.2. Data and Variables

The data for this study is a sub-sample from the 2010/11 Centre for Health Economics Uganda HIV Survey (CUHS). The sub-sample comprises of 1,140 children aged 6-18 years old from 360 households that have a Person Living With HIV/AIDS (PLWHA).

Outcome variables

The analysis focuses on four outcomes of which three represent schooling inputs in quantitative terms (Enrolment (E); Participation (SP) and Hours (SH)) and one represents quality of schooling (Schooling for Age (SAGE). Enrolment (E) and Participation (SP) are binary measures while Hours (SH) and Schooling for Age (SAGE) are continuous variables. E and SAGE capture all children belonging to the household between 6-18 years while SP and SH exclude children belonging to the household that were in boarding school during the school term, hence captures school participation and hours for children at home during the school term. All schooling information was reported by an adult respondent, interviewed during the household survey and by the children in the household. The outcome variables E_{ik},SP_{ik}, SH_{ik}, $SAGE_{ik}$, are described in detail below.

The SAGE model investigates the successful progression of children from one grade to another. It is possible that the effect of formal assistance and ART package could be better captured in school progression than school enrolment and participation. Being a member of a household with a PLWHA may impact a child's timely enrolment, consistent school participation which may result in age-grade distortions in the long term. Such accumulated impact on the child's schooling can be captured by the school progression variable (Yamano *et al.* 2006).

Normal progress is measured using the schooling for age (SAGE) formula which measures age-grade distortions following Patrinos and Psacharopoulos (1997).

$$SAGE_{ik} = \left[\frac{Years\ of\ schooling\ (S)}{Current\ Age\ (A) - UsualSchool\ Entry\ Age\ (E)}\right] * 100 \tag{7.1}$$

where $SAGE_{ik}$ is the ratio for child *i* from *k* household:

If SAGE is below 100, then a child is below normal progress in the school system (Patrinos and Psacharopoulos 1997). Similar to (Cascio 2005), children "on grade" are assumed to start primary one (Grade one) at age six which is the official school start age in Uganda (Grogan 2009; Kavuma 2010). Two SAGE variables are used; one captures all children aged 6-18 for both enrolled and non-enrolled children (SAGE-all) and the other excludes children that are no longer enrolled in school (SAGE-enrol).

$$SAGE_{all} = \left[\frac{Highest\ grade\ passed + 1}{Current\ Age\ - 6}\right] * 100 \quad for\ enrolled;\ \ or \tag{7.2}$$

$$= \left[\frac{Highest\ grade\ passed}{Current\ Age\ - 6}\right] * 100 \quad for\ unenrolled; \tag{7.3}$$

while

$$SAGE_{enrol} = \left[\frac{Highest\ grade\ passed + 1}{Current\ Age\ - 6}\right] * 100 \quad for\ enrolled \qquad (7.4)$$

Given that SAGE for children aged 6 under normal progress will be unattainable, the entry age is readjusted to 5 for all ages to avoid dividing by zero for children aged 6.

Text box 7.1: SAGE examples

Child six years old currently in grade 1:

SAGE = (0+1)/6-5 = 1/1 * 100 = 100 which is normal progress.

Child ten years old currently in grade 3:

SAGE = (3+1)/10-5 = 3/5*100 = 60 hence below normal progress.

Child ten years old, currently not enrolled and having completed grade 4:

SAGE = 4/10-5 = 4/5*100 = 80, hence below normal progress.

Child ten years old and currently in grade 5:

SAGE = (4+1)/10-5 = 5/5*100 = 100, hence normal progress.

Explanatory variables

Based on a review of literature, the following is hypothesised to affect schooling outcomes: formal assistance as measured HBC[31], ERA and HOR; and the nature of ART package (ARTP) received by the PLWHA residing in the household. Given the burden of caring for the sick in AIDS affected households, well-resourced HBC and other material support has been indicated to help mitigate any adverse impacts on schooling (Gilborn *et al.* 2001; Bennell 2005). Challenges related to belonging to a household with a PLWHA have been reported to affect schooling through absenteeism and abandoning school (Case *et al.* 2004; Kendall and O'Gara 2007; Mishra *et al.* 2007a); hence investigating the association between schooling for children from a household with a PLWHA, and the nature of treatment taken by the PLWHA as measured by the ART package associated with the PLWHA in the household is important. HBC, ERA and HOR were measured as binary

[31] HBA-Home Based Care, ERA-Education Related Assistance and HOR-Health Out Reach

variables indicating whether a child belongs to a household that received HBC, ERA or HOR in the past 12 months prior to the survey. ARTP had four levels as explained in the survey methods; TASOART, TASOWL, MOHART and MOHWL (TASOART and TASOWL are PLWHA obtaining ART and septrin from TASO respectively; while MOHART and MOHWL are PLWHA receiving ART and septrin from MOH respectively).

Control variables

Other factors adjusted for in the multivariate model include the child level factors (CHLD), and these include age (dummies for 6-9 and 10-12 years old (corresponding to lower and upper primary respectively); and 13-16 and 17-18 years (corresponding to Ordinary[32] level and Advanced level education respectively)), gender, orphan status (Richter 2004; Case and Ardington 2006), whether the mother of the child is resident in the household and whether the child had an acute disease four weeks prior to the survey (Patrinos and Psacharopoulos 1997; Yamano and Jayne 2005; Nishimura *et al.* 2008).

Furthermore, the model controls for household level factors (HHD). Socio-economic status has been shown to affect schooling of children (Bennell 2005; Nishimura *et al.* 2008), hence the household wealth index, savings and owning land were used to represent household resources. The household wealth index was constructed as explained in Chapter 4 and included high, average and low wealth. In addition, the household type of residence (urban or rural) was adjusted for as a socio-demographic variable. The number of children under five years old were controlled for, since they have been shown to increase domestic chores in the household, which may hinder schooling (Le Breton and Brusati 2001; Moyi 2011). Also, adjustment for the household head factors including gender, religion (Catholic, Muslim, Anglican and other Christian), education attainment (dummy for-none if education years less than seven; and primary-plus if education years exceed 7 years), marital status (married - monogamously or polygynously, widowed and separated) and occupation of the household head (agricultural related, non-agricultural related and other occupation) was made. Controlling for the observables is also important in dealing with the endogenous treatment bias for the observables due to individuals' self-selection into

[32] Ordinary level is the first four years of secondary school; while Advanced level is the two years of high school

TASO other than MOH. All analyses were conducted using Stata 11 software (StataCorp, College Park Station, TX).

7.3. Empirical Approach

The relationship between the different schooling outcomes (E; SP SH and SAGE) and formal assistance[33] (HBC, HOR and ERA) is estimated using the general model indicated below:

$$Y_{ik} = f\,(FA_k, ARTP_k, CHLD_{ik}, HHD_k) \qquad (7.5)$$

where Y is either E[34] or SP or SH or SAGE for child *i* of household *k*; FA_k is either HBC or HOR or ERA received by household *k*; and $ARTP_k$ is the ART package associated with the PLWHA in household *k*; $CHLD_{ik}$ is a set of characteristics of child *i* of household *k*; and HHD_k is a set of household characteristics.

E and SP are binary variables taking on the value of 1 if a child in the household was enrolled in school or if a child in a household attended school in a typical week during the school term respectively and zero otherwise. E and SP are estimated using a Probit model with clustering at the household level.

SH and SAGE are examined using Ordinary Least Square (OLS) regression models. Schooling hours include hours spent at school and other school related activities like homework during a typical week during the school term for children at home.

7.4. Results

Tables 7.1, 7.2 and 7.3 represent the characteristics of the sampled households. As in previous studies, the majority of children (91%) are enrolled in school (Essama-Nssah 2010). The mean schooling hours per week is 34 hours and average schooling for age (SAGE) value when considering all children whether enrolled or not is 74.85, hence one and a quarter years below normal progress; and 90 for ‘only enrolled’ children, falling half

[33] Formal Assistance (FA)

[34] E-School Enrolment; SP-School Participation; SH is Schooling Hours and SAGE is Schooling For Age

a year below normal progress. Confirming earlier studies (Gilborn *et al.* 2001; Foster 2004; Foster 2007), very few households affected by AIDS receive formal assistance with about 3 percent, 8 percent and 36 percent having received Home Based Care (HBC), Health Out Reach (HOR) and Education Related Assistance (ERA) respectively. Table 7.3 shows that TASO households significantly are more likely (10% level of significance) to receive HBC compared to MOH households. However, there is no difference between TASO and MOH households in regard to receiving ERA and HOR services.

Table 7.1: Child level Descriptive statistics (Mean (SD) or %) of children 6-18 years

	Variable	**Mean (SD) or %**
Outcome Variable	School enrolment	91.14
	School participation	82.65
	School participant hours	33.69 (21.46)
	SAGE-all	74.85 (32.60)
	SAGE-enrol	89.59 (40.17)
Child level factors	Age in years	11.85 (3.63)
	Child male	46.92
Orphan status	Orphan	43.32
	Maternal orphan	12.31
	Paternal orphan	37.38
	Total Orphan	5.87
	Mother resides in household	70.45
	Acute disease	27.74

Table 7.2: Household level Descriptive statistics (Mean (SD) or %)

	Variable	Mean (SD) or %
Formal Assistance	Home Based Care	2.51
	Health Outreach	7.54
	Education Related Assistance	35.75
Household head factors	Age	43.39 (10.49)
	Male	40.28
Marital status	Married	38.61
	Widowed	43.33
	Separated/divorced	18.06
Occupation group	Other Occupation	2.01
	Non-Agricultural occupation	37.93
	Agricultural occupation	60.06
Education Attainment	Maximum years of education	5.55 (3.47)
	No education attainment	61.11
	Primary education plus	38.89
	Number of children < 5 years	0.79 (0.97)
Household wealth category	Wealth Index top	37.78
	Wealth Index middle	34.72
	Wealth Index low	27.50
	Savings	26.82
	Own land	64.72
	Urban residence	25.70
Religion	Muslim	15.08
	Catholic	54.47
	Anglican	20.11
	Other Christian	10.34

Table 7.3: Comparing formal assistance for TASO and MOH (%)

Formal Assistance Type	TASO	MOH
Home Based Care (HBC)	4.61*	1.03*
Health Outreach (HOR)	37.48	39.59
Education Related Assistance	11.21	5.77

*p<0.10; values %; test is chi squared test.

Determinants of school enrolment

Univariate estimates of the association of formal assistance in terms of HBC, ERA and HOR and schooling enrolment demonstrate no effect on enrolment rates (Columns 2, 6 & 10 of Table 7.4). Adding the ART packages makes no difference to the effect of formal assistance on enrolment but children from households with a PLWHA who receives ART from TASO, that is TASOART (henceforth TASOART households) are 4 percent more likely to enrol than children from households with a PLWHA that receives septrin from MOH, that is MOHWL (henceforth MOHWL households) (Columns 3, 7 and 11 Table 7.4).

Controlling for the child level factors (Table 7.4 Columns 4, 8 and 12), all ART package factors become significant with children from TASOART households 8 percent more likely to enrol, children from a household with a PLWHA receiving ART from MOH, that is MOHART, and children from a household with a PLWHA receiving septrin from TASO, that is TASOWL, 5 percent more likely to enrol than children from a household with a PLWHA receiving septrin from MOH, that is MOHWL households. Children aged 10-12 years old are more likely to enrol than the 6-9 years olds of lower primary level (10%); while children of secondary school age are less likely to be enrolled than the 6-9 year olds (5% for 13-16 year olds; and 16% for the 17-18 year olds).

Adding the household variables makes the mother's resident variable significant (for ERA and HOR) and the TASOWL insignificant for all formal assistance types. Children who reside with their biological mothers are about 4 percent more likely to be enrolled (Table 7.4 Columns 5, 9 and 13). The child age effects remain similar to the last model, although the ARTP effects are relatively smaller. Children from households with a household head with religion as 'other Christian' (compared to Roman Catholic) and with rural (compared to urban) residence are about 6 percent and 7 percent less likely to enrol; while children from high wealth category households are about 5 percent more likely to enrol than children from the low wealth category.

Table 7.4: School Enrolment, Formal Assistance and ARTP

	Home Based Care (HBC)				Education Related Assistance (ERA)				Health Out Reach (HOR)			
	(2) FA	(3)ARTP	(4) CHLD	(5) HHD	(6) FA	(7)ARTP	(8) CHLD	(9) HHD	(10) FA	(11)ARTP	(12) CHLD	(13) HHD
Formal Assistance	0.003	-0.006	-0.020	-0.010	-0.012	-0.013	0.003	0.003	0.011	0.004	-0.015	-0.007
	(0.054)	(0.054)	(0.048)	(0.051)	(0.018)	(0.017)	(0.018)	(0.017)	(0.034)	(0.033)	(0.034)	(0.032)
MOHWL (Base)												
MOHART		0.024	**0.049***	**0.043***		0.023	**0.049***	**0.043***		0.024	**0.050***	**0.043***
		(0.022)	(0.025)	(0.025)		(0.026)	(0.025)	(0.025)		(0.026)	(0.025)	(0.025)
TASOART		**0.041***	**0.081*****	**0.071*****		**0.041***	**0.080*****	**0.070*****		**0.041***	**0.082*****	**0.071*****
		(0.026)	(0.024)	(0.024)		(0.022)	(0.023)	(0.023)		(0.022)	(0.024)	(0.024)
TASOWL		0.039	**0.053***	0.039		0.037	**0.053***	0.040		0.039	**0.053***	0.039
		(0.030)	(0.030)	(0.028)		(0.030)	(0.030)	(0.029)		(0.030)	(0.030)	(0.029)
Child level factors												
Age 10-12$^{\#}$			0.103***	0.102***			0.102*	0.102**			0.102***	0.102***
			(0.037)	(0.034)			(0.036)	(0.037)			(0.036)	(0.037)
Age 13-16			-0.050**	-0.060***			-0.050**	-0.060**			-0.050**	-0.060***
			(0.022)	(0.022)			(0.022)	(0.022)			(0.022)	(0.022)
Age 17-18			-0.163***	-0.169***			-0.163***	-0.170**			-0.163***	-0.170***
			(0.026)	(0.026)			(0.026)	(0.026)			(0.026)	(0.026)
Girl child			0.015	0.019			0.015	0.019			0.014	0.018
			(0.018)	(0.017)			(0.018)	(0.018)			(0.018)	(0.018)
Orphan			-0.011	-0.010			-0.010	-0.010			0.011	-0.010
			(0.018)	(0.023)			(0.019)	(0.023)			(0.019)	(0.023)
Mother resident			0.037	0.044			0.036	0.043*			0.035	0.043*
			(0.022)	(0.023)			(0.022)	(0.023)			(0.023)	(0.023)
Acute			-0.013	-0.014			-0.013	-0.014			-0.013	-0.014
			(0.018)	(0.018)			(0.018)	(0.018)			(0.018)	(0.018)
Household factors												
Male				-0.043				-0.043				-0.042
				(0.035)				(0.035)				(0.034)

Separated†				-0.002				-0.002				-0.001
				(0.044)				(0.044)				(0.044)
Widowed				0.007				0.006				0.008
				(0.041)				(0.040)				(0.039)
Agric occup (base)												
Other occupation				0.025				0.025				0.024
				(0.022)				(0.022)				(0.026)
No education (base)												
Primary-plus				0.003				0.003				0.003
				(0.019)				(0.019)				(0.019)
Catholic (Base)												
Muslim				-0.019				-0.018				-0.018
				(0.024)				(0.024)				(0.024)
Anglican				-0.024				-0.025				-0.024
				(0.025)				(0.025)				(0.026)
Other Christian				-0.056*				-0.056				-0.056*
				(0.033)				(0.033)				(0.033)
Under five children				-0.003				-0.003				-0.002
				(0.010)				(0.010)				(0.010)
Low wealth (Base)												
Average wealth				0.031				0.030				0.031
				(0.027)				(0.027)				(0.026)
Top wealth				0.046*				0.046*				0.046
				(0.027)				(0.027)				(0.027)
Savings				0.012				0.011				0.012
				(0.021)				(0.021)				(0.022)
Own land				0.007				0.007				0.007
				(0.018)				(0.017)				(0.017)
Rural residence				-0.068**				-0.067***				-0.067**
				(0.026)				(0.026)				(0.026)
N	1,138	1,136	983	979	1,138	1,136	983	979	1,138	1,136	983	979

Marginal effects reported; *p<0.10, **p<0.05, ***p<0.001: #Age 6-9 (Base); †Married (Base)

Table 7.5: School Participation, Formal Assistance and ARTP

	Home Based Care (HBC)				Education Related Assistance (ERA)				Health Out Reach (HOR)			
	(2) FA	(3) ARTP	(4) CHLD	(5) HHD	(6) FA	(7) ARTP	(8) CHLD	(9) HHD	(10) FA	(8) ARTP	(9) CHLD	(11) HHD
Formal Assistance	0.050	0.036	0.018	0.011	-0.004	-0.003	0.026	0.030	0.032	0.030	0.008	0.028
	(0.079)	(0.081)	(0.070)	(0.072)	(0.028)	(0.028)	(0.028)	(0. 026)	(0.056)	(0.057)	(0.055)	(0.051)
MOHWL (Base)												
MOHART		-0.061	-0.050	-0.023		-0.062	-0.050	-0.023		-0.063	-0.051	-0.024
		(0.043)	(0.041)	(0.039)		(0.043)	(0.041)	(0. 039)		(0.043)	(0.041)	(0.039)
TASOART		-0.010	0.031	0.045		-0.009	0.031	0.044		-0.012	0.030	0.043
		(0.039)	(0.037)	(0.039)		(0.039)	(0.037)	(0.039)		(0.039)	(0.038)	(0.040)
TASOWL		0.011	0.042	0.033		0.012	0.047	0.038		0.010	0.042	0.032
		(0.045)	(0.043)	(0.046)		(0.045)	(0.044)	(0.046)		(0.046)	(0.044)	(0.046)
Child level factors												
Age 10-12[#]			0.069	0.078**			0.069	0.076*			0.070	0.078*
			(0.043)	(0.040)			(0.043)	(0.039)			(0.043)	(0.040)
Age 13-16			-0.119***	-0.129***			-0.119***	-0.130***			-0.119***	-0.128***
			(0.034)	(0.033)			(0.034)	(0.033)			(0.034)	(0.033)
Age 17-18			-0.329***	-0.323***			-0.330***	-0.324***			-0.329***	-0.321***
			(0.037)	(0.035)			(0.038)	(0.035)			(0.037)	(0.035)
Girl child			-0.023	-0.015			-0.022	-0.015			-0.023	-0.014
			(0.027)	(0.025)			(0.026)	(0.025)			(0.026)	(0.025)
Orphan			0.015	-0.005			0.013	-0.006			0.015	-0.005
			(0.030)	(0.034)			(0.030)	(0.034)			(0.030)	(0.034)
Mother resident			0.014	0.021			0.014	0.019			0.015	0.022
			(0.031)	(0.030)			(0.031)	(0.030)			(0.031)	(0.030)
Acute			-0.022	-0.022			-0.021	-0.021			-0.022	-0.021
			(0.027)	(0.027)			(0.027)	(0.027)			(0.027)	(0.027)
Household factors												
Male				-0.124***				-0.123***				-0.126***
				(0.038)				(0.040)				(0.040)
Separated[†]				-0.025				-0.022				-0.027
				(0.057)				(0.058)				(0.058)

Widowed				-0.053				-0.055				-0.058
				(0.044)				(0.044)				(0.044)
Agric occupt'n (base)												
Other occupation				-0.061*				-0.062**				-0.060*
				(0.032)				(0.031)				(0.032)
No education (base)												
Primary-plus				-0.004				-0.001				-0.004
				(0.029)				(0.029)				(0.029)
Catholic (Base)												
Muslim				-0.051				-0.050				-0.055
				(0.037)				(0.036)				(0.036)
Anglican				0.005				0.006				0.005
				(0.038)				(0.038)				(0.038)
Other Christian				-0.162***				-0.159***				-0.162***
				(0.051)				(.050)				(0.051)
Under five children				-0.004				-0.007				-0.004
				(0.016)				(0.015)				(0.016)
Low wealth (Base)												
Average wealth				-0.012				-0.016				-0.012
				(0.041)				(0.040)				(0.040)
Top wealth				0.004				0.001				0.004
				(0.044)				(0.044)				(0.016)
Savings				0.004				0.002				0.002
				(0.033)				(0.032)				(0.033)
Own land				-0.001				-0.001				<0.001
				(0.033)				(0.033)				(0.033)
Rural residence				-0.101**				-0.101**				-0.102**
				(0.042)				(0.041)				(0.041)
Constant	0.935***	1.014***	1.244***	2.244***	0.947***	1.021***	1.201***	2.218***	0.930***	1.014***	1.240***	2.253***
N	1,026	1,024	891	887	1,026	1,024	891	887	1,026	1,024	891	887

Marginal effects reported; *p<0.10, **p<0.05, ***p<0.001: #Age 6-9 (Base); †Married (Base)

Determinants of school participation

Unlike school enrolment, neither formal assistance (HBC/ ERA/ HOR) nor ART packages has any effect on school participation (Table 7.5). When child factors are added to the model, the older children are 12 percent and 33 percent less likely to participate in school (13-16 and 17-18 years old respectively) compared to those younger (6-9 years). Controlling for household level factors, children from male headed households and heads with religion as ‘other Christian’, are about 12 percent and 16 percent less likely to participate in school respectively for all models (Table 7.5 Columns 5, 9 and 11). Children from households where the household head’s occupation is non-agricultural are 6 percent less likely to participate in school compared to a child from a household with a head in agricultural occupation; and children residing in the rural are 10 percent less likely to participate in school compared to urban resident children.

Determinants of schooling hours

For the univariate model (Table 7.6 Columns 2, 6 and 10); HBC, ERA and HOR increase a child’s schooling by 9, 5 and 7 hours per week respectively. However, no ART package effect is evident when ART packages are controlled for (Table 7.6 Columns 3, 7 and 11). With the addition of the child factors, the HBC, ERA and HOR effect on schooling hours remains insignificant. Secondary (A level) age children (17-18 years old) have about 16 hours less of schooling per week compared to the lower primary age children of 6-9 years old; while upper primary age children (10-12 years old) have about 8 hours more of schooling than the 6-9 year olds. A child’s having an acute illness reduces schooling hours by 3 hours per week. Controlling for the household level factors gives similar results, except that children who reside with their biological mother have 3 hours more of schooling for all formal assistance types. The formal assistance effect remains significant (7 hours for HBC, 5 hours for ERA and 8 hours for HOR).

Table 7.6: Schooling Hours, Formal Assistance and ARTP

	Home Based Care (HBC)				Education Related Assistance (ERA)				Health Out Reach (HOR)			
	(2) FA	(3)ARTP	(4) CHLD	(5) HHD	(6) FA	(7) ARTP	(8) CHLD	(9) HHD	(10) FA	(11) ARTP	(12) CHLD	(13) HHD
Formal Assistance	**8.797****	**7.658***	**8.092****	**7.000***	**4.612*****	**4.969*****	**6.134*****	**5.436*****	**7.293****	**7.153****	**8.076****	**7.607****
	(3.758)	**(4.090)**	**(3.791)**	**(4.061)**	**(1.757)**	**(1.786)**	**(1.822)**	**(1.756)**	**(3.074)**	(3.311)	**(3.342)**	**(3.434)**
MOHWL (Base)												
MOHART		-3.645	-2.991	-2.679		-3.853	-3.177	-2.932		-4.192	-3.613	-3. 229
		(2.882)	(2.911)	(2.912)		(2.801)	(2.830)	(2.865)		(2.860)	(2.866)	(2.870)
TASOART		0.952	1.102	0.335		1.032	1.309	0.463		0.443	0.435	-0.088
		(2.329)	(2.391)	(2.526)		(2.349)	(2.420)	(2.548)		(2.361)	(2.450)	(2.567)
TASOWL		2.905	3.048	2.233		3.629	3.909	2.865		2.587	2.623	1.860
		(2.635)	(2.515)	(2.583)		(2.660)	(2.562)	(2.678)		(2.662)	(2.569)	(2.645)
Child level factors												
Age 10-12$^{\#}$			7.561***	7.320***			7.421***	7.149***			7.761***	7.419***
			(1.825)	(1.818)			(1.814)	(1.815)			(1.793)	(1.801)
Age 13-16			1.144	1.058			0.945	0.813			1.181	1.082
			(2.171)	(2.185)			(2.165)	(2.173)				(2.165)
Age 17-18			-16.018***	-16.077***			-16.492***	-16.479***			-15.956***	-15.852***
			(2.881)	(2.940)			(2.922)	(2.964)			(2.926)	(2.953)
Girl child			-1.175	-0.462			-1.202	-0.519			-0.907	-0.252
			(1.499)	(1.486)			(1.472)	(1.468)			(1.475)	(1.471)
Orphan			-1.786	-3.030			-2.039	-3.127			-1.859	-2.818
			(1.878)	(1.960)			(1.850)	(1.938)			(1.861)	(1.923)
Mother resident			1.896	3.047*			2.013	3.001*			2.462	3.352*
			(1.854)	(1.784)			(1.833)	(1.763)			(1.855)	(1.794)
Acute			-3.267*	-3.081*			-3.138*	-2.934*			-3.443**	-3.205**
			(1.760)	(1.618)			(1.741)	(1.617)			(1.737)	(1.594)
Household factors												
Male				-2.034				-1.839				-2.656
				(3.414)				(3.437)				(4.212)

Separated†				-2.396				-1.527				-2.769
				(4.209)				(4.282)				(4.212)
Widowed				1.100				1.237				0.078
				(3.489)				(3.496)				(3.512)
Agricoccupt'n (base)												
Other occup				-0.844				-1.178				-0.597
				(2.348)				(2.238)				(2.362)
No education (base)												
Primary-plus				-0.677				-0.030				-0.556
				(1.979)				(1.956)				(1.973)
Catholic (Base)												
Muslim				-0.811				-0.883				-1.735
				(2.663)				(2.549)				(2.589)
Anglican				-1.201				-0.765				-0.933
				(2.536)				(2.514)				(2.556)
Other Christian				-1.981				-2.023				-2.283
				(4.042)				(3.942)				(3.935)
Under five children				-1.300				-1.550				-1.245
				(0.790)				(0.959)				(0.982)
Low wealth (Base)												
Average wealth				2.322				1.869				2.529
				(2.932)				(2.883)				(2.880)
Top wealth				4.118				3.486				4.172
				(3.121)				(3.133)				(3.078)
Savings				-1.861				-1.842				-2.251
				(2.554)				(2.437)				(2.532)
Own land				-0.535				-0.704				-0.688
				(2.048)				(2.013)				(2.047)
Rural residence				3.931				3.761				3.985
				(3.187)				(3.111)				(3.069)
N	1,026	1,024	891	887		1,024	891	887	1,026	1,024	891	887

*p<0.10, **p<0.05, ***p<0.001: #Age 6-9 (Base); †Married (Base)

Determinants of school progression

For the univariate model, children from households that received HBC have better school progression by one and a half years; same as one and a half grades (15 points for both SAGE-enrol and SAGE-all) while ERA and HOR have no effect for SAGE-all. Also, children from households that received HOR have better schooling progression by 12 points; which is better school progression by more than one year or just over one grade (Tables 7.7 and 7.8). Controlling for ARTP in addition to formal assistance, the HBC and HOR effect remains (though smaller), and children from TASOART households have better school progression by at least 17 points (which is better progression by just under two grades) for all formal assistance types, while children from TASOWL have 10 points higher on SAGE-enrol (about one great better) compared to children from MOHWL households (Tables 7.7).

Considering all children (whether enrolled or not (SAGE-all)), children from MOHART, TASOART and TASOWL households have better progression than children from MOHWL households with about 9, 18 and 12 points (almost a grade, over one grade and under two grades further) higher respectively (Tables 7.8 Column 4, 8 and 12). The ART package effect on school progression considering all children (SAGE-all) remains significant (Tables 7.8). Consistent with enrolment results, older children also have slower school progression compared to the younger children of age 6-9 for both SAGE-all and SAGE-enrol outcomes with poorer school progression of about three grades behind when only enrolled children are considered (SAGE-enrol) compared to all children (Tables 7.7 and 7.8). Female children have better progression (9 and 7 points more (about a grade to less than a grade further) for SAGE-enrol and SAGE-all respectively for HBC and HOR).

Controlling for the household level variables; the HBC effect on school progression for all children (SAGE-all) becomes significant with better progression by more than one grade further (13 points) for children in households that accessed HBC compared those that didn’t (Table 7.8 Column 5). The association between school progressions (SAGE), ARTP and age of children remain similar to the previous model for all formal assistance types (Tables 7.7 and 7.8). Likewise, the association between being a female and school progression remains. Education of the household head improves school progression by more than half a grade (about 8 and 7 points) for SAGE-enrol and SAGE-all respectively (Tables 7.7 and 7.8). Considering religion of the household head, compared to the Catholics, children from Muslim households have better progression by about one grade and more than one grade (for SAGE-enrol and Sage-all respectively) while other Christians have slower school progression of about one grade or more for SAGE-all and SAGE-enrol outcomes for all formal assistance types. Savings increase school progress by one grade and beyond half a grade (11 and 6 points) for SAGE-enrol and SAGE-all respectively for all formal assistance types (Tables 7.7 and 7.8 Columns 5, 9 and 13); while children from high wealth households have better school progression for SAGE-all by more than half a grade (6 points). Children from rural residence have slower progression compared to children from urban areas by almost a grade and half a grade (about 8 and 5 points) for SAGE-enrol and SAGE-all respectively.

Table 7.7: School Progression (SAGE-enrol), Formal Assistance and ARTP

	Home Based Care (HBC)				Education Related Assistance (ERA)				Health Out Reach (HOR)			
	(2) FA	(3)ARTP	(4) CHLD	(5) HHD	(6) FA	(7)ARTP	(8) CHLD	(9) HHD	(10) FA	(11)ARTP	(12) CHLD	(13) HHD
Formal Assistance	**15.133*****	**11.836*****	**9.938*****	**11.534***	-0.903	-1.143	0.941	1.156	**11.766****	**9.251***	**10.637****	6.849
	(4.817)	**(3.692)**	**(3.935)**	**(6.911)**	(2.973)	(2.893)	(3.115)	(3.077)	**(5.270)**	**(5.130)**	**(4.811)**	(4.737)
MOHWL (Base)												
MOHART		5.481	7.958	7.504		5.274	7.869	7.297		4.764	7.185	6.786
		(5.167)	(5.508)	(5.092)		(5.144)	(5.538)	(5.105)		(5.158)	(5.508)	(5.118)
TASOART		**16.443*****	**19.313****	**15.102*****		**16.786*****	**19.661*****	**15.597*****		**15.891*****	**18.361*****	**14.870*****
		(4.596)	**(5.230)**	**(5.228)**		**(4.571)**	**(5.276)**	**(5.293)**		**(4.635)**	**(5.304)**	**(5.290)**
TASOWL		**9.927***	**11.912****	7.876		**10.082*****	**12.317****	8.244		**9.846***	**11.606***	7.801
		(5.288)	**(5.944)**	(5.347)		**(5.338)**	**(6.037)**	(5.424)		**(5.245)**	**(5.893)**	(5.301)
Child level factors												
Age 10-12$^{\#}$			-30.624***	-29.736***			-30.625***	-29.764***			-34.590***	-36.725***
			(5.082)	(4.857)			(5.083)	(4.847)			(5.011)	(4.810)
Age 13-16			-34.549***	-36.643***			-34.612***	-36.699***			-34.489***	-38.006***
			(5.017)	(4.818)			(4.998)	(4.784)			(5.495)	(5.270)
Age 17-18			-34.516***	-38.040***			-34.722***	-38.231**			9.134***	9.476***
			(5.525)	(5.270)			(5.488)	(5.225)			(2.556)	(2.499)
Girl child			8.810***	9.238***			8.903***	9.335***			5.004	1.123
			(2.596)	(2.511)			(2.602)	(2.522)			(3.190)	(3.715)
Orphan			5.061	0.867			5.256	1.087			-0.910	1.164
			(3.229)	(3.746)			(3.308)	(3.744)			(3.900)	(3.740)
Mother resident			-1.474	0.898			-1.362	1.024			2.332	-3.320
			(3.956)	(3.748)			(3.951)	(3.691)			(2.955)	(3.036)
Acute			-2.232	-3.240			2.271	-3.277			-2.332	-3.320
			(8.001)	(3.049)			(2.965)	(3.042)			(2.955)	(3.036)
Household factors												
Male				-3.617				-3.613				-4.146
				(6.869)				(6.824)				(6.646)

Separated†				-3.118				-2.738				-3.190
				(7.040)				(6.975)				(6.821)
Widowed				5.767				5.869				5.129
				(7.417)				(7.392)				(7.294)
Agricultural occupation (base)												
Other occupation				3.607				3.534				3.882
				(3.682)				(3.687)				(3.686)
No education (base)												
Primary-plus				8.241***				8.635***				8.433***
				(2.959)				(3.035)				(2.924)
Catholic (Base)												
Muslim				9.289**				8.759**				8.196*
				(4.314)				(4.266)				(4.323)
Anglican				-7.283*				-6.675				-6.678
				(4.140)				(4.205)				(4.092)
Other Christian				-13.057***				-13.049**				-13.303***
				(4.995)				(5.054)				(5.004)
Under five children				-1.150				-1.076				-1.067
				(1.553)				(1.593)				(1.551)
Low wealth (Base)												
Average wealth				3.937				4.264				4.399
				(4.981)				(4.931)				(4.962)
Top wealth				7.336				6.991				7.324
				(5.069)				(5.113)				(5.122)
Savings				10.195**				10.608***				10.048**
				(3.916)				(3.910)				(3.924)
Rural residence				-8.714**				-8.030*				-8.382**
				(4.230)				(4.266)				(4.234)
Constant	89.13***	79.49***	98.65***	97.51***	89.95***	80.20***	98.30***	96.16***	88.58***	79.48***	98.13***	97.22***
N	1,032	1,030	885	881	1,032	1,030	885	881	1,032	1,030	885	881

*p<0.10, **p<0.05, ***p<0.001: #Age 6-9 (Base); †Married (Base); SAGE-enrol excludes non-enrolled and SAGE-all considers both enrolled and non-enrolled

Table 7.8: School Progression (SAGE-All), Formal Assistance and ARTP

	HBC					ERA				HOR		
	(2)FA	(3)ARTP	(4)CHLD	(5)HHD	(6) FA	(7)ARTP	(8)CHLD	(9) HHD	(10)FA	(11)ARTP	(12)CHLD	(13)HHD
Formal Assistance	**14.808***	**11.796***	11.600	**12.906****	-0.791	-0.983	0.491	0.977	8.69	6.054	7.367	3.947
	(7.703)	**(6.701)**	(7.115)	**(6.455)**	(2.581)	(2.439)	(2.568)	(2.447)	(5.344)	(4.918)	(5.049)	(4.231)
MOHWL (Base)												
MOHART		**8.722***	**9.636****	**9.661****		**8.597****	**9.567****	**9.489****		**8.256****	**9.116****	**9.230****
		(4.033)	**(4.421)**	**(4.401)**		**(4.008)**	**(4.425)**	**(4.411)**		**(4.064)**	**(4.458)**	**(4.460)**
TASOART		**17.26*****	**18.11*****	**15.351*****		**17.66*****	**18.53*****	**15.929*****		**17.03*****	**17.622*****	**15.523*****
		(2.971)	**(3.505)**	**(3.447)**		**(3.003)**	**(3.552)**	**(3.499)**		**(2.962)**	**(3.545)**	**(3.515)**
TASOWL		**12.27*****	**12.02*****	**8.840****		**12.43*****	**12.36*****	**9.146****		**12.13*****	**11.718*****	**8.789****
		(3.690)	**(4.197)**	**(3.676)**		**(3.661)**	**(4.176)**	**(3.652)**		**(3.673)**	**(4.207)**	**(3.652)**
Child level factors												
Age 10-12$^{\#}$			-12.788***	-12.054***			-12.811***	-12.121***			-12.614***	-12.037***
			(3.772)	(3.745)			(3.789)	(3.758)			(3.800)	(3.594)
Age 13-16			-10.632**	-12.369***			-10.73**	-12.488***			-10.600***	12.405***
			(3.650)	(3.550)			(3.657)	(3.557)			(3.686)	
Age 17-18			-8.865**	-11.948***			-9.118**	-12.223***			-8.844**	-11.998***
			(4.352)	(4.372)			(4.369)	(4.390)			(4.379)	(4.451)
Girl child			6.510**	6.742***			6.573**	6.798***			6.765***	6.901***
			(2.524)	(2.348)			(2.520)	(2.336)			(2.533)	(2.364)
Orphan			2.825	-1.201			3.188	-0.837			2.957	-0.787
			(2.347)	(2.736)			(2.441)	(2.754)			(2.374)	(2.758)
Mother resident			1.828	4.276			1.901	4.402			2.280	4.516
			(3.158)	(3.260)			(3.139)	(3.250)			(3.034)	(3.219)
Acute			-0.332	-1.106			-0.436	-1.189			-0.435	-1.199
			(2.541)	(2.555)			(2.548)	(2.554)			(2.554)	(2.558)
Household factors												
Male				-8.632				-8.647				-8.974
				(6.014)				(5.950)				(5.810)

Separated†				-8.207				-7.852				-8.170
				(6.757)				(6.716)				(6.541)
Widowed				-0.081				<0.001				-0.499
				(6.493)				(6.408)				(6.270)
Agric occupt'n (base)												
Other occup				3.225				3.190				3.367
				(3.098)				(3.080)				(3.089)
No education (base)												
Primary-plus				7.096***				7.511***				7.343***
				(2.393)				(2.507)				(2.398)
Catholic (Base)												
Muslim				13.012**				12.419**				12.129**
				(5.937)				(5.849)				(5.981)
Anglican				-4.555				-4.049				-4.080
				(2.954)				(2.936)				(2.952)
Other Christian				-9.495***				-9.591***				-9.754***
				(3.605)				(3.673)				(3.676)
Under five children				-1.332				-1.191				-1.169
				(1.282)				(1.285)				(1.292)
Low wealth (Base)												
Average wealth				4.374				4.804				4.906
				(3.689)				(3.747)				(3.675)
Top wealth				6.722**				6.384*				6.558*
				(3.383)				(3.435)				(3.407)
Savings				5.828**				6.361**				6.042**
				(2.894)				(2.932)				(2.906)
Rural residence				-5.715*				-4.943				-5.073*
				(3.074)				(3.043)				(3.020)
Constant	74.39***	63.24***	65.34***	67.00***	75.15***	63.83***	65.23***	65.62***	74.06***	63.31	64.90***	66.23***
N	1,133	1,131	980	976	1,133	1,131	980	976	1,133	1,131	980	976

*p<0.10, **p<0.05, ***p<0.001: #Age 6-9 (Base); †Married (Base); SAGE-enrol excludes non-enrolled and SAGE-all considers both enrolled and non-enrolled

7.5. Discussion, Conclusion and Implications

This chapter contributes new knowledge on the association and causality of formal assistance to schooling outcomes of children of both primary level and secondary level age. In addition, the study documents the association between schooling outcomes and the nature of treatment (ARTP) the PLWHA is receiving; highlighting the fact that children's schooling outcomes may differ with the nature of treatment the PLWHA receives. The results reveal that formal assistance improves schooling in terms of school progression and schooling hours. Furthermore, the chapter contributes new evidence of ARTP improving school enrolment and school progression for children residing in households with a PLWHA (possibly due to a third unobserved factor for example ability or intelligence of the child, adherence to ART and conforming to ART treatment or the schooling schedule which, may explain the heightened propensity to seek ART treatment and improved school attendance). The chapter also shows that older children of secondary school age have the worst outcomes for all schooling outcomes.

Households affected by AIDS have been found to have increased labour demands with illness of the PLWHA (Gilborn *et al.* 2001; Kendall and O'Gara 2007); provision of home based care to look after the sick at home frees up the children's time and hence children are more likely to spend more time at school and hence progress normally (Bennell 2005). Provision of education related assistance such as scholastic materials deals with the immediate need to spend more time at school but does not have the long-term effect on the way a child will progress in school. The results find significant positive associations between such formal assistance and schooling outcomes in terms of schooling hours per week and school progression; but no association for school enrolment and participation. The results emphasise the importance of formal assistance in improving school progression and time spent at school but not enrolment per se, given that formal assistance makes little difference to enrolment rates in an environment with universal primary education where school tuition is free (Yamano *et al.* 2006), as is the case in Uganda. That is, all children enrol, but real engagement measures indicate differences in outcomes due to the formal assistance programs.

Results also reveal that the nature of treatment received by the PLWHA (ARTP) affects schooling outcomes differently; ARTP has significant associations with rates of enrolment and school progression but not participation or hours. Overall, ART from TASO (TASOART which has other forms of additional support not focused on here) seems to have a consistently greater impact than other treatments (followed by ART from MOH) probably emphasising importance of additional support in addition to ART for PLWHA, which translates into better outcomes for the PLWHA and the families to which they belong (Okero *et al.* 2003; Gonzalez *et al.* 2004; Luszczynska *et al.* 2007; Reich *et al.* 2010; Yadav 2010; Ilebani and Fabusoro 2011). This implies that ART other than septrin gives better schooling outcomes, especially for enrolment rates. This may have implications of greater resource use for HIV treatment especially for a resource constrained country like Uganda, which depends on donor funding for HIV care and treatment. In spite of the cost implications, however, better schooling outcomes from such treatment have the potential to improve returns to investment in human capital and hence impact national development. Moreover, better schooling for girls has the potential to impact future children's health, education and reduce fertility (Drèze and Murthi 2001; Boyle *et al.* 2006).

Contrary to our hypothesis of ART-plus in terms of ART from TASO and septrin from TASO giving better outcomes than ART only; ART plus as indicated by ART from TASO (TASOART) and septrin from TASO (TASOWL) does not seem to have consistent superior outcomes to ART only, ART from MOH (MOHART) and septrin from MOH (MOHWL). Only ART from TASO is superior to all the other treatment types but septrin from TASO generally seems to give similar or in some cases, worse outcomes than ART from MOH (Tables 7.8). This highlights the importance of the nature of treatment in terms of ART and prophylactic septrin, with evidence of ART leading to better outcomes than septrin even when additional support is considered for those on septrin (TASOWL), compared to those on ART but with no support (MOHART). This may have policy implications for earlier initiation of ART as recommended by WHO; by considering initiation of ART for PLWHA with CD4 cell count of <= 350 cells/mm^3 other than 200 cells/mm^3 as has been the practise in Uganda. This would imply greater opportunity cost for HIV treatment, but increased exposure to ART would compensate by reducing ART related deaths. Importantly, ART seems to give better schooling outcomes which are important for human development and hence a bright future for children in PLWHA households.

However, considering PLWHA on the same type of treatment such as those on ART and those on prophylactic septrin, PLWHA with additional support has superior outcomes. TASOART consistently gives better outcomes than MOHART; and TASOWL gives better outcomes than MOHWL (Tables 7.7 and 7.8). In this regard, additional support per treatment type is superior and this may have policy implications for each treatment type that a PLWHA receives. To maximise benefits from all treatment types, giving support to PLWHA may help maximise benefits from treatment and ensure consumption is smoother for households with a PLWHA.

Finally, older children of secondary level age (who have been previously excluded in schooling related research) are more likely to have the worst schooling outcomes for example falling at least three grades below normal progress for all enrolled children (Tumushabe 2000; UNICEF 2000b). Education For All (EFA) in Uganda covers only primary school, hence older children are more limited by resources and finances to pursue their education (Bennell 2005). As such, this leads to lower enrolment rates, reduced school participation, less schooling hours and inevitably slower school progression. Older children have greater opportunity costs given that they can participate more in the labour market than the younger ones (as shown in Chapter 6). Assistance to families with such vulnerable older children in struggling AIDS affected households is vital (Richter 2004; Richter *et al.* 2009; Richter 2010), to reap the known benefits from better educational attainment (Bloom *et al.* 2006).

This study has some limitations in that the data used are only from Central Uganda, which has relatively better HIV/AIDS services than the other regions in Uganda and hence, may not be representative on a national scale. However, given that 40 percent of services are in this region, the study provide insights into the important aspects that relate to AIDS affected households, formal assistance and schooling outcomes. Secondly, given time and funding limitations, the study coverage encompassed only TASO and MOH as the AIDS service providers. Given the numerous agencies in HIV service provision in Uganda, especially Central Uganda, more research including other agencies would give a better picture of the effect of formal assistance on schooling outcomes for the region as a whole. It is also important to note that the data has an issue of endogenous treatment bias but this has been partly controlled by the observables that are suspected to lead to self-selection into TASO. Additionally, there is a possibility of social desirability bias in self-reported education data especially in developing countries like Uganda where attendance data may not be readily available. Baird and Özler (2012) indicated that misreporting is common in school participation overstating enrolment and attendance rates. Such over-reporting is reported to compress the differences between treatment and control groups causing a downward bias in observed program impacts. The authors concluded that meaningful measures of school participation are unlikely to be obtained if information from students, their parents or their teachers is obtained and, are likely to produce biased estimates of participation levels or program impacts. As noted by Baird and Özler (2012), better school participation can be collected through observation or independent sources of data from a credible source. Consequently, the results from this chapter should be treated with caution.

Despite these limitations, the findings provide empirical evidence that can help inform policy to improve schooling outcomes for children in AIDS affected households. Budgetary re-allocation that would prioritise more spending on health to support vulnerable children in AIDS affected households through cash transfers, preferably conditional on children's schooling, would enhance schooling outcomes (de Janvry *et al.* 2006). Lessons are evident from Kenya, Botswana and South Africa where budgetary re-allocations have made resources available for cash transfers to AIDS affected households, improving household welfare and children outcomes including schooling (Skovdal *et al.* 2008; Richter 2010).

Alternatively, community based interventions such as community based transfers, with national assistance can be developed at the community level to enhance the benefits of schooling (Skovdal *et al.* 2008). Also, provision of formal assistance through the partnership of organisations and stakeholders[35] involved in HIV/AIDS projects with HIV service providers is a pathway that can provide formal assistance to enhance schooling outcomes of children in such affected households. Additionally, better schooling outcomes for ART (TASOART and MOHART compared to TASOWL and MOHWL) may have greater cost implications for earlier initiation of ART for PLWHA receiving prophylactic septrin in resource constrained countries like Uganda (WHO 2009b; Ford *et al.* 2010; WHO 2010). This, if implemented, may reduce the number of people that can access ART

[35] Examples in Uganda include ACDI/VOCA and WFP that have partnered with TASO in the past to provide food supplements for a defined period, usually 5 years.

given resource constraints. However, the challenge to the Ugandan government will be to weigh up the huge opportunity cost of earlier ART initiation against the future benefits of better schooling outcomes, especially for girls who in the future would be mothers who might greatly impact child health and education outcomes. Furthermore, provision of additional support to PLWHA irrespective of the nature of treatment they access can be a pathway of improving children schooling outcomes.

In conclusion, although EFA improved enrolment rates for primary school aged children (Deininger 2003; Grogan 2009; Essama-Nssah 2010), there is work to be done to improve outcomes for older secondary age children to benefit from educational investment in Uganda. This study is evident that provision of formal assistance goes beyond school attendance, and therefore important for quality schooling outcomes by impacting hours invested in schooling and ensuring better school progression, hence better achievement at school.

Chapter 8 - Adult Resource Allocation

8.1. Introduction and Background

The previous two chapters explored children's resource allocation including labour allocation for domestic and farm work (Chapter 6) for children residing in PLWHA and non-PLWHA households, and the effect of formal assistance and antiretroviral treatment packages (ARTP) on schooling outcomes for children residing in PLWHA households (Chapter 7). This Chapter seeks to explore resource allocation in adults 19 years and older. Here, the relationship between adult labour allocation and ARTP is explored.

There are several factors that affect the amount of labour hours provided by adult household members and understanding these factors is important for policy. HIV/AIDS predominantly affects individuals that are economically active and inevitably affects labour hours for such adults. Numerous studies have explored factors that are associated with labour supply (Chiappori 1997; Lundberg and Rose 2002; Chiappori 2011) but very few studies have explored labour supply in the context of households with a Person Living with HIV/AIDS (PLWHA).

Most studies have focused on the macroeconomic impact of HIV on labour supply (Arndt and Lewis 2000; UNDESA 2004); some have explored the effect of HIV/AIDS on the labour market (Dorward *et al.* 2006), finding that the introduction of "labour saving[36]" technologies to assist labour-constrained AIDS-affected households may have negative impacts in areas where wages are already falling due to HIV/AIDS depressing labour demand than contracting labour supply (Dorward *et al.* 2006). Dorward *et al*, (2006) implied that more conventional "labor-demanding[37]" crop technologies may offer the best opportunities for both AIDS-affected and "healthy" poor households where labor-demanding technologies are defined as increasing both labor and land productivity, but with greater increases in the latter. Labour demanding technologies have been shown to lead to both increased returns to labor and labor demand supporting wages. The study also emphasised the need for AIDS-affected households to obtain extra support such as cash transfers to enable hiring labour.

Other studies have explored the impact of an adult death on household time allocation and activities (Oni *et al.* 2002; Beegle 2005). Beegle (2005) found small insignifiant changes in labour supply of individuals in households that had experienced an adult death. The same study also showed that past deaths were not associated with changes in either wage employment or non-farm self-employment and did not reduce the household diversification over income sources. However, the study indicated a reduction in coffee farming for households with an adult death within 6 months but not after 6 months; and a decrease in wage employment of adult men in response to a future female or male adult death. Oni et al., on the other hand indicated reduced household labour supply available for productive purposes as a result of an adult death of a household member due to HIV/AIDS. In this case, household coping included diversifying of income sources to compensate for the reduced income due to the adult death.

This chapter seeks to contribute to the HIV/AIDS labour supply literature by exploring the association between the nature of treatment for HIV/AIDS (in terms of the antiretroviral treatment package[38] (ARTP)) and labour allocation (for individual adults in general; individual men and women and couples in a household). The chapter additionally explores the relationship between being a part of a household affected by HIV/AIDS in terms of the

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[36] Labour saving technologies for example use of draught animals for tillage; conservation agriculture, roof water harvesting and milling machines.

[37] Labour demanding activities include land preparation, weeding, fetching water and firewood

[38] ARTP includes TASOART, TASOWL, MOHART and MOHWL as described in Chapter 4.

care provided to PLWHA (specifically TASO and MOH) compared to non-PLWHA and labour allocation.

As mentioned in Chapter 1, there is evidence of gender dimensions in resource allocation (FAO 2011; Seebens 2011). Analysing male and female labour separately aims to explore whether labour allocation for males and females is affected differently by the factors that are associated with labour supply. Importantly, the effect of ARTP on male and female allocation is also explored to try and discover how the nature of treatment affects female and male labour supply and what the implications of this might be for policies that aim to improve household productivity. Furthermore, for couples, bargaining power is explored to ascertain whether women are disadvantaged compared to men, given that patriarchal societies like Uganda tend to have cultural practices that favour men (FAO 2011). An analysis of bargaining power in the household may inform policy on how disadvantaged women can be empowered to reduce subordination caused by cultural norms.

Early studies generally modelled household behaviour assuming the household as a set of stable and transitive preferences under the unitary model (Becker 1965; Becker 1991) but this has been refuted, leading to the development of non-unitary models of household behaviour (Browning *et al.* 2006). Non-unitary models propose explicitly that households consist of a number of different members with preferences that are different from each other (Chiappori and Donni 2009).

Non-unitary models have been shown to be important in providing evidence of gender differences and inequality (Lundberg 1988; Lundberg and Rose 2002; Lancaster *et al.* 2006). There is a suggestion that women have a greater propensity to allocate resources towards children (Strauss *et al.* 2000) with substantial evidence existing that indicates men and women have different preferences. Such evidence has asserted that relative to fathers, mothers care more about the health, education and wellbeing of their children and women seek to allocate more resources towards improving child health than men (Strauss *et al.* 2000). This chapter seeks to use the collective household resource allocation model to explore gender differences in labour supply among couples. The chapter initially analyses labour hours for all adults in the household and further analyses male and female labour supply separately. Finally, the analysis of labour supply for couples including bargaining power is also investigated. The rest of the chapter is organised as follows. Section 8.2 outlines the household resource allocation models, section 8.3 gives a concise literature review on household resource allocation, section 8.4 outlines economic theories on household choice including producer choice which affects labour supply choice decisions which determine household resource allocation), section 8.5 is the methodology, section 8.6 covers the empirical approach, section 8.7 discusses the results and section 8.8 concludes.

8.2. Household Resource Allocation models

Economic models of household resource allocation have been used to understand how resources within the household are allocated among household members. Interest in household resource distribution has been spurred by poverty and inequality, which may lead to differential resource allocation within the household which may seriously reduce the welfare of some members. An example is policy concern with household level food security and the mechanisms for consumption smoothing in the event of negative shocks. For poor families, it is possible that women and children suffer most from the shock because workers are mostly men and these may get first food allocations to maintain their labour productivity (Strauss *et al.* 2000).

For simplicity, most of the models have been assumed to be static while incorporating some dynamics in terms of household size and composition (Strauss *et al.* 2000). They have also been noted to neglect aspects relating to formation and dissolution of households and transfers from and to the household. However, despite their shortcomings, they have revealed the role of age, gender, nutrition, health, expenditure, wages and labour opportunities in the distribution of resources among members of the household (Strauss *et al.* 2000; Maitra 2004; Maitra and Ray 2005).

Economists use two main approaches to explain household resource allocation. The first approach is the unitary model that was introduced by Becker (1965), and the second is the collective model which was developed as an alternative that challenged the unitary approach (Alderman *et al.* 1995). The following gives an overview of intra-household models including the unitary model as explained by the *common preference model* and *unified household model*, and the *collective model* described by the *cooperative bargaining* and *non-cooperative bargaining model*, where households are modelled in a collective framework that recognises the individualistic elements in households. Collective models make the assumption of Pareto efficiency in intra-household resource allocation (Strauss *et al.* 2000).

8.2.1. Common preference model

The common preference model treats the household as a single unit of analysis. Individual preferences are aggregated into household preferences assuming that all of the members of the household have identical utility; homothetic[39] functions imply that maximising the household utility function gives the same results as maximising individual utility functions (Doss 1996). Through aggregation, however, there is a possibility of losing information about individual preferences (Arrow 1951). One possible approach to modelling the common preference model is to assume that a dictator or benevolent altruist aggregates the individual utility function as the basis of household decisions (Doss 1996; Strauss *et al.* 2000). In this sense, decision making is treated as a black box under unitary type models (Strauss *et al.* 2000). This model has been mostly used to model income with the share of income or wealth of individuals within the household assumed not to affect allocation of resources within the household (Doss 1996).

8.2.2. Unified household Model

The unified model also assumes that a household maximises a single household welfare function that is subject to various household level constraints. The model assumes that all household resources are pooled and that the distribution of income among household members does not matter (Strauss *et al.* 2000). In contrast to the common preference model, the unified model incorporates both consumption and production decisions. The agricultural household model is one popular model that has been used to examine household behaviour in developing countries following the unified model (Ahn *et al.* 1981). It was developed to explain the effects of price and other policies on households that are both producers and consumers. In its simplest form, it assumes that production and consumption decisions are separable (Singh *et al.* 1986). The agricultural model assumes that consumption and labour supply decisions of individuals within the household can be aggregated into single household consumption and labour supply decisions (Singh *et al.* 1986).

[39] Homothetic utility functions assume that the utility received from different goods does not vary across household members or across income levels (Doss, 1996)

The *unitary* type models are flawed in that not all household members necessarily behave voluntarily in preference maximisation and in accordance to the dictator's orders. Usually, the presence of violence in the household is an indicator somebody (the dictator) is forcing other household members to accept the assumed common good. It is also problematic to define the common good and it is not obvious who decides the best outcome for the household (Mattila-Wiro 1999). There have been efforts to deal with the problem of ignoring individual preference by aggregating preferences to obtain average utility functions that are assumed to indicate the level of well-being of the entire household, - for example using the welfare of the family as a weighted average of the net utility of all members (Mattila-Wiro 1999). Additionally, there is evidence of unequal distribution of resources and commodities within a household due to cultural and traditional norms. Exploring intrahousehold inequalities using the *unitary* model would be impossible in this case and use of such a model would lead to inadequate and misleading policies (Chiappori 1992; Mattila-Wiro 1999).

8.2.3. Collective Model

Unlike the *unitary model* as described by the common preference and unified model that assume an aggregate household utility function, the *collective model*, introduced by Chiappori (1988), disaggregates the household utility function. The collective model assumes Pareto efficiency where no one in the household can be made better off in the distribution of household resources without making someone else worse off (Doss 1996). The model assumptions include; (a) some goods to be private; (b) caring preferences where household members have the utility of household members in their utility function; (c) each members sub-utility function is separable with respect to private consumption; and (d) at least one private good is assignable to determine who consumes the good (Browning *et al.* 1994). In the collective model, the allocation of private expenditure is explained as the outcome of a sharing rule (Doss 1996). The collective model is a general model with both the unified and cooperative bargaining models being a restricted case of the collective model (Doss 1996; Strauss *et al.* 2000).

Browning and Chiappori (1998) indicate that if behaviour is Pareto efficient, the household objective function is a weighted utilitarian maximand (Strauss *et al.* 2000). In other words, if behaviour is efficient, households maximise the weighted sum of each member's utility, subject to the budget constraint. For a two person household:

$$\max \mu \, U^A(x^A, x^B) + (1-\mu)U^B(x^A, x^B) subject \;\; to \;\; p(x^A \, + \, x^B) = \Upsilon$$

where U^i represents member i's utility (i= A, B) and x represents private consumption for i. The utility of member i is a function of member i's private consumption and other household members private consumption; in this case utility of member A is a function of x^A, x^B. Total household income is Υ, and p represents a vector of prices for x, μ (0<μ<1) represents the welfare weight of members (member A in this case) in household allocations. μ is not constant but a function of prices, total household income and other variable like distributional income. This model of efficient behaviour collapses into the unified model if U^A and U^B are identical, or if μ is either 1 or 0 (i.e., members' preferences across all goods are identical, or there is a dictator in the household) (Strauss *et al.* 2000).

8.2.4. Cooperative bargaining Model

The cooperative bargaining models first started with the work of Manser and Brown (1980) and McElroy and Horney (1981). In this model, household decisions are made through a cooperative Nash game. In McElroy and Horney's model, Nash equilibrium is obtained when each individual's threat point (fall-back position) is his/her utility outside of marriage. Threat points are characterised as some level of utility obtained if no agreement can be reached (Strauss *et al.* 2000). The model assumes that couples pool their resources, allocate them jointly and share public goods. However, some authors have refuted dissolution of marriage as an appropriate threat point. Lundberg and Pollak (1993) and (1994) developed a model where bargaining over gains from marriage other than divorce determined allocation of resources. In this case, gender roles determined each individual's activities and contributions to the household if partners do not reach an agreement. In this case, the non-cooperative outcome where agreement is not reached is the threat point (Lundberg and Pollak 1993; Doss 1996) .

In cooperative bargaining models, the factors that influence the threat points of individuals affect the distribution of resources within the household, even when individual and total household resource levels are not altered. Similar to the collective model, household production and consumption is Pareto efficient. The cooperative bargaining model is different to the collective model by specifying which Pareto efficient point will be chosen (Doss 1996).

Recent developments in cooperative bargaining models include dynamic models. These have been developed to deal with the inadequacy of static models in describing risks and consumption smoothing behaviour due to the uncertainty of income in many developing agricultural countries (Xu 2007). One example is Ligon (2011) who developed a dynamic bargaining model to illustrate contract enforcement problems within households. Dynamic models are different from the static models in that no household member desires to terminate the marriage; bargaining positions can vary over-time and re-negotiation can be ongoing; and negotiation results need not always be Pareto optimal (Xu 2007; Ligon 2011). In this case, the setting is multi-period and negotiation in each period is shown to form a sharing agreement. Such sharing is shown to produce *ex post* optimality given that it is based on the history of previous time periods. The allocation is not Pareto optimal *ex ante* because of a lack of any binding enforcing mechanism (Xu 2007; Ligon 2011). Risk averse and forward looking households are postulated to negotiate on the basis of the entire sequence of power alternation other than relative power in a single period. Family members are assumed to efficiently divide any surplus resource according to the invariant sharing rule until they reach optimality, in that continuing to use the rule may make one of the members worse off than if they became single. In this case, households re-negotiate the sharing agreement between them until the point where one of them would be better off ending the relationship (Xu 2007; Ligon 2011).

8.2.5. Non-cooperative bargaining Models

Non-cooperative bargaining models assume that income is not pooled and instead they explicitly model how the levels of shared goods are chosen. Non-cooperative models allow for individual preferences and allow individuals to make consumption and production decisions based on their own labour and access to resources. The outcomes from this model can be either Pareto efficient or non-Pareto efficient. Unlike the cooperative model where the public good is given and hence exogenous, the public good is endogenous in non-cooperative models and determined through the bargaining process. The arguing process determines how much an individual spends on both private and public goods within the household, including health, education, food and housing (Doss 1996). The non-cooperative models are the least restrictive of the household resource allocation models but are challenging to estimate in that they require more detailed data (Doss 1996).

The collective models of household behaviour are able to explore the different preferences, conflicts and inequalities among the household members but have the challenge of becoming complex as more variables are included in the analysis, making policy formulation problematic (Mattila-Wiro 1999).

8.3. Concise literature review on household resource allocation

The literature on intra-household resource allocation is vast. Below is a summary of some of the literature that investigates non-unitary resource allocation in a household following a collective framework approach including examples on the balance of power among couples; as well as resource allocation models on individual and household labour supply.

8.3.1. Non-unitary resource allocation models

Duflo and Udry (2004) investigated household resource allocation in Cote d'Ivore using the general collective model. They discovered that conditional on overall levels of expenditure, the composition of household expenditure was sensitive to the gender of the recipient of a rainfall shock (where rainfall shock refers to variation in rainfall). Rainfall shocks associated with high yields of crops predominantly cultivated by women were found to shift expenditure towards all types of food consumption (except staples). In contrast, rainfall shocks associated with high yields of crops mainly cultivated by men had no effect on the purchase of food. Additionally, rain-fed fluctuations in income from yams were found to be transmitted to expenditure on education and food, not to expenditure on private goods like alcohol and tobacco. Furthermore, the study revealed that rainfall shocks that increased the output of yams ("appreciated products[40]") were associated with strong shifts in the composition of expenditure towards education, staples and overall food consumption, but not adult goods and prestige goods like jewellery. On the other hand, rainfall shocks that increased the output of crops cultivated individually, either by men or women, were associated with strong

[40] "Appreciated products" are always under the control of the household head for redistribution to the entire household in the form of food.

expenditure towards adult and prestige goods. The study indicated that different sources of income are allocated to different uses depending on the identity of the income earner and social norms on gender roles.

Koolwal and Ray (2002) use the collective approach where the weights are determined and simultaneously estimated with the household outcomes, hence weights being endogenous. Using Nepalese evidence, they indicate that a woman's share of household earning understates her power in making household decisions. On the other hand, their study indicated that an increase in the woman's educational experience increased her bargaining power.

A similar study by Lancaster, Maitra and Ray (2006) showed that household balance of power may be endogenous and might be affected by changes in the household choice vector. An example is decision making being affected by the share of household earnings, which depend on the labour supply of spouses; women's empowerment effects which may affect household consumption patterns; education, which increases women's power, share of income and expenditure which is a choice variable. Therefore, balance of power is affected by household decisions implying rejection of the unitary model. The authors examined the effect of relative spousal power (measured by share of spousal income) on household expenditure patterns, similar to Haddinott and Haddad (1995), except that they assume bargaining power to be exogenous. Assuming exogenous bargaining power is problematic given that it has been shown to be affected by other factors including household choices (Lancaster *et al.* 2006).

Lancaster *et al.*, (2006) provide evidence on the impact of intrahousehold balance of power by testing the unitary and collective model. The unitary model postulates that the identity of the income recipient or share of earnings of the individual member does not matter for household expenditure outcomes. In that case, the balance of power (θ), does not have any effect on household expenditure patterns. The authors suggest that balance of power θ, though, is data dependent and hence tests were conducted at different levels of θ. The authors account for endogeneity of male power and per capita expenditure (which is used as a proxy for household permanent income) and jointly estimate male power, per capita household expenditure and the budget shares using three stage least squares (3SLS). The results reveal that bargaining power of the adult decision maker significantly affects budget share of items that the household spend on, hence implying that household welfare is better protected in households where bargaining power is spread evenly between spouses rather than having a dominant partner. The results confirmed the importance of promoting both male and female education levels inside the household as a means of improving both partners' income earnings opportunities to avoid dominance by one partner in household decision making.

Other studies that have refuted the fact that welfare weights assigned to each member are exogenous to the household decision making, as postulated by Chiappori's collective model include Basu (2006) who instead models household behaviour with endogenously determined balance of power; Anxo and Carlin (2004) who controlled for endogeneity and revealed that a greater husband's share of income leads to lower male share of work; Blundell, Browning and Meghir (1994) who indicated that labour supply and commodity demand are endogenously decided with male and female labour decisions having different effects on demand. Similarly, Beegle, Frankenberg and Thomas (2001) explored endogenous balance of power including asset share and education and how this affected child health using a cooperative bargaining model. Their results revealed that more female power led to better reproductive health choices (Beegle *et al.* 2001). In the same way, Chiappori, Fortin and Lacroix (2002) indicated that sex ratio and divorce laws in favour of women lead to favourable changes in female labour supply.

8.3.2. Resource allocation models on labour supply

A number of studies have also examined individual and household labour supply using intra-household resource allocation models, including the effect on child labour. Basu and Ray (2002) explore the effect of women's power on child labour using a collective model. The authors postulate that more educated women have greater income contribution to the household and hence have greater say in the household decision making. Their results revealed that as a woman's power increased, child labour initially declines, but later increases beyond a certain point. Their results revealed that the best outcome of having the lowest rate of child labour would be to have households where power is evenly balanced in such a way that neither the man nor the woman has disproportionate amount of power. The study suggests having more balanced education among parents as a means of having balanced power; this is a challenge in many developing countries given that women are disproportionately less educated, hence a need for policies in developing countries that emphasise female education as a bid to fight child labour.

Fortin and Lacroix (1997) explore household labour supply using data from the 1986 Canadian Census of Population and Housing. The data generally indicated men to have higher computed hourly wage rates, more yearly hours and stock of wealth than women. The authors tested the income pooling restriction of the unitary model for different sub-groups including age sub-groups, and the income pooling restriction was rejected for all except for the 24-35 age group with no pre-school children (and the collective model of the same age-group could not be rejected either). However, when couples with pre-school children were considered, the collective model was rejected. The authors postulate that pre-school children represent some aspect of a public good within the household and generate non-separatabilities in the consumption of household members, which are not allowed in the collective model.

Similarly, Chiappori et al., (2002) extend Chiappori's (1992) collective model of household labour supply to account for distribution factors. These factors included the state-level sex ratios and a compendium of state divorce laws. Using household labour data from the 1989 wave of the Panel Study of Income Dynamics (PSID), the authors rejected the unitary assumption of distribution factors being irrelevant to labour supply decisions. The authors revealed that a one percentage point increase in the proportion of males in the population defined by age, race and jurisdiction induced the husband in the said population to increase their transfer to their wives by USD 2,163 on average; while passage of a divorce law that favoured women would induce their husbands to transfer, on average an additional USD 4,310 to their wives. The results from this study indicated the usefulness of the collective approach in highlighting the consequences of public policies like divorce laws on the allocation of household resources including income and welfare within the household.

8.4. Economic theories on household choice

8.4.1. The traditional theory of choice: Consumer choice

The traditional model on consumer behaviour assumes that the consumer unit, for example a household, maximises utility, *u*, which is obtained directly from the goods and services x_i

purchased in the market place (Becker 1965; Donni 2008). The utility function can be denoted by

$$U = U(y_1, y_2 \dots, y_n), \tag{8.1}$$

subject to resource constraint

$$\sum_{i=1}^{n} p_i \, y_i = I = W + V, \tag{8.2}$$

where y_i represents goods purchased in the market, p_i are their prices, I is money income and W is earnings and V is other income. The utility function has the usual properties of strict quasi-concavity, smoothness and monotonicity (Becker 1965; Michael and Becker 1973; Donni 2008).

The household's maximisation problem is given by

$$\max_{\{y^1,\dots,y^n\}} U(y_1, \dots, y_n) \tag{8.3}$$

Subject to constraint (8.2). The demands that result from optimisation problem are called the 'Marshallian demands' and are shown below:

$$y_i = y_i(p_1, \dots, p_n, I) \text{ with } i = 1, \dots, n \tag{8.4}$$

Variations in demand which are not related to changes in income and relative prices are due to changes in taste. Hence, together, the three factors that fully explain consumption behaviour are income, prices and tastes (Michael and Becker 1973).

Marshallian demand main properties:

1. Adding up, where the total value of household demands is total equal to total income.

$$\sum_{i=1}^{n} p_i y_i \left(p_i, \dots, p_{n,} I\right) = I \tag{8.5}$$

2. Homogeneity; which implies that the household demands are homogenous of degree zero in total income and prices together, i.e, for any scalar t > 0 and any $n=1, \ldots, n$,

$$y_i \left(tp_1, \ldots, tp_{n,} tI\right) = y_i \left(p_1, \ldots, p_{n,} I\right) \tag{8.6}$$

The above properties arise from the linearity of the budget constraint. The Marshallian demand derivatives with respect to price must satisfy certain restrictions which closely relate to the structure of the consumer's optimisation problem. The Slutsky decomposition states that the effect on the decomposition can be represented as below:

$$S^{nj} \frac{\partial y_n}{\partial p_j} + \frac{\partial y_n}{\partial I} y_j \tag{8.7}$$

where S^{nj} is the substitution effect and $-\left(\frac{\partial y_n}{\partial I}\right) y_j$ is the income effect.

3. Symmetry: This property implies that the cross-price substitution effects are symmetric, that is, for any j, $n=1,\ldots,n$,

$$\frac{\partial y_n}{\partial p_j} + \frac{\partial y_n}{\partial I} y_j = \frac{\partial y_j}{\partial p_n} + \frac{\partial y_j}{\partial I} y_{n.} \tag{8.8}$$

4. Negativity implies that the matric formed by the elements S^{nj} is negative and semi-definite, that is, for any set of constraints $\{e_1, \ldots, e_n\}$,

$$\sum_{j=1}^{n} \quad \sum_{n=1}^{n} e_j e_n \left(\frac{\partial y_n}{\partial p_j} + \frac{\partial y_n}{\partial I} y_j\right) \leq 0. \tag{8.9}$$

The negative property leads to inequality restrictions on substitution effects particularly, own-substitution effects which must be non-positive.

$$S^{nn} \frac{\partial y_n}{\partial p_n} + \frac{\partial y_n}{\partial I} y_n \leq 0, \tag{8.10}$$

normally known as the law of demand. This implies that the consumer will always substitute away from a good that becomes more expensive. The cross substitution effect can be negative, positive or zero. If the substitution effect between good *j* and *n* is positive, the goods are substitutes (standard Hicks' definition), if the substitution effect is negative, the goods are complements. On the other hand if the income effect of a good is positive, the good is referred to as superior (or normal) and if the income effect is negative, the good is inferior (Donni 2008).

8.4.2. The traditional theory of choice: Labour supply choice (production function)

The individual is assumed to have a fixed endowment of a particular good: time in this case. Time can be spent working in the market place (earning a wage which is the value of the opportunity of working) or in leisure (to obtain direct utility).

Assuming that leisure corresponds to good 1 and the wage rate (p_1) is denoted by W and leisure (y_1) is by L, the budget constraint becomes:

$$WL + \sum_{i=2}^{n} p_i y_i \leq I. \tag{8.11}$$

The behaviour of the worker is described by the following optimisation problem:

$$\max_{\{L, y_2, \dots, y_n\}} U(L, y_2, \dots, y_n) \tag{8.12}$$

Subject to constraint (8.11). If the prices of the n-1 goods are assumed to be equal to one (as is commonly the case in labour analysis), the Marshallian demand for leisure is denoted as:

$$L = L(W, I), \tag{8.13}$$

and satisfies

$$\frac{\partial L}{\partial W} + \frac{\partial L}{\partial y} L \leq 0 \tag{8.14}$$

Leisure is assumed superior hence $\frac{\partial L}{\partial y} > 0$.

The Marshallian labour supply derived from the time constraint is given by:

$$h = T - L(W, V + WT) = h(W, V, T) \tag{8.15}$$

where the endowment in time is y_1 is denoted by T and the *n-1* other endowments are set equal to zero. The function must satisfy the inequality restriction that corresponds to the negativity property of the leisure demand. The Marshallian demand for leisure is differentiated with respect to W keeping V constant. This gives the following model:

$$\left.\frac{\partial L}{\partial W}\right|_{dV=0} \quad - \left.\frac{\partial L}{\partial W}\right|_{dI=0} \quad + \frac{\partial L}{\partial I}.T, \tag{8.16}$$

that is the wage effect can be broken down into the pure price effect (first term on the right hand side) and income effect (the second term). Substituting this expression in the slutsky inequality (8.14) gives:

$$\left.\frac{\partial L}{\partial W}\right|_{dV=0} \quad - \frac{\partial L}{\partial I}(T - L) \leq 0. \tag{8.17}$$

Using the labour supply equation (8.15) gives the positivity property of the labour supply shown below:

$$\frac{\partial h}{\partial W} - \frac{\partial h}{\partial V} h \geq 0. \tag{8.18}$$

The condition is sufficient as well in that if the substitution effects associated to labour supply are positive, a system of preferences exists that rationalises the workers behaviour. It is possible to indicate that the system of preferences is unique. Given that the substitution effects are positive and income effects are negative, the total effect of the variation is undetermined (Donni 2008).

Household production functions

Gary Becker's *Treatise on the Family* (1965) emphasises the importance of division of labour using household production functions that describe the possibilities of producing household commodities (Bergstrom 1997). The household commodities are non-market goods that are outputs of the production process which use market goods and labour time of household members as inputs. Becker's household commodities include children, prestige and envy, health and pleasure of the senses and he suggests that the number of household commodities is usually smaller than the number of the market goods. Each individual in the household can use their time for household labour or market labour, and the family can purchase market goods for direct consumption or as inputs to the household production (Bergstrom 1997). This chapter investigates time allocation through wage labour supply by adults in the household, 19 years and older. It initially explores individual labour supply for all adults in the household, and further studies labour supply by gender. It finally investigates a household's couple labour supply and the effect of partner bargaining power on labour supply. The chapter also importantly investigates the association between adult labour supply and PLWHA[41] categories including ART.

8.5. Methodology

Ordinary least squares (OLS) and two stage least squares (2SLS) regressions are used to analyse labour hours for all adult individuals in the household. Additionally, quantile regression is also used (see Appendix E.4). Further analysis of separate male and female models using OLS and 2SLS is also undertaken since past studies have indicated males and females to participate differently in the labour market with women having lower participation (Ellis *et al.* 2006; Nyende 2010). For individual and gender analyses, the severity of AIDS of the PLWHA associated with the household is controlled for; hence these analyses exclude the non-PLWHA households, since these do not have any clinic records relating to severity of HIV/AIDS.

For couple analysis, the model is based on the collective household model that assumes allocation within the household to be Pareto efficient. Use of the collective model is justified by the fact that theoretically, the unitary model's aggregation of individual preferences into a

[41] PLWHA categories include PLWHA, TASOPLWHA, MOHPLWHA, TASOART, TASOWL, MOHART and MOHWL compared to non-PLWHA. ARTP refers to TASOART, TASOWL, MOHART and MOHWL

household utility function is referred to as a “black box” and aspects relating to intrahousehold inequality cannot be explained by this model. Also, empirically, evidence has generally rejected the unitary model predictions but supported the collective model, and the collective model of resource allocation has been shown to be more robust than the unitary model as portrayed in the literature review above. Additionally, most current literature follows the collective model of resource allocation by disaggregating the household utility function (Beegle *et al.* 2001; Chiappori *et al.* 2002; Koolwal and Ray 2002; Anxo and Carlin 2004; Duflo and Udry 2004; Basu 2006; Lancaster *et al.* 2006; Chiappori and Donni 2009; Chiappori 2011).

In the collective model, the household’s objective function is a weighted sum of the utilities of the household members following Browning and Chiappori (1998). The model is estimated using OLS and 2SLS to account for the endogenous variables (wages and wage difference). For polygynous couples, the oldest wife was retained and the other wives excluded in the couple analysis (polygynous cases were equal to three).

To account for the various determinants of labour supply per week, the analysis was undertaken in a stepwise manner with the first model comprising of the simple analysis; the second (partially complete model) analysis excludes the log (stock of wealth), the occupation variable, marital status and gender of the household head, which are included in the last analysis for the full model.

8.5.1. Data

The data is a sub-set of the 2010/2011 CUHS survey consisting of 1,206 adults, 19 years and older; and reports individual economic activities. The sample consists of 125 (10.60%) individuals that were not involved in any economic activity mostly because of being unemployed (42.8%). Of those unemployed, about 14 percent were too sick to do any work. 76 percent (N=910) of the households are PLWHA households and the rest are non-PLWHA households (24%). The data also consists of 331 couples (N=662).

8.5.2. Variables

The dependent variable is labour supplied in hours per week (individual or household labour hours) for economic activities undertaken by adult household members. For both the individual and gender analysis, all adults are considered while only couples are considered in the household model. The economic activities considered include: salaried/wage employment in an organisation (business, government and NGO's); non-farm labour (informal sector selling, trading, repairs, hair dressing); working on a commercial farm or on someone else's farm/garden; domestic services in someone else's home; working on own household farm/plot; managing self-owned non-agricultural business; and managing self-owned agricultural/livestock business.

The explanatory variable is explored in three broad categories. Firstly, adults from PLWHA households are compared to adults from non-PLWHA households. Secondly, the PLWHA households are disaggregated to indicate the service provider groups such that MOHPLWHA, TASOPLWHA are compared with non-PLWHA households. Lastly, the MOH and TASO are disaggregated to indicate the antiretroviral package (ARTP), This is detailed as TASO and MOH PLWHA receiving ART (TASOART and MOHART respectively), TASO and MOH PLWHA receiving septrin (TASOWL and MOHWL respectively), and the four categories are compared to non-PLWHA. The reference in all cases is adults from non-PLWHA households who are not receiving any treatment (neither ART nor septrin).

Other explanatory variables controlled for include: wages per week (wage); occupation (agricultural, non-agricultural and other occupation); gender (male); age in years (age, age squared); number of dependants (children under five years; children 6-18 years); male-female age difference for couples (couple age difference); couple age difference*log household stock of wealth[42] interaction (age difference*log household stock of wealth); type of residence (urban); individual in household having an acute or chronic disease (acute, chronic); education in years; marital status (married, widowed, divorced and single); religion of the household head (Anglican, Muslim, other Christians and Roman Catholic); age-education

[42] This was obtained from valuing productive assets, consumer durables and livestock assets. A substantial number of households owned livestock with 30% and 34% owning pigs and chicken respectively, while 12% owned livestock. The majority of households owned land (75%) with a minority being poor landless households. It is common for households in Uganda to invest their wealth in land especially in central Uganda where individual ownership of land is common. The composition and construction of the household stock of wealth is explained in Appendix E.1

interaction (age-education, age squared-education, age cubed-education) and gender of the household head (male head). Note that while some explanatory variables are for an individual, others are common to the household, including the number of dependent children younger than five years and 6-18 years old; the occupation type; type of residence; individual in household having an acute illness or chronic disease; individual gender; male head; individual age, individual age squared; education level in years and education categories.

Subsequent sensitivity analysis also controls for severity of HIV. Severity is measured as the CD4 cell count (CD4-first, best or worst[43]), WHO stage and weight at CD4 cell count recording. The effect of the period on ART in months is also explored in sensitivity analysis.

Balance of power variable for couples

For couple analysis, the household is assumed to consist of two members, male (m) and female (f) (*i*= m, f), whose utility depends on both consumption of good, X, and leisure, L. The household's problem can be written as

$$Max\ \theta U_m\left(ARTP, X_m, X_f, L_m, L_f\right) + \ \ Max(1-\theta)U_f\left(ARTP, X_m, X_f, L_m, L_f\right) \qquad (8.19)$$

Subject to a budget constraint:

$$\sum P' X_i \ \leq \ W_i(T_i - L_i) + HSW \qquad (8.20)$$

Note that $(T_i - L_i) = \ H_i$ (8.21)

Where U_i represents the utility of member $i(i = m, f)$, X_i represents a vector of private consumption of individual *i*, and W_i, T_i, H_i, HSW represent the wage rate of individual *i*, time endowment of individual *i*, hours worked by individual *i* and household stock of wealth respectively. P' represents a vector of prices. Prices are assumed to be exogenous; but wages and HSW are assumed endogenous. The variable $\theta \in [0,1]$ denotes the welfare weight of

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[43] The clinic questionnaire collected the last three CD4 cell count entries that the patient had had before the survey and the CD4 cell count at diagnosis. CD4 cell count at diagnosis was not available for all PLWHA given that sometimes, diagnosing AIDS is based on the WHO-clinical staging, stage 3 or 4. CD4 first is the record that was taken earliest given the data available; worst is the lowest CD4 cell count recorded; and best is the highest CD4 cell count recorded from the data collected.

member m and represents the balance of power, which depends on prices, household income and other variables such as household size and socioeconomic status of the household.

Household level labour supply can be estimated as a weighted average of balance of power (θ). In this analysis, balance of power will be estimated as male-female age difference $\left(Age_m - Age_f\right)$; male-female wage difference $\left(Wage_m - Wage_f\right)$; and male education share ($Education\ years_m/(Total\ couple\ years\ of\ education\ )$) in separate models.

The couple age difference bargaining power variable is assumed exogenous. Both male education share and male-female wage difference are endogenous but only wage difference is instrumented due to a lack of instruments for education share (Pontual Ribeiro 2001).

The wage earned per week was computed from the wage information collected in the survey, and includes information on average income earned per month/ per week/ per day/ per piecework/per season. A considerable number of respondents (N=364/1054) had wage missing. Details of the generation of the weekly wage variable including descriptive characteristics relating to the missing and non-missing raw wage data are presented in Appendix E.2. The missing wage was imputed using the nearest neighbour regression matching (also referred to as predictive mean matching) and hot deck method (Jerez *et al.* 2010).

For the nearest neighbour regression matching method, the available wage data was used to estimate the wage equation to obtain the predicted wage. The predicted wage group averages for education years, gender and occupation were computed and the predicted wage group average is used to replace the missing wage value. This is referred to as wage-MM.

The hot deck method involves replacing missing values of one or more variables for a non-respondent (the recipient) with observed values from a respondent (the donor) that is similar to the non-respondent with respect to characteristics observed by both cases. The random hot deck method was used where the donor is selected randomly from a set of potential donors called the donor pool (Andridge and Little 2010). A number of categorical variables were used to define imputation classes for the variable to be imputed and these included years of education, gender and occupation. Averages of these groups were used to replace the recipients missing wage. This is referred to as wage-HD. Details relating to imputation of the missing wage are indicated in Appendix E.3.

8.6. Empirical Approach

Several approaches are used in this chapter including ordinary least squares (OLS), two stage least squares (2SLS), and quantile regression.

The general equation used for the OLS and 2SLS analysis of household adult labour supply (both in individual models and couple bargaining models) is as follows:

$$H_i = f(PLWHA_k, non - PLWHA_k, Wage_i, SW_i, Z, \theta_i\ ) \tag{8.22}$$

$$H_i = f(TASOPLWHA_k, MOHPLWHA_k, non - PLWHA_k, Wage_i, SW_i, Z, \theta_i\ ) \tag{8.23}$$

$$H_i = f(ARTP_k, Wage_i, SW_i, Z, \theta_i\ ) \tag{8.24}$$

Where H_i is individual *i*'s labour supply in hours per week, $ARTP_k$ is the antiretroviral package that is associated with household k, $Wage_i$ is individual *i*'s wage per week, SW_i is the individual stock of wealth and Z is other explanatory variables including individual characteristics and household characteristics (INDV and HHD respectively). $PLWHA_k$, $TASOPLWHA_k$, $MOHPLWHA_k$ and non-$PLWHA_k$ refer to household k associated with a person living with HIV, or a person living with HIV from TASO, or a person living with HIV from MOH and no known person living with HIV respectively. Note that θ_i is not considered in the individual and gender separate analyses.

The 2SLS model is similar to equation (8.22-8.23) except that the stock of wealth[44] or wage variables are estimated using instrumental variables reduced form equation to correct for endogeneity (see equation 8.29 and 8.30).

The *q*th quantile regression estimator $\hat{\beta}_q$ minimises over β_q as indicated in model below:

[44] For couple analysis, the value of household stock of wealth (HSW) is employed and individual SW is considered for individual analysis.

$$Q_N(\beta_q) = \sum_{i:y_i \geq x_i'\beta}^{N} q|y_i - x_i'\beta_q| + \sum_{i:y_i < x_i'\beta}^{N} (1-q)|y_i - x_i'\beta_q|, \tag{8.25}$$

where using β_q rather than β indicates the fact that different choices of q estimate different values of β (Cameron and Trivedi 2005).

Considering the antiretroviral treatment package (ARTP) and other household characteristics, the full equation can be illustrated as follows following the general collective model[45]:

$$H = b_0 + b_1 ARTP_k + b_3\theta + b_4\theta^2 HSW + b_5(1-\theta)^2 HSW + b_6(wage_m, wage_f) + b_7 Z(INDV_i, HHD_k) + \varepsilon \tag{8.26}$$

The unitary model assumes that the identity of the income recipient does not have any effect on the household labour supply hours. Given equation (8.26), this would imply that the bargaining power variable, θ, has no effect on household labour supply. This would require

$$b_3 = 0;\ b_4^m\theta = b_5^f(1-\theta) \tag{8.27}$$

m and f indicates that the bargaining power variable relates to the male individual and female individual respectively.

Testing for the unitary model would be a joint test of the null hypothesis that θ has no effect on household labour supply hours.

For endogenous θ, $\theta = \theta(R)$, where R are variables that determine θ (equation (8.31)). For θ, HSW, wages and H, the reduced form equations are shown below:

$$\mathrm{H}_i = \mathrm{H}_i(\theta_i, \mathrm{ARTP}_{k,} HSW, \mathrm{wage}_i, D1) + v1 \tag{8.28}$$

$$HSW = HSW(D2) + v2 \tag{8.29}$$

[45] Model adopted from Lancaster et al., Lancaster, G., Maitra, P. and Ray, R. (2006). "Endogenous Intra-household Balance of Power and its Impact on Expenditure Patterns: Evidence from India." Economica **73**(291): 435-460.

$$\text{wage}_i = \text{wage}_i(D3) + v3 \quad (8.30)$$

$$\theta_i = \theta_i(D4) + v4 \quad (8.31)$$

D1 is the household size and composition variables (individual age, age squared, number of children below 5 years, number of children 6-18 years, urban residence, gender (male), individual education in years (educ), educ^2, having a chronic or acute disease (chronic, acute), individual occupation (agricultural, non-agricultural and other occupation[46]). D2 is D1 plus interaction of age and education (age*education, age squared*education age cubed*education). D3 is D1 plus religion (Roman Catholic, Muslim, Catholic and other Christian). D4 is D1 plus household maximum years of education (hhdmaxeduc). (D4 was used for wage-difference but was a poor instrument and hence the results were not considered. v1, v2, v3 and v4 are error terms.

Given potential endogeneity of wage, stock of health and some of the bargaining power variables, these are instrumented using 2SLS and a test of endogeneity undertaken. All analyses are performed using Stata 11 (StataCorp, 2009).

8.6.1. The instruments

Instrumental Variable (IV) estimation provides consistent estimates of the endogenous variables (wage, balance of power (male-female wage difference and male education share) and stock of wealth) if relevant and valid instruments are used. An instrumental variable (*z*) is valid if it is uncorrelated with the error term (v4 in this case- $Cov(z, v4)=0$) and, an instrument is relevant when it is highly correlated with the endogenous variable ($Cov(z, x)\neq 0$). The correlation of the instrument and endogenous variable can be tested using a simple regression of $x=\pi_0+ \pi_1 z +v$ and $\pi_1\neq 0$ if the instrument is relevant. However, in most cases the correlation between the instrument and the unobserved error term cannot be tested except for cases where more than one instrumental variable exists (over identification case). Given over identification, some of the instruments can be tested whether they are uncorrelated with the structural error (Wooldridge 2005).

[46] Other occupation includes being a housewife, doing housework, being a student, being too sick to work and being a village elder.

Possible instruments for the stock of wealth value include religion and ethnicity given evidence of people from different ethnicity using their income to buy assets and store their wealth in such assets. For example, in Uganda, it is common for individuals from the cattle corridor to invest their wealth in livestock, mainly cattle while individuals from central Uganda tend to store wealth by purchasing land and other consumer durables. An extract from the New Vision newspaper quotes a herdsman who mentions that "cows are our lives and wealth" (Kato 2007), hence highlighting the importance of cattle as wealth in such cattle corridor communities. On the other hand, there is a tendency of individuals from certain religions to invest differently in wealth. In Uganda for example, it is common for Muslims to be more involved in the trade business (Islam Online 2011). A study by Haynes, (2007) indicated that religion and ethnicity were important in determining competition of resources and deciding who gets what in Sudan.

However, there is no evidence that religion or ethnicity has a direct effect on hours of labour supply worked; hence religion was used as an instrument for the stock of wealth (the test for endogeneity showed no endogeneity hence only OLS results are discussed). Earlier studies have instrumented wealth for example father's wealth using the father's education and occupation (Charles and Hurst 2003; Asadullah 2011), but this is more likely correlated with hours of labour supplied, hence this was not used as an instrument. Alternatively, Fafchamps and Gubert (2007) instrumented wealth using predicted values from a regression that included ethnicity, gender, education of the household head, number of children, the value of inheritance of the household head and spouse. Similarly, occupation and the industry type have been used to instrument wealth in financial studies (Carroll *et al.* 2003) but this may be problematic for hours of labour supplied since in most cases the occupation type or industry can be correlated with hours worked.

The instrument for male-female wage difference is household maximum education (but this is in effect a weak instrument, hence results are not focused upon), while the instrument for wage include the interaction of age and education as linear and squared and cubed expressions (age*education, age^2*education and age^3*education), similar to Pontual Ribeiro (2001) and Sinha (2007), and these were found to correlate with wage at 10 percent, 5 percent and 5 percent level of significance respectively.

8.7. Results and Discussions

Table 8.1 below summarises the entire sample and also provides a comparison between adults who are economically active and those who are not. Adults worked an average of 6.78 hours per week for paid work and earned an average of 12,597 Uganda Shillings (UGX), an equivalent of 5 USD (1 USD=2500 UGX), per week. The sample's stock of wealth (as a proxy for non-labour income) is 4,075,396 UGX (1630 USD); the difference in the mean for stock of wealth (SW) for individuals that were economically active and those not economically active is not significant, although it is much lower for those who are not economically active. The majority of the adults are female, married and urban dwellers (63%, 43% and 74% respectively). Strangely, adults that are not economically active had an average of 10 years of schooling (beyond Primary Education attainment) compared to 6 years for adults that were economically active.

With respect to PLWHA categories, 40 percent of the adults are associated with TASO households, 36 percent are associated with MOH households, while the rest (24%) are non-PLWHA households; of the PLWHA households, 36 percent are MOH PLWHA while 40 percent are TASO PLWHA (these are compared to the 24 percent non-PLWHA households). In terms of antiretroviral packages (ARTP), about 23 percent are associated with households with a PLWHA from the MOH on ART (MOHART), 13 percent are associated with households with a PLWHA from the MOH on septrin (MOHWL), 27 percent are associated with a PLWHA from TASO on ART (TASOART) and 13 percent are associated with a PLWHA from TASO on septrin (TASOWL). Only MOHART gives a statistically significant difference in means for those that were economically active and not, though this is only at the 10 percent level.

Table 8.1: Descriptive characteristics of some important variables- by economic activity involvement (Mean (SD) or %).

Variable	Whole sample (N=1168)	Economically active (N=1043)	Not economically active (N=125)
Hours per week	6.78 (6.59)	7.59 (6.52)	0
Wage (UGX per week)	12,597 (76,342)	14,879 (82,774)	0
Wage MM (UGX per week)	13,116 (63,931)	14,695 (67,503)	0
Wage HT (UGX per week)	13,087 (63,945)	14,663 (67,517)	0
Age (years)	37.26 (13.70)	38.48*** (13.06)	29.63*** (15.92)
Number of children<=5 years old	0.98 (1.06)	0.99 (1.03)	0.93 (1.27)
Number of children 6-18 years old	2.57 (2.05)	2.57 (2.03)	2.29 (2.03)
Stock of wealth (SW) (UGX)	4,075,396 (1.4E+07)	4,343,795 (1.4E+07)	2,445,826 (1.9E+07)
Urban Residence	26.26	23.84***	42.40***
Female	63.00	63.66	60.80
Education years	6.62 (4.35)	6.2 (4.03)	9.57 (5.53)
Less than Primary Education	52.40	55.50***	32.81***
Primary Education plus	47.60	44.50***	67.20***
Male household head	52.32	53.51	44.80
Acute	30.24	31.91**	20.80**
Chronic	38.58	40.51**	28.80**
Married	43.44	47.05***	20.80***
Single	22.92	16.83***	61.60***
Divorced	12.62	13.59**	6.40**
Widowed	21.01	22.53***	11.20***
Agricultural Occupation	51.92	57.62***	10.48***
Non-Agricultural Occupation	31.00	34.76***	4.03***
Other Occupation	17.08	7.62***	85.48***
Non-PLWHA(Control)	24.28	24.30	24.00
TASO	40.10	40.55	36.80
MOH	35.62	35.15	39.20
TASOART	27.09	27.92	20.80
TASOWL	13.01	12.63	16.00
TASOCONTROL	11.6	11.68	12.00
MOHART	22.45	21. 57*	29.60*
MOHWL	13.17	13.58	9.60
MOHCONTROL	12.68	12.44	12.00
MOHPLWHA	35.63	35.33	39.20
TASOPLWHA	40.10	40.55	38.80

***P<0.01, **P<0.05, *P<0.1 implies that the difference in means is significantly different at 1%, 5% and 10% respectively. For mean, ttest assuming equal means; for proportions, chi squared test; UGX is Uganda Shillings

Table 8.2: Descriptive characteristics of Labour hours worked by gender (Mean (SD) or %)

Variable	Whole sample (N=1206)	Males (N=446)	Females (N=760)
Whole sample	6.78 (6.59)	7.63*** (7.50)	6.29*** (5.95)
PLWHA	6.71 (6.64)	7.49** (7.92)	6.30*** (5.82)
Non-PLWHA(Control)	7.00 (6.45)	7.98** (6.37)	6.26** (6.43)
TASOPLWHA	6.46 (6.39)	6.20 (6.71)	6.60 (6.23)
MOHPLWHA	6.99 (6.90)	8.93*** (8.89)	6.00*** (5.31)
TASOART	6.47 (6.81)	6.12 (7.19)	6.66 (6.60)
TASOWL	6.45 (5.45)	6.39 (5.51)	6.48 (5.46)
TASO Non-PLWHA(Control)	6.33 (5.72)	6.48 (6.15)	6.23 (5.44)
MOHART	6.64 (6.77)	8.34** (8.74)	5.81** (5.41)
MOHWL	7.58 (7.09)	9.80*** (9.12)	6.25*** (5.14)
MOH Non-PLWHA(Control)	7.62 (7.02)	9.25** (6.32)	6.28** (7.33)
Urban Residence	7.75 (7.19)	9.37** (8.06)	6.95** (6.59)
Rural Residence	6.44 (6.34)	7.10** (7.26)	6.04** (5.68)
Education years	6.62 (4.35)	7.60 (4.48)	6.04 (4.17)
Less than Primary Education	6.98 (6.69)	7.88** (8.05)	6.58** (5.97)
Primary Education plus	6.55 (6.48)	7.43*** (7.05)	5.87*** (5.92)
Male household head	7.10 (6.60)	8.21*** (7.24)	5.87*** (5.58)
Acute	6.67 (6.11)	7.21 (7.78)	6.45 (5.27)
Chronic	6.96 (6.03)	8.01** (6.97)	6.57** (5.60)
Married	7.61 (6.55)	8.98*** (7.03)	6.24*** (5.73)
Single	5.04 (6.49)	5.279 (7.15)	4.78 (5.67)
Divorced	6.564 (6.48)	8.40 (13.13)	6.33 (5.12)
Widowed	7.00 (6.53)	4.99* (4.73)	7.10* (6.64)
Agricultural Occupation	5.91 (4.82)	9.19 (4.06)	5.78 (5.16)
Non-Agricultural Occupation	10.46 (7.83)	11.97*** (9.01)	9.30*** (6.58)
Other Occupation	2.43 (5.25)	1.86 (5.85)	2.75 (4.88)

***P<0.01, **P<0.05, *P<0.1 implies that the difference in means is significantly different at 1%, 5% and 10% respectively. For mean, ttest assuming equal means; for proportions, chi squared test

Table 8.2 above summarises labour hours of the entire sample and also compares between genders. Males supplied significantly more hours of labour per week compared to females (7.6 and 6.3 respectively). There were significant differences in labour hours supplied between the males and females for PLWHA and non-PLWHA. Notably, there were differences between males and females for all MOH categories (MOHPLWHA, MOH non-PLWHA, MOH ART, MOHWL) with females generally providing less paid labour hours compared to males but no differences by gender for the TASO categories.

This is potentially because males is because males are normally more likely to engage in paid labour activities than females (Arbache *et al.* 2010; Kristjanson *et al.* 20010) as women are more likely to engage in housework and child rearing which reduces their opportunities to engaged in paid work (Arbache *et al.* 2010). Research from the OECD indicated women to undertake more unpaid work than men in all countries (Veerle 2011). However, Table 8.2 suggests this is not the case for males and females receiving TASO support. It is possible that the social support activities provided by TASO, such as group income generating activities, makes women (who are over-represented in TASO) empowered to participate more in the paid labour market as much as the men, hence the gender differences evident in the MOH group are not reproduced here, indeed females are found to work more than males.

8.7.1. An aside: The Uganda labour market

At a glance, the labour hours per week shown in Tables 8.1 and 8.2 seem puzzlingly low especially compared to labour hours in developed countries, for example including Australia, where the average hours of work is around 33 hours per week (ABS 2010b; ABS 2010a). Moreover, only 3.34 percent (39/1168) of the individuals in the sample had 20 or more hours of paid[47] work per week.

The majority of households in Uganda depend on agriculture, with agriculture providing 73 percent of employment by industry (UBOS 2007; Mukwaya *et al.* 2011). Most of the Ugandan population (85%) resides in rural areas where agriculture is the main source of livelihoods. However, Uganda's agriculture is characterised by the small holder farmer with poor technology including use of the hand hoe as the main tool of production. This limits the level of production and hence most households are involved in own production rather than production for trade. Consequently, few farming households in Uganda use hired labour as evidenced by the 2005/2006 Uganda National household Survey where only 9.4 percent of agricultural labour hours was provided by hired employees with the rest being family labour (UBOS 2007; Mukwaya *et al.* 2011). This partly explains why the paid labour hours are quite low in this case given that the majority of households (>70%) were sampled from the rural agricultural areas. Labour absorption from the sectors other than the agricultural sector has

[47] The labour hours considered included salaried wages, paid daily non-farm activities, hired farm labour, paid domestic work and self-owned agricultural and non-agricultural business that generated income. Self-employed work including work on own household farm and self-owned livestock for own production was not included if income was not earned in the survey reference period of the last 12 months prior to the survey.

been inadequate to employ the growth in the population of workers leading to an increase in the proportion of the population depending on agriculture (Mukwaya *et al.* 2011). A report by UBOS (2001) indicated that only 12 percent of the rural households were primarily involved in non-farm employment compared to 83 percent of urban households. Nonetheless, there is evidence of an increase in non-agricultural self-employment which has been shown to be important for households to reduce exposure to economic risk and facilitate more efficient use of family labour during agricultural slack periods (Lanjouw and Lanjouw 2001). Non-agricultural sources are also an important source of income given that agricultural has been shown to provide only 46 percent of household income with the deficit arising from non-agricultural enterprises (Mukwaya *et al.* 2011).

Trade has been identified as the most common non-farm activity and this is usually through self-employment (Deininger and Okidi 2001), this is captured in the survey. Economic theories of development, for example the Lewis model, emphasise the importance of industrialisation in absorbing redundant labour from the rural agricultural based sector (Ray 1998) but this has been limited in Uganda given that the industrial sector only employed about 9 percent of the population compared to 70 percent in the agricultural sector for the period of 2005/2006 (Mukwaya *et al.* 2011). This lack of expansion in employment activities beyond agriculture has led to great unemployment, with unemployment among youths exceeding 83 percent (World Bank 2009). The inequalities and discrepancies in the labour market in Uganda described here partly explain the unusually low paid hours of labour per week in the sample.

8.7.2. Regression results

OLS results for the original and imputed wages are indicated in Tables 8.3, 8.4 and 8.5 below. The results show that PLWHA, TASOPLWHA, MOHPLWHA or ARTP[48] (in terms of TASOART, TASOWL, MOHART and MOHWL) have no significant effect on individual labour supply hours across any wage estimations. The initial investigation before controlling

[48] PLWHA are households with a person living with HIV/AIDS, TASOPLWHA and MOHPLWHA are households with a PLWHA from TASO or MOH respectively; TASOART and MOHART are households with PLWHA on ART from TASO and MOH; and TASOWL and MOHWL are households with a PLWHA on septrin from TASO and MOH respectively. TASOART and TASOWL comprise ART-plus while MOHART and MOHWL comprise ART-only. ART-plus and ART-only are the antiretroviral treatment packages (ARTP) considered.

for other explanatory variables indicates that PLWHA, TASOPLWHA and MOPLWHA are likely to supply less labour hours compared to non-PLWHA individuals (Tables 8.3, 8.4 and 8.5: Columns 1 and 2). Comparing ARTP to non-PLWHA, TASOART, TASOWL and MOHAR are likely to supply less labour hours compared to non-PLWHA while MOHWL are likely to supply more labour hours (Tables 8.3-8.5, Column 3). The association is positive for MOHPLWHA and TASOART for the original wage when other variables are controlled for (Columns 5 and 6), which means that individuals from households that have a PLWHA from the MOH and a PLWHA from TASO on ART are more likely to supply more hours of labour compared to adults from non-PLWHA households. The association is negative for TASOPLWHA, TASOWL and MOHART and this is maintained in the imputed wage equation (Tables 8.4-8.5 Columns 5 and 6). For the final model however, PLWHA, and TASOPLWHA become positive while MOHPLWHA becomes positive for the original wage and imputed wages (Table 8.3-8.5 Columns 7 and 8). Note however, that these associations are not statistically significant.

When including other explanatory variables, columns (4) to (9) Tables 8.3 to 8.5, all wage variables (that is Wage-Original, Wage-Mean Matching and Wage-Hot Deck (hereafter referred to as Wage-Original, Wage-MM and Wage-HD)) have a significant and positive association with hours of labour supplied. For example increasing the wage by 100,000 Uganda Shillings (40 USD) per week would lead to an increase of about 1.2 hours of labour supplied per week (Table 8.3 Col 6 Wage-Original coefficient). For the partially complete model (Tables 8.3-8.5, Columns 4, 5 and 6), household age shows an inverted U relationship with labour supply first increasing and then decreasing with age; individuals from the urban sector provide about 1.2-2 hours more of labour per week; males provide about 1-1.6 more hours of labour per week; and the years of education are negatively associated with labour supply. However, with the complete model (Columns 7, 8 and 9) only wage and the occupation variable remain significant for the original wage and imputed wages (wage-MM and wage-HD), and being male and having a chronic disease are significant for the imputed wages. Occupation is shown to significantly affect labour supply, employment in a non-agricultural occupation increases labour hours by about 5 hours per week (Table 8.3 Columns 7-9), while employment in the 'other' sector reduces labour hours by 2.5 hours per week compared to being employed in agricultural related occupation.

Table 8.3: OLS regression for individual labour supply for wage-original and PLWHA categories

	(1) PLWHA	(2) TASO/MOH	(3) ARTP	(4) PLWHA	(5) TASO/MOH	(6) ARTP	(7) PLWHA	(8) TASO/MOH	(9) ARTP
(Reference non-PLWHA)									
PLWHA	-0.289			-0.048			0.114		
	(0.465)			(0.577)			(0.506)		
(Reference non-PLWHA)									
TASOPLWHA		-0.537			-0.190			0.279	
		(0.505)			(0.629)			(0.547)	
MOHPLWHA		-0.011			0.110			-0.042	
		(0.541)			(0.679)			(0.602)	
(Reference non-PLWHA)									
TASOART			-0.531			0.128			0.627
			(0.563)			(0.708)			(0.620)
TASOWL			-0.548			-0.750			-0.418
			(0.622)			(0.744)			(0.659)
MOHART			-0.359			-0.450			-0.305
			(0.609)			(0.748)			(0.640)
MOHWL			0.577			1.063			0.354
			(0.713)			(0.927)			(0.925)
Wage-Original				1.3E-4**	1.3E-5**	1.2E-5**	9.1E-6**	9.0E-6**	8.8E-6**
				(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Age				0.327***	0.326***	0.332***	0.053	0.050	0.053
				(0.081)	(0.081)	(0.082)	(0.099)	(0.100)	(0.101)
Age squared				-0.004***	-0.004***	-0.004***	-0.001	-0.001	-0.001
				(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Number children ≤5 years				0.096	0.094	0.091	-0.082	-0.086	-0.054
				(0.282)	(0.279)	(0.279)	(0.255)	(0.257)	(0.257)
Number children 6-18 years				-0.126	-0.117	-0.136	0.013	0.006	-0.016
				(0.119)	(0.121)	(0.122)	(0.116)	(0.116)	(0.117)
Urban residence				1.219**	1.199**	1.178**	-0.138	-0.126	-0.129

				(0.595)	(0.595)	(0.590)	(0.610)	(0.609)	(0.608)
Male				1.018*	1.004*	0.965*	0.673	0.667	0.676
				(0.534)	(0.534)	(0.535)	(0.627)	(0.625)	(0.626)
Education years				-0.174***	-0.170**	-0.167**	-0.024	-0.030	-0.028
				(0.064)	(0.066)	(0.066)	(0.142)	(0.144)	(0.144)
Education years squared				-0.187	-0.180	-0.139	-0.380	-0.390	-0.354
				(0.508)	(0.509)	(0.510)	(0.475)	(0.474)	(0.475)
Chronic				-0.017	-0.018	-0.047	-0.244	-0.246	-0.262
				(0.558)	(0.558)	(0.564)	(0.512)	(0.514)	(0.517)
Acute							-0.008	-0.008	-0.008
							(0.008)	(0.009)	(0.008)
Log (Stock of wealth)							0.021	0.023	0.026
							(0.065)	(0.063)	(0.063)
(Reference Married)									
Single							-1.263	-1.328	-1.285
							(1.135)	(1.168)	(1.173)
Divorced							-0.327	-0.329	-0.294
							(0.880)	(0.879)	(0.883)
Widowed							-0.511	-0.550	-0.550
							(0.751)	(0.746)	(0.755)
(Reference Agricultural Occupation)									
Other occupation							-2.541***	-2.498***	-2.481***
							(0.824)	(0.810)	(0.809)
Non-agricultural occupation							4.962***	4.992***	4.980***
							(0.624)	(0.625)	(0.629)
Male household head							-0.215	-0.177	-0.237
							(0.642)	(0.629)	(0.629)
Constant	6.998***	6.998***	6.998***	1.422	1.388	1.317	6.176**	6.265**	6.227**
N	1168	1168	1168	813	813	813	779	779	779

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8.4: OLS regression for individual labour supply for Wage-MM and PLWHA categories

	(1) PLWHA	(2) TASO/MOH	(3) ARTP	(4) PLWHA	(5) TASO/MOH	(6) ARTP	(7) PLWHA	(8) TASO/MOH	(9) ARTP
(Reference non-PLWHA)									
PLWHA	-0.289			-0.295			0.042		
	(0.465)			(0.454)			(0.421)		
(Reference non-PLWHA)									
TASOPLWHA		-0.537			-0.368			0.209	
		(0.505)			(0.512)			(0.478)	
MOHPLWHA		-0.011			-0.216			-0.112	
		(0.541)			(0.522)			(0.482)	
(Reference non-PLWHA)									
TASOART			-0.531			-0.266			0.433
			(0.563)			(0.583)			(0.556)
TASOWL			-0.548			-0.565			-0.248
			(0.622)			(0.592)			(0.545)
MOHART			-0.359			-0.545			-0.312
			(0.609)			(0.591)			(0.529)
MOHWL			0.577			0.346			0.202
			(0.713)			(0.699)			(0.699)
Wage-MM				1.3E-5**	1.3E-5**	1.3E-5**	9.2E-6**	9.1E-6**	9.0E-6**
				(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Age				0.273***	0.273***	0.277***	0.059	0.057	0.059
				(0.063)	(0.063)	(0.063)	(0.077)	(0.077)	(0.078)
Age squared				-0.003***	-0.003***	-0.003***	-0.001	-0.001	-0.001
				(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Number children ≤5 years				0.061	0.060	0.044	-0.057	-0.059	-0.048
				(0.210)	(0.209)	(0.212)	(0.192)	(0.193)	(0.195)
Number children 6-18 years				-0.107	-0.103	-0.110	-0.012	-0.020	-0.030
				(0.095)	(0.097)	(0.098)	(0.096)	(0.097)	(0.098)

Urban residence				1.455***	1.452***	1.443***	0.245	0.245	0.233
				(0.501)	(0.500)	(0.499)	(0.498)	(0.499)	(0.501)
Male				1.559***	1.556***	1.532***	1.040**	1.029**	1.023**
				(0.443)	(0.442)	(0.443)	(0.498)	(0.498)	(0.500)
Education years				-0.142***	-0.140***	-0.137***	-0.062	-0.070	-0.072
				(0.051)	(0.053)	(0.053)	(0.132)	(0.135)	(0.135)
Education years squared				-0.132	-0.129	-0.123	-0.371	-0.380	-0.366
				(0.429)	(0.431)	(0.430)	(0.422)	(0.422)	(0.421)
Chronic				-0.518	-0.519	-0.535	-0.700*	-0.698*	-0.711*
				(0.431)	(0.430)	(0.433)	(0.414)	(0.414)	(0.416)
Acute							-0.004	-0.004	-0.004
							(0.008)	(0.008)	(0.008)
Log (Stock of wealth)							0.025	0.027	0.031
							(0.050)	(0.050)	(0.050)
(Reference Married)									
Single							-1.054	-1.107	-1.094
							(0.863)	(0.879)	(0.886)
Divorced							-0.899	-0.905	-0.852
							(0.706)	(0.705)	(0.715)
Widowed							-0.558	-0.598	-0.584
							(0.672)	(0.663)	(0.672)
(Reference Agricultural Occupation)									
Other occupation							-2.356***	-2.325***	-2.301***
							(0.668)	(0.661)	(0.663)
Non-agricultural occupation							4.401***	4.429***	4.448***
							(0.506)	(0.506)	(0.510)
Male household head							-0.427	-0.403	-0.421
							(0.534)	(0.532)	(0.532)
Constant	6.998***	6.998***	6.998***	1.885	1.877	1.817	5.723**	5.805**	5.770**
N	1168	1168	1168	1151	1151	1151	1108	1108	1108

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8.5: OLS regression for individual labour supply for Wage-HD and PLWHA categories

	(1) PLWHA	(2) TASO/MOH	(3) ARTP	(4) PLWHA	(5) TASO/MOH	(6) ARTP	(7) PLWHA	(8) TASO/MOH	(9) ARTP
(Reference Non-PLWHA)									
PLWHA	-0.289			-0.295			0.042		
	(0.465)			(0.454)			(0.421)		
(Reference Non-PLWHA)									
TASOPLWHA		-0.537			-0.368			0.208	
		(0.505)			(0.512)			(0.478)	
MOHPLWHA		-0.011			-0.215			-0.111	
		(0.541)			(0.522)			(0.482)	
TASOART			-0.531			-0.266			0.433
			(0.563)			(0.583)			(0.556)
(Reference Non-PLWHA)									
TASOWL			-0.548			-0.566			-0.249
			(0.622)			(0.592)			(0.545)
MOHART			-0.359			-0.544			-0.312
			(0.609)			(0.591)			(0.529)
MOHWL			0.577			0.347			0.202
			(0.713)			(0.699)			(0.699)
Wage-HD				1.3E-5**	1.3E-5**	1.3E-5**	9.2E-6**	9.2E-6**	9.0E-6**
				(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Age				0.273***	0.272***	0.277***	0.059	0.057	0.059
				(0.063)	(0.063)	(0.063)	(0.077)	(0.077)	(0.078)
Age squared				-0.003***	-0.003***	-0.003***	-0.001	-0.001	-0.001
				(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Number children ≤5 years				0.061	0.060	0.044	-0.057	-0.059	-0.048
				(0.210)	(0.209)	(0.212)	(0.192)	(0.193)	(0.195)
Number children 6-18 years				-0.107	-0.103	-0.110	-0.012	-0.020	-0.030
				(0.095)	(0.097)	(0.098)	(0.096)	(0.097)	(0.098)

Urban residence				1.453***	1.450***	1.442***	0.244	0.244	0.233
				(0.501)	(0.500)	(0.499)	(0.498)	(0.499)	(0.501)
Male				1.560***	1.557***	1.533***	1.041**	1.030**	1.024**
				(0.443)	(0.442)	(0.443)	(0.498)	(0.498)	(0.500)
Education years				-0.142***	-0.140***	-0.138***	-0.062	-0.070	-0.072
				(0.051)	(0.053)	(0.053)	(0.132)	(0.135)	(0.135)
Education years squared				-0.132	-0.129	-0.123	-0.371	-0.380	-0.366
				(0.429)	(0.431)	(0.430)	(0.422)	(0.422)	(0.421)
Chronic				-0.516	-0.518	-0.533	-0.699*	-0.697*	-0.710*
				(0.431)	(0.430)	(0.433)	(0.414)	(0.414)	(0.416)
Acute							-0.004	-0.004	-0.004
							(0.008)	(0.008)	(0.008)
Log (Stock of wealth)							0.025	0.027	0.031
							(0.050)	(0.050)	(0.050)
(Reference Married)									
Single							-1.053	-1.105	-1.092
							(0.863)	(0.879)	(0.886)
Divorced							-0.898	-0.904	-0.850
							(0.706)	(0.705)	(0.715)
Widowed							-0.558	-0.598	-0.584
							(0.672)	(0.663)	(0.672)
(Reference Agricultural Occupation)									
Occupation-Other							-2.356***	-2.325***	-2.301***
							(0.668)	(0.661)	(0.663)
Non-agricultural occupation							4.400***	4.428***	4.447***
							(0.506)	(0.506)	(0.509)
Male household head							-0.427	-0.403	-0.422
							(0.534)	(0.531)	(0.532)
Constant	6.998***	6.998***	6.998***	1.891	1.882	1.823	5.725**	5.807**	5.772**
N	1168	1168	1168	1151	1151	1151	1108	1108	1108

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Given that wages are perhaps endogenous, tests for endogeneity across wage variables were carried out. The Durbin and Wu-Hausman test after 2SLS suggests all wages are exogenous with $p>0.01$ with the null hypothesis of exogeneity not rejected (tests were robust regression–based tests since the model included clustering). Consequently, the wages are instrumented for methodological reasons only (Table 8.6), but results are not dwelt upon given that exogeneity could not be rejected.

Unsurprisingly, the results controlling for endogeneity of the wage variable (Table 8.6) are quite similar to the OLS results (for the occupation variable and being a male), except that the wage effect disappears and the effect of non-agricultural occupation on labour supply becomes smaller. Similar to the previous analysis (Table 8.3-8.5) where individuals with a chronic disease are likely to supply less labour hours, the 2SLS results indicate the same for individuals with an acute disease.

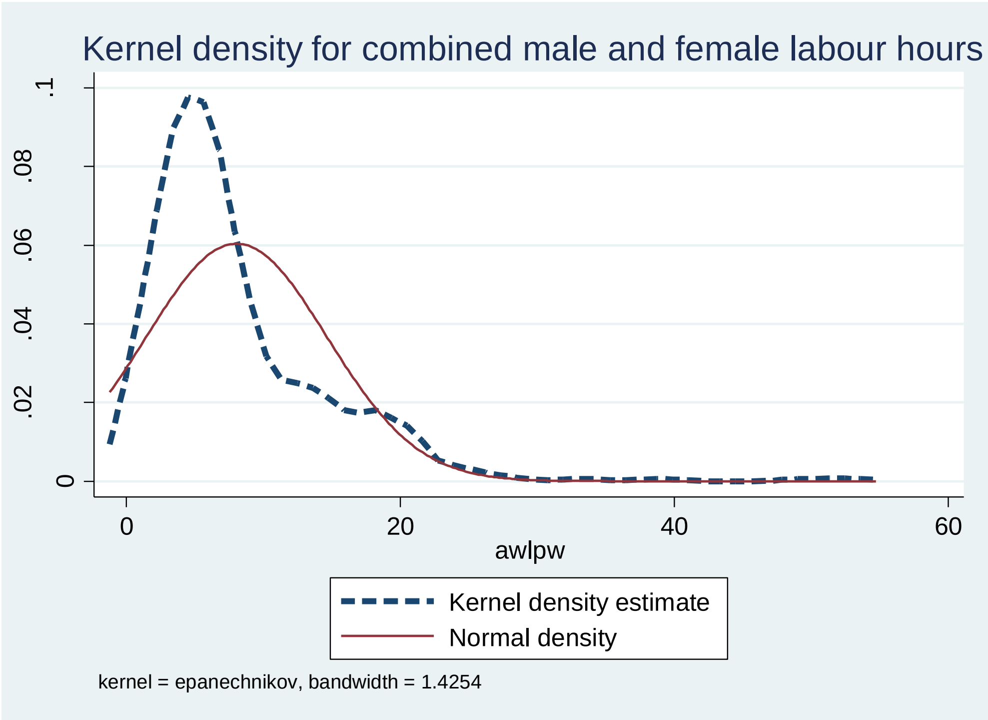
Table 8.6: Individual Analysis 2SLS regression for all wages

	(1) PLWHA	(2) TASO/MOH	(3) ARTP	(4) PLWHA	(5) TASO/MOH	(6) ARTP	(7) PLWHA	(8) TASO/MOH	(9) ARTP
(Reference non-PLWHA)									
PLWHA	0.074			0.021			0.019		
	(0.497)			(0.413)			(0.413)		
(Reference non-PLWHA)									
TASOPLWHA		0.061			0.099			0.089	
		(0.549)			(0.467)			(0.468)	
MOHPLWHA		0.082			-0.055			-0.049	
		(0.608)			(0.483)			(0.484)	
(Reference non-PLWHA)									
TASOART			0.210			0.183			0.167
			(0.682)			(0.565)			(0.567)
TASOWL			-0.277			-0.120			-0.120
			(0.683)			(0.573)			(0.572)
MOHART			0.007			-0.149			-0.139
			(0.689)			(0.549)			(0.550)
MOHWL			0.208			0.115			0.114
			(0.992)			(0.720)			(0.723)
Wage-original	6.9E-5	7.2E-5	7.6E-5						
	(0.000)	(0.000)	(0.000)						
Wage-MM				5.3E-5	5.6E-5	6.3E-5			
				(0.000)	(0.000)	(0.000)			
Wage-HD							5.6E-5	5.9E-5	6.6E-5
							(0.000)	(0.000)	(0.000)
Age	-0.015	-0.018	-0.022	0.032	0.029	0.026	0.030	0.027	0.024
	(0.138)	(0.136)	(0.142)	(0.092)	(0.092)	(0.093)	(0.092)	(0.092)	(0.094)
Age squared	-0.000	-0.000	-0.000	-0.001	-0.001	-0.000	-0.001	-0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Number children ≤5 years	0.014	0.018	0.042	-0.002	0.000	0.013	0.001	0.004	0.017

	(0.283)	(0.286)	(0.285)	(0.206)	(0.208)	(0.210)	(0.207)	(0.209)	(0.211)
Number children 6-18 years	-0.018	-0.019	-0.030	-0.025	-0.030	-0.036	-0.027	-0.031	-0.037
	(0.132)	(0.131)	(0.129)	(0.102)	(0.102)	(0.103)	(0.103)	(0.103)	(0.104)
Urban Residence	-0.744	-0.770	-0.813	-0.069	-0.090	-0.144	-0.094	-0.116	-0.171
	(0.859)	(0.877)	(0.892)	(0.616)	(0.620)	(0.626)	(0.624)	(0.629)	(0.635)
Male	0.422	0.412	0.402	0.932*	0.920*	0.900*	0.932	0.920	0.901
	(0.640)	(0.640)	(0.643)	(0.505)	(0.505)	(0.508)	(0.504)	(0.505)	(0.508)
Education years	-0.146	-0.150	-0.157	-0.131	-0.139	-0.151	-0.137	-0.145	-0.156
	(0.215)	(0.215)	(0.218)	(0.174)	(0.174)	(0.175)	(0.176)	(0.176)	(0.177)
Education years squared	-0.004	-0.004	-0.004	-0.002	-0.002	-0.002	-0.002	-0.002	-0.001
	(0.010)	(0.010)	(0.010)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Log (Stock of wealth)	0.019	0.019	0.020	0.025	0.026	0.028	0.025	0.025	0.027
	(0.065)	(0.064)	(0.064)	(0.050)	(0.050)	(0.050)	(0.051)	(0.050)	(0.051)
Chronic	-0.558	-0.565	-0.561	-0.458	-0.468	-0.474	-0.463	-0.473	-0.480
	(0.502)	(0.502)	(0.510)	(0.435)	(0.436)	(0.440)	(0.437)	(0.437)	(0.442)
Acute	-0.357	-0.361	-0.375	-0.765*	-0.768*	-0.785*	-0.762*	-0.765*	-0.781*
	(0.635)	(0.644)	(0.654)	(0.462)	(0.466)	(0.477)	(0.465)	(0.471)	(0.483)
Single‡	-1.184	-1.177	-1.151	-0.952	-0.970	-0.943	-0.934	-0.949	-0.920
	(1.108)	(1.121)	(1.131)	(0.835)	(0.846)	(0.855)	(0.836)	(0.848)	(0.857)
Divorced	-0.232	-0.228	-0.205	-0.804	-0.801	-0.761	-0.791	-0.786	-0.746
	(0.892)	(0.894)	(0.895)	(0.723)	(0.723)	(0.727)	(0.726)	(0.727)	(0.730)
Widowed	-0.896	-0.909	-0.932	-0.735	-0.765	-0.785	-0.746	-0.776	-0.795
	(0.875)	(0.860)	(0.872)	(0.716)	(0.705)	(0.721)	(0.719)	(0.708)	(0.725)
(Reference Agricultural Occupation)									
Other occupation	-2.273***	-2.265***	-2.245***	-2.097***	-2.065***	-2.015***	-2.080***	-2.049***	-1.999***
	(0.799)	(0.786)	(0.787)	(0.700)	(0.697)	(0.699)	(0.704)	(0.701)	(0.703)
Non-agricultural occupation	4.115***	4.078***	4.014***	3.924***	3.907***	3.839***	3.888***	3.867***	3.797***
	(1.055)	(1.075)	(1.082)	(0.776)	(0.787)	(0.795)	(0.788)	(0.801)	(0.808)
Male household head	-0.290	-0.295	-0.328	-0.417	-0.405	-0.414	-0.418	-0.407	-0.416
	(0.640)	(0.641)	(0.631)	(0.518)	(0.517)	(0.514)	(0.517)	(0.516)	(0.513)
N	779	779	779	1108	1108	1108	1108	1108	1108

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; ‡Reference Married

Figure 8.1: Kernel density of labour hours for the entire sample



Given the wide range of labour hours supplied as indicated in Figure 8.1 above, quantile regression is used to further explore the effect of the PLWHA categories including ARTP on labour supply hours compared to OLS. The results are presented in Table E.41 (for PLWHA and non-PLWHA) and Table E.42 (for ARTP and non-PLWHA) in Appendix E 4 for wage-original. The results are similar to the OLS results mainly for the occupation variables and positive association of the wage variables (though not significant for quantile analysis). The results at the tenth percentile reveal individuals from the urban sector to supply less labour hours (Table E.41 and E.42), the association between the square of education years and labour supply is negative at the 95th percentile (Tables E.41 and E.42), labour hours supplied increase with the number of older children aged 6-18 years at the 50th percentile (Tables E.41 and E.42), and being a widow is associated with supply of less hours of labour by 1.3 hours compared to a married individual at the 75th percentile (Table E.41).

Individual labour supply was further analysed using OLS controlling for severity of HIV/AIDS, hence only PLWHA are included in this analysis. The severity variables include CD4 cell count, WHO HIV stage, number of months on ART and weight at CD4 cell count recording. Tables 8.7 and 8.8 below present results for the three different wage variables, controlling for CD4 count (CD4-worst[49]) and WHO HIV stage. With the inclusion of CD4 cell count, the association of TASOPLWHA is significantly positive for the imputed wage variable (Columns 5 and 8, Tables 8.7 and 8.8). The coefficient suggests that individuals from TASO households with a person living with HIV/AIDS (TASOPLWHA) are likely to provide 1.2 more hours of labour per week (Table 8.7 Columns 5 and 8) compared to individuals from MOH households with a person living with HIV/AIDS (MOHPLWHA).

The association of the CD4 cell count is not significant for all models but the association is negative, contrary to expectations of a higher CD4 Cell count being associated with greater supply of labour hours (given that a higher CD4 cell count implies being healthier and being able to engage in more work, hence more hours of labour supplied). The association for the other variables is similar to the previous OLS regression results with the wage, being male and non-agricultural occupation type significantly affecting labour supply. Further analyses controlling for months on ART and weight at CD4 cell recording give similar results to the CD4 cell regression results except that months on ART does not give significant coefficients for TASOPLWHA. Results for weight at CD4 cell recording (Table E.71) and months on ART (Table E.72) are presented in Appendix E.7). Note that the association between labour hours supplied and the number of children aged 6-18 years is negative but positive for children aged five years and below (Table E.71, Columns 6, 9 and 5 (at 12% level of significance)).

[49] CD4 worst was used for most of the CD4 analysis since it gives similar results to the other CD4 information, that is CD4_best and CD4_first

Table 8.7: Individual analysis controlling for CD4 cell count-all wages

	(1) PLWHA	(2) TASO/MOH	(3) ARTP	(4) PLWHA	(5) TASO/MOH	(6) ARTP	(7) PLWHA	(8) TASO/MOH	(9) ARTP
(Reference MOHPLWHA)									
TASOPLWHA		1.161			**1.181***			**1.181***	
		(0.761)			(0.683)			(0.683)	
(Reference MOHWL)									
TASOART			1.226			1.178			1.177
			(1.338)			(1.101)			(1.101)
TASOWL			-0.718			-0.986			-0.986
			(1.203)			(0.962)			(0.962)
MOHART			-0.582			-0.760			-0.761
			(1.260)			(0.969)			(0.969)
Wage-Original	7.6E-6***	7.5E-6***	7.2E-6**						
	(0.000)	(0.000)	(0.000)						
Wage-MM				8.0E-6***	7.8E-6***	7.4E-6***			
				(0.000)	(0.000)	(0.000)			
Wage-HD							8.1E-6***	7.8E-6***	7.4E-6***
							(0.000)	(0.000)	(0.000)
CD4[50]-worst	-0.001	-0.001	-0.001	1.02E-4	-1.01E-4	1.07E-4	1.02E-4	-1.04E-4	1.07E-4
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Age	0.100	0.081	0.067	0.028	0.013	0.004	0.028	0.013	0.005
	(0.148)	(0.145)	(0.146)	(0.122)	(0.125)	(0.128)	(0.122)	(0.125)	(0.128)
Age squared	-0.002	-0.002	-0.002	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Number children ≤5 years	0.357	0.398	0.426	0.585	0.608	0.604	0.586	0.608	0.605
	(0.507)	(0.507)	(0.519)	(0.400)	(0.401)	(0.414)	(0.400)	(0.401)	(0.414)
Number children 6-18 years	-0.119	-0.158	-0.164	-0.174	-0.206	-0.213	-0.174	-0.207	-0.214

[50] CD4 cell worst used in this case-CD4 cell worst is the lowest CD4 cell count recorded. All other CD4 types gave similar results, hence CD4-worst only shown.

	(0.183)	(0.180)	(0.179)	(0.151)	(0.147)	(0.146)	(0.151)	(0.147)	(0.146)
Urban Residence	-0.488	-0.519	-0.419	-0.034	-0.188	-0.056	-0.036	-0.190	-0.058
	(1.320)	(1.353)	(1.329)	(1.039)	(1.079)	(1.051)	(1.039)	(1.079)	(1.051)
Male	1.606	1.611	1.644	1.561^{*}	1.565^{*}	1.570^{*}	1.561^{*}	1.566^{*}	1.570^{*}
	(1.128)	(1.117)	(1.119)	(0.915)	(0.908)	(0.907)	(0.915)	(0.908)	(0.907)
Education years	-0.110	-0.146	-0.150	-0.145	-0.202	-0.187	-0.145	-0.202	-0.187
	(0.243)	(0.252)	(0.248)	(0.228)	(0.242)	(0.235)	(0.228)	(0.242)	(0.235)
Education years squared	-0.008	-0.007	-0.007	-0.002	-0.000	-0.001	-0.002	-0.000	-0.001
	(0.015)	(0.015)	(0.015)	(0.013)	(0.014)	(0.013)	(0.013)	(0.014)	(0.013)
Log (Stock of wealth)	0.037	0.048	0.048	0.079	0.088	0.094	0.079	0.088	0.094
	(0.128)	(0.124)	(0.122)	(0.091)	(0.090)	(0.089)	(0.091)	(0.090)	(0.089)
Chronic	-0.038	-0.070	-0.008	-0.261	-0.323	-0.288	-0.260	-0.323	-0.288
	(0.837)	(0.839)	(0.830)	(0.732)	(0.739)	(0.738)	(0.732)	(0.739)	(0.738)
Acute	0.559	0.638	0.506	-0.152	-0.068	-0.168	-0.150	-0.067	-0.167
	(0.981)	(0.983)	(1.011)	(0.741)	(0.734)	(0.750)	(0.741)	(0.734)	(0.750)
Single‡	-0.733	-1.056	-1.309	-0.904	-1.205	-1.415	-0.902	-1.203	-1.413
	(1.857)	(1.957)	(1.969)	(1.411)	(1.478)	(1.494)	(1.411)	(1.478)	(1.494)
Divorced	1.418	1.238	1.071	0.607	0.446	0.424	0.606	0.445	0.423
	(1.478)	(1.432)	(1.399)	(1.171)	(1.138)	(1.128)	(1.171)	(1.138)	(1.128)
Widowed	0.074	-0.249	-0.333	0.594	0.327	0.304	0.592	0.325	0.303
	(1.164)	(1.125)	(1.109)	(0.994)	(0.955)	(0.940)	(0.994)	(0.955)	(0.940)
(Reference Agricultural Occupation)									
Other occupation	-2.261	-2.107	-2.088	-1.991	-1.903	-1.856	-1.990	-1.903	-1.855
	(1.475)	(1.465)	(1.482)	(1.225)	(1.216)	(1.225)	(1.225)	(1.216)	(1.225)
Non-agricultural occupation	4.881^{***}	5.023^{***}	4.990^{***}	4.162^{***}	4.303^{***}	4.372^{***}	4.161^{***}	4.302^{***}	4.370^{***}
	(1.049)	(1.068)	(1.076)	(0.897)	(0.907)	(0.912)	(0.897)	(0.907)	(0.912)
Male household head	-0.784	-0.751	-1.068	-0.334	-0.336	-0.546	-0.337	-0.338	-0.548
	(0.968)	(0.965)	(1.002)	(0.777)	(0.783)	(0.796)	(0.777)	(0.783)	(0.796)
Constant	5.880	6.095	7.054	5.928	6.175	6.845^{*}	5.928	6.175	6.845^{*}
N	345	345	345	485	485	485	485	485	485

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; ‡Reference Married

Table 8.8: Individual Analysis controlling for WHO HIV stages for all wages

	(1) PLWHA	(2) TASO/MOH	(3) ARTP	(4) PLWHA	(5) TASO/MOH	(6) ARTP	(7) PLWHA	(8) TASO/MOH	(9) ARTP
(Reference MOHPLWHA)									
TASOPLWHA		0.825			**1.093***			**1.093***	
		(0.721)			(0.644)			(0.644)	
(Reference MOHWL)									
TASOART			1.238			1.237			1.236
			(1.351)			(1.085)			(1.085)
TASOWL			-0.821			-0.994			-0.994
			(1.199)			(0.957)			(0.957)
MOHART			-0.199			-0.645			-0.646
			(1.286)			(0.981)			(0.981)
Wage-Original	7.6E-6***	7.5E-6***	7.2e-6***						
	(0.000)	(0.000)	(0.000)						
Wage-MM				7.9E-6***	7.8E-6***	7.3e-6***			
				(0.000)	(0.000)	(0.000)			
Wage-HD							7.9E-6***	7.8E-6***	7.3E-6***
							(0.000)	(0.000)	(0.000)
WHO HIV-Stage	-0.182	-0.131	-0.141	-0.396	-0.356	-0.353	-0.396	-0.357	-0.354
	(0.470)	(0.475)	(0.472)	(0.457)	(0.446)	(0.445)	(0.457)	(0.446)	(0.445)
Age	0.130	0.114	0.101	0.075	0.054	0.050	0.075	0.054	0.050
	(0.152)	(0.151)	(0.152)	(0.123)	(0.127)	(0.129)	(0.123)	(0.127)	(0.129)
Age squared	-0.002	-0.002	-0.002	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Number children ≤5 years	0.346	0.365	0.446	0.551	0.569	0.606	0.552	0.570	0.606
	(0.466)	(0.466)	(0.473)	(0.373)	(0.374)	(0.385)	(0.373)	(0.374)	(0.385)
Number children 6-18 years	-0.121	-0.148	-0.179	-0.168	-0.195	-0.222	-0.169	-0.196	-0.223
	(0.176)	(0.174)	(0.173)	(0.150)	(0.146)	(0.145)	(0.150)	(0.146)	(0.145)
Urban Residence	-0.719	-0.725	-0.602	-0.263	-0.360	-0.245	-0.264	-0.362	-0.246

	(1.293)	(1.315)	(1.316)	(1.000)	(1.030)	(1.016)	(1.000)	(1.030)	(1.016)
Male	1.759*	1.760*	1.861*	1.767**	1.751**	1.824**	1.767**	1.752**	1.825**
	(1.054)	(1.047)	(1.058)	(0.873)	(0.865)	(0.870)	(0.873)	(0.865)	(0.870)
Education years	-0.096	-0.121	-0.108	-0.157	-0.207	-0.182	-0.157	-0.207	-0.182
	(0.239)	(0.248)	(0.243)	(0.228)	(0.240)	(0.233)	(0.228)	(0.240)	(0.233)
Education years squared	-0.010	-0.010	-0.011	-0.002	-0.000	-0.001	-0.002	-0.000	-0.001
	(0.015)	(0.015)	(0.015)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Log (Stock of wealth)	0.033	0.041	0.036	0.070	0.080	0.082	0.070	0.079	0.082
	(0.115)	(0.111)	(0.109)	(0.086)	(0.085)	(0.084)	(0.086)	(0.085)	(0.084)
Chronic	-0.216	-0.214	-0.171	-0.468	-0.497	-0.473	-0.468	-0.497	-0.472
	(0.794)	(0.798)	(0.786)	(0.726)	(0.729)	(0.726)	(0.726)	(0.729)	(0.726)
Acute	0.735	0.784	0.695	-0.092	-0.020	-0.080	-0.090	-0.018	-0.078
	(0.945)	(0.944)	(0.958)	(0.704)	(0.697)	(0.705)	(0.704)	(0.697)	(0.705)
(Reference Married)									
Single	-0.797	-1.040	-1.267	-0.952	-1.250	-1.419	-0.950	-1.248	-1.417
	(1.868)	(1.963)	(1.988)	(1.422)	(1.485)	(1.503)	(1.422)	(1.485)	(1.503)
Divorced	1.333	1.264	1.081	0.499	0.412	0.362	0.498	0.411	0.361
	(1.446)	(1.421)	(1.382)	(1.144)	(1.122)	(1.107)	(1.144)	(1.122)	(1.107)
Widowed	-0.128	-0.288	-0.364	0.469	0.271	0.261	0.468	0.270	0.260
	(1.130)	(1.090)	(1.071)	(0.977)	(0.942)	(0.928)	(0.976)	(0.941)	(0.927)
(Reference Agricultural Occupation)									
Other occupation	-2.166	-2.063	-1.991	-1.906	-1.841	-1.743	-1.906	-1.841	-1.743
	(1.427)	(1.416)	(1.423)	(1.185)	(1.181)	(1.177)	(1.185)	(1.181)	(1.177)
Non-agricultural occupation	5.168***	5.297***	5.242***	4.399***	4.545***	4.591***	4.397***	4.543***	4.590***
	(1.078)	(1.098)	(1.100)	(0.906)	(0.916)	(0.920)	(0.906)	(0.916)	(0.920)
Male household head	-0.859	-0.800	-1.154	-0.262	-0.237	-0.508	-0.265	-0.239	-0.509
	(0.907)	(0.893)	(0.920)	(0.749)	(0.747)	(0.753)	(0.749)	(0.747)	(0.753)
Constant	5.401	5.373	6.104	5.772	5.914	6.521	5.773	5.915	6.522
	(4.933)	(4.916)	(4.880)	(4.133)	(4.171)	(4.172)	(4.132)	(4.171)	(4.171)
N	360	360	360	507	507	507	507	507	507

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

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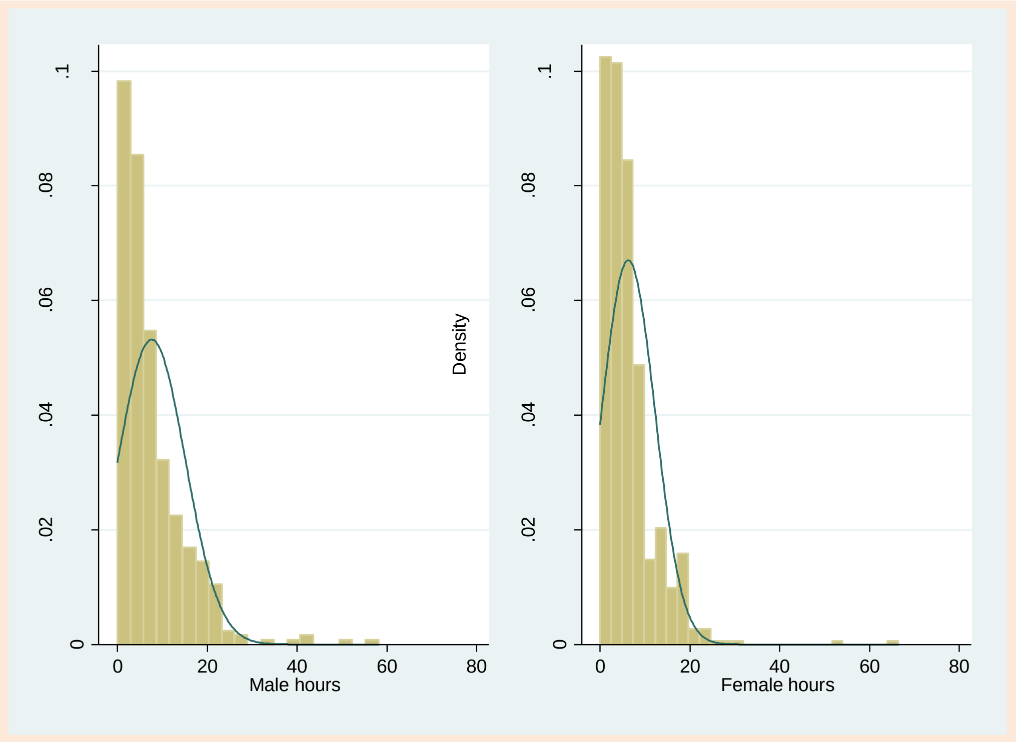
Gender analysis of labour hours supplied

The variation in the sample is further explored using gender separate analysis. Given past evidence of lower participation of women in economic activities in Uganda (Ellis *et al.* 2006; Nyende 2010), varied labour supply for men and women is expected. The labour hours supplied by males and females are illustrated as histograms in figure 8.2 below.

Figure 8.2: Histogram for male and female hours



Descriptive statistics by gender are indicated in Table 8.9. Generally, men have more hours of work per week, higher wage and individual stock of wealth, are more likely to be married, and are more likely to be household heads than females.

Table 8.9: Descriptive characteristics of some important variables (Mean (SD) or %) for the whole sample and by gender

Variable	Whole Sample (N=1206)	Male (N=446)	Female (N=760)
Hours per week	6.78 (6.59)	7.63*** (7.50)	6.29*** (5.95)
Wage-Original (UGX/week)	12,597 (76,342)	13,785 (32,906)	11,965 (91,422)
Wage-MM (UGX/week)	13,115 (63,931)	14,583 (26,846)	12,260 (77,777)
Wage-HD (UGX/week)	13,0873(63,944	14,500 (26,898)	12,264 (77,784)
Age in years	36.02 (13.94)	36.02 (13.94)**	37.99 (13.51)**
Number of children<=5 years	0.983 (1.06)	0.94 (1.00)	1.01 (1.09)
Number of children 6-18 years	2.57 (2.05)	2.41** (2.15)	2.66** (1.99)
No Working	2.04 (0.97)	2.249*** (0.922)	2.041*** (0.961)
Stock of wealth (UGX)	4,074,810 (1.40+07)	5123645** (1.20+07)	3477498** (1.51+07)
Urban	26.31	24.94	27.11
Education level			
Less primary education	52.40	43.5***	57.63***
Primary plus education	44.33	56.50***	42.37***
Head male	53.93	74.89***	39.21***
Acute	30.29	24.22***	33.86***
Chronic	38.64	28.92***	44.34***
Marital status	**N=1204**	**N=445**	**N=759**
Married	43.44	58.65***	34.52***
Single	22.92	33.26***	16.86***
Divorced	12.62	3.82***	17.79***
Widowed	21.01	4.27***	30.83***
Occupation type	**N=1200**	**N=443**	**N=757**
Agricultural occupation	51.92	46.05***	55.35***
Non-Agricultural occupation	31.00	36.79***	27.61***
Other Occupation	17.08	17.16	17.04
ART provider	**N=912**	**N=319**	**N=593**
TASO	52.96	53.29	52.78
MOH	47.04	46.71	47.22
ARTP	**N=1205**	**N=445**	**N=760**
TASOART	27.14	26.97	27.24
TASOWL	12.95	11.24	13.95
TASOCONTROL	11.62	12.81	10.92
MOHART	22.49	20.45*	23.68*
MOHWL	13.11	13.03	13.16
MOHCONTROL	12.70	15.51***	11.05***
MOHPLWHA	35.60	33.48	36.84
TASOPLWHA	40.08	38.20***	41.18***
CONTROL(Non-PLWHA)	24.32	28.31***	21.97***
PLWHA	75.68	71.69***	78.03***

***p<0.01, **p<0.05, *p<0.1; for mean, ttest assuming equal means; for proportions, chi squared test. MM and HT are imputed wages by propensity mean matching and hot deck methods respectively.

The simple analyses of the different PLWHA categories by gender are presented in Table 8.10 below. The results indicate that males from TASOPLWHA and TASOART households supply about 2 hours less of labour per week compared to males from non-PLWHA households. Note that men from TASOWL households similarly supply less hours of labour though insignificant at 10 percent (that is the standard error is large).

Table 8.10: Labour supply by gender for PLWHA categories

	(1) Male PLWHA	(2) Female PLWHA	(3) Male MOH/TASO	(4) Female MOH/TASO	(5) Male ARTP	(6) Female ARTP
(Reference Non-PLWHA)						
PLWHA	-0.489	0.044				
	(0.79)	(0.56)				
(Reference Non-PLWHA)						
TASOPLWHA			**-1.776****	0.342		
			(0.85)	(0.62)		
MOHPLWHA			0.950	-0.292		
			(0.98)	(0.61)		
(Reference Non-PLWHA)						
TASOART					**-1.858***	0.402
					(0.97)	(0.68)
TASOWL					-1.588	0.224
					(0.99)	(0.76)
MOHART					0.362	-0.447
					(1.15)	(0.67)
MOHWL					1.821	-0.010
					(1.35)	(0.73)
Constant	7.978***	6.255***	7.978***	6.255***	7.978***	6.255***
	(0.64)	(0.51)	(0.65)	(0.51)	(0.65)	(0.51)
N	427	741	427	741	427	741

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The OLS results of the partially complete model and the full model that control for additional variables (for wage-original) are shown in Tables 8.11 and 8.12. For the partial model (Table 8.11), the TASOPLWHA and TASOART coefficients for males become insignificant while TASOWL coefficient becomes significant. The wage-original variable is positively associated with labour hours for both males and females. Age indicates an inverted U relationship for males and females while males residing in urban areas work about 2 hours more per week than those that reside in rural areas.

Table 8.11: Labour supply by gender (Partial model)-Original wage

	(1) PLWHA Male	(2) PLWHA Female	(3) MOH/TASO Male	(4) MOH/TASO Female	(5) ARTP Male	(6) ARTP Female	(7) PLWHA Male	(8) PLWHA Female	(9) MOH/TASO Male	(10) MOH/TASO Female	(11) ARTP Male	(12) ARTP Female
(Reference non-PLWHA)												
PLWHA	-0.489	0.044					0.070	-0.098				
	(0.79)	(0.56)					(0.84)	(0.75)				
(Reference non-PLWHA)												
TASOPLWHA			**-1.776****	0.342					-0.648	0.183		
			(0.85)	(0.62)					(0.99)	(0.78)		
MOHPLWHA			0.950	-0.292					0.853	-0.410		
			(0.98)	(0.61)					(1.03)	(0.84)		
(Reference non-PLWHA)												
TASOART					**-1.858***	0.402					0.090	0.371
					(0.97)	(0.68)					(1.26)	(0.81)
TASOWL					-1.588	0.224					**-1.978***	-0.136
					(0.99)	(0.76)					(1.08)	(0.94)
MOHART					0.362	-0.447					0.244	-0.657
					(1.15)	(0.67)					(1.13)	(0.92)
MOHWL					1.821	-0.010					1.718	0.054
					(1.35)	(0.73)					(1.61)	(1.03)
Wage-Original							5.8E-5*	9.3E-5**	5.6E-5*	9.2E-5**	5.4E-5*	9.1E-5**
							(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Age							0.430***	0.184*	0.420***	0.182*	0.431***	0.184
							(0.13)	(0.10)	(0.13)	(0.10)	(0.13)	(0.10)
Age squared							-0.005***	-0.002**	-0.005***	-0.002**	-0.005***	-0.002*
							(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Number children ≤ 5Years							0.523	-0.246	0.497	-0.249	0.543	-0.249
							(0.52)	(0.26)	(0.51)	(0.26)	(0.52)	(0.27)
Number children 6-18 years							-0.073	-0.120	-0.041	-0.138	-0.104	-0.145
							(0.20)	(0.14)	(0.20)	(0.14)	(0.21)	(0.14)
(Reference Urban)												
Urban Residence							2.203*	0.625	2.149*	0.668	1.985*	0.680

							(1.18)	(0.66)	(1.16)	(0.65)	(1.17)	(0.65)
Education years							0.065	0.114	0.069	0.100	0.078	0.097
							(0.35)	(0.18)	(0.36)	(0.18)	(0.34)	(0.19)
Education years squared							-0.015	-0.020	-0.014	-0.019	-0.015	-0.019
							(0.02)	(0.01)	(0.02)	(0.01)	(0.02)	(0.01)
Chronic							-1.206	0.107	-1.233	0.081	-1.145	0.097
							(1.02)	(0.56)	(1.01)	(0.56)	(0.99)	(0.56)
Acute							0.026	0.050	0.000	0.052	0.006	0.027
							(1.20)	(0.55)	(1.18)	(0.55)	(1.18)	(0.56)
Constant	7.978^{***}	6.255^{***}	7.978^{***}	6.255^{***}	7.978^{***}	6.255^{***}	-1.631	4.444	-1.604	4.606	-1.673	4.590
	(0.64)	(0.51)	(0.65)	(0.51)	(0.65)	(0.51)	(3.45)	(2.48)	(3.46)	(2.50)	(3.48)	(2.51)
N	427	741	427	741	427	741	283	530	283	530	283	530

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The full model (Table 8.12) shows no significant effect of PLWHA categories and the male urban effect disappears. The wage variable remains positively associated with labour supply and significant while the inverted U relationship with age for males is maintained. Furthermore, the association between female labour supply and the number of children aged five years and younger is negative, implying that females with younger children tend to supply less labour hours (note that the association is positive for older children though insignificant). Additionally widowed males work about 2.5 hours less per week compared to the married males, males and females engaged in non-agricultural occupation supply about 6 and 4.5 hours more per week respectively, while females engaged in other-occupation supply 3 hours less per week compared to females engaged in agricultural related occupation.

Similar analysis was undertaken using the imputed wage variables and results of gender analysis using the imputed wage variables (for the partially complete model) are presented in Appendix E.6 (Table E.61). The partial model results are similar to the wage-original results and reveal that males from TASOWL provide about 1.5 hours of labour (smaller coefficient compared to wage-original) less per week compared to males from non-PLWHA. Unlike the wage-original analysis, the imputed wage results indicate that women residing in the urban area are more likely to supply more hours of labour (similar to the males) compared to females from the rural areas.

The full model results (Table E.62) are also similar to the wage-original results (with smaller coefficients for the occupation variable) but the association between female labour supply and children five years and younger disappears while the association between female labour supply and the (log) stock of wealth is positive and significant. This implies that females that are better endowed (in terms of stock of wealth as an indicator of empowerment) are more likely to engage in the labour market.

Table 8.12: Labour supply by gender –Full model Original wage

	(1) PLWHA	(2) PLWHA	(3) MOH/TASO	(4) MOH/TASO	(5) ARTP	(6) ARTP
(Reference non-PLWHA)						
PLWHA	0.912	-0.149				
	(0.79)	(0.68)				
(Reference non-PLWHA)						
TASOPLWHA			0.779	0.191		
			(0.89)	(0.72)		
MOHPLWHA			1.036	-0.476		
			(1.02)	(0.75)		
(Reference non-PLWHA)						
TASOART					1.772	0.375
					(1.19)	(0.77)
TASOWL					-1.023	-0.181
					(1.14)	(0.83)
MOHART					1.018	-0.626
					(1.08)	(0.80)
MOHWL					0.996	-0.220
					(1.68)	(0.95)
Wage-Original	4.0E-5**	7.0E-6***	4.0E-5***	6.8E-6***	4.0E-5**	6.8E-6***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Age	0.375*	-0.114	0.380*	-0.118	0.398*	-0.119
	(0.20)	(0.11)	(0.20)	(0.11)	(0.20)	(0.11)
Age squared	-0.004*	0.000	-0.004*	0.000	-0.004**	0.000
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Number children ≤ 5Years	0.487	-0.400*	0.488	-0.411*	0.615	-0.395
	(0.53)	(0.24)	(0.53)	(0.24)	(0.54)	(0.24)
Number children 6-18 years	-0.043	0.017	-0.039	-0.002	-0.128	-0.008
	(0.19)	(0.13)	(0.19)	(0.14)	(0.20)	(0.14)
(Reference Rural)						
Urban Residence	0.378	-0.380	0.388	-0.337	0.289	-0.328
	(1.17)	(0.63)	(1.18)	(0.62)	(1.20)	(0.62)
Education years	-0.037	0.001	-0.035	-0.016	0.019	-0.018
	(0.32)	(0.15)	(0.32)	(0.15)	(0.30)	(0.15)
Education years squared	-0.002	-0.015	-0.002	-0.014	-0.005	-0.014
	(0.02)	(0.01)	(0.02)	(0.01)	(0.02)	(0.01)
Log (Stock of wealth)	-0.132	0.091	-0.132	0.096	-0.144	0.099
	(0.11)	(0.06)	(0.11)	(0.06)	(0.12)	(0.06)
Chronic	-1.227	-0.166	-1.221	-0.191	-1.197	-0.174
	(1.05)	(0.52)	(1.05)	(0.51)	(1.02)	(0.51)
Acute	0.735	-0.385	0.732	-0.381	0.688	-0.398
	(1.19)	(0.49)	(1.18)	(0.49)	(1.18)	(0.49)
(Reference Married)						
Single	-0.167	-0.528	-0.103	-0.672	-0.044	-0.605
	(2.38)	(1.08)	(2.54)	(1.07)	(2.44)	(1.11)
Divorced	0.146	0.245	0.175	0.238	0.535	0.267
	(3.22)	(0.93)	(3.18)	(0.92)	(3.24)	(0.92)
Widowed	-2.459*	0.355	-2.452*	0.241	-2.435*	0.259
	(1.36)	(0.91)	(1.36)	(0.90)	(1.43)	(0.91)
(Reference Agricultural Occupation)						
Other occupation	-1.994	-2.917***	-2.034	-2.842***	-2.037	-2.837***
	(1.96)	(0.79)	(1.91)	(0.79)	(1.95)	(0.78)

Non-agricultural occupation	5.944***	4.434***	5.910***	4.462***	5.875***	4.470***
	(1.21)	(0.64)	(1.22)	(0.64)	(1.22)	(0.64)
Male household head	0.521	0.101	0.457	0.155	0.474	0.144
	(1.33)	(0.78)	(1.19)	(0.78)	(1.14)	(0.80)
Constant	-2.506	10.119***	-2.600	10.296***	-2.882	10.266***
	(6.68)	(3.03)	(6.91)	(3.05)	(6.76)	(3.13)
N	266	513	266	513	266	513

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Further analysis of gender supply of labour included controlling for the CD4 cell count (CD4-worst). Tables 8.13, 8.14 and 8.15 show the simple analysis, partial model and full model respectively for wage-original and wage-MM variables. The inclusion of just the PLWHA categories (including ARTP) and labour supply indicate that females from TASOPLWHA households significantly supply an additional 1.3 hours of labour per week than MOHPLWHA while men from TASOWL supply 4.3 hours less per week than males from MOHWL.

The female TASOPLWHA and male TASOWL variables become insignificant in the partial model results for wage-original and imputed wage but the female TASOART becomes significant for the imputed wage (wage-MM) with females from households with a PLWHA from TASO receiving ART supplying about 2 hours more of labour compared to females from MOHWL households. There is an inverted U relationship between age and labour supply for females for wage-original and for both males and females for the imputed wage (wage-MM). The wage variable is positively associated with labour supply and significant.

Furthermore, the association between CD4 cell count (CD4-worst) and labour supply is significantly negative for females for wage original (for the partial model) but not for the imputed wage, meaning women with a high CD4 cell count supply less hours of labour, contrary to expectations of a higher CD4 Cell count being associated with greater supply of labour hours.

For the full model however, the female TASOPLWHA effect becomes significant for wage original and imputed wage (Table 8.15, Column 4 and 10), with females supplying 1.2 and 2 hours more per week respectively compared to females from MOHPLWHA households. Conversely, for the imputed wages (wage-MM), the full model still indicates that females from TASOART households provide 2.3 hours more compared to females from MOHWL households. For the other variables, the effects of being a male widower (compared to a married male) and occupation types, non-agricultural and other occupation (compared to agricultural occupation) for both males and females are maintained (as the previous model without severity control) for the wage variables.

Table 8.13: PLWHA categories and CD4 cell count by gender

	(1) Male	(2) Female	(3) Male	(4) Female	(5) Male	(6) Female
(Reference MOHPLWHA)						
TASOPLWHA			-1.601	**1.280***		
			(1.26)	(0.65)		
(Reference MOHWL)						
TASOART					-3.067	1.433
					(2.05)	(0.87)
TASOWL					**-4.258****	0.260
					(1.99)	(0.89)
MOHART					-2.681	-0.220
					(2.02)	(0.76)
CD4-worst[51]	-0.002	-0.001	-0.002	-0.001	-0.002	-0.001
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Constant	8.138***	6.793***	8.770***	6.339***	10.609***	6.437***
	(1.17)	(0.61)	(1.34)	(0.70)	(2.18)	(0.78)
N	173	333	173	333	173	333

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

[51] CD4 cell worst used in this case-CD4 cell worst is the lowest CD4 cell count recorded. All other CD4 types gave similar results, hence CD4_worst only shown.

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Table 8.14: PLWHA categories and CD4 cell count by gender (Partial model)

	(1) Male	(2) Female	(3) Male	(4) Female	(5) Male	(6) Female	(7) Male	(8) Female	(9) Male	(10) Female	(11) Male	(12) Female
(Reference MOHPLWHA)												
TASOPLWHA			0.693	1.224					-0.178	1.476		
			(1.92)	(0.76)					(1.44)	(0.78)		
(Reference MOHWL)												
TASOART					0.463	1.249					-0.909	**1.707***
					(2.90)	(0.94)					(2.20)	(1.00)
TASOWL					-2.694	0.427					-2.802	0.505
					(2.47)	(1.11)					(2.12)	(0.95)
MOHART					-1.543	-0.290					-1.713	-0.112
					(2.30)	(1.02)					(1.92)	(0.78)
Wage-Original	7.1E-6*	4.5E-5***	7.2E-6*	4.9E-5***	7.5E-6*	4.8E-5***						
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)						
Wage-MM							4.8E-5*	7.9E-6***	4.8E-5*	7.6E-5***	4.4E-5*	7.4E-6***
							(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
CD4-worst	-0.003	-0.003**	-0.003	-0.003**	-0.002	-0.003**	-0.003	-0.000	-0.003	-0.001	-0.003	-0.001
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Age	0.264	0.458***	0.262	0.460***	0.233	0.457***	0.289**	0.287**	0.287**	0.282**	0.292**	0.282**
	(0.18)	(0.13)	(0.18)	(0.14)	(0.19)	(0.14)	(0.13)	(0.12)	(0.13)	(0.12)	(0.13)	(0.12)
Age squared	-0.003**	-0.006***	-0.003**	-0.006***	-0.003*	-0.006***	-0.004**	-0.003**	-0.004**	-0.003**	-0.004**	-0.003**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Number children ≤ 5Years	1.068	0.164	1.101	0.195	1.063	0.201	1.100	0.439	1.088	0.430	1.013	0.428
	(1.10)	(0.41)	(1.10)	(0.40)	(1.15)	(0.41)	(0.91)	(0.31)	(0.91)	(0.31)	(0.96)	(0.32)
Number children 6-18 years	-0.016	-0.138	-0.037	-0.198	-0.103	-0.198	-0.129	-0.122	-0.126	-0.160	-0.130	-0.162
	(0.36)	(0.18)	(0.37)	(0.18)	(0.39)	(0.18)	(0.26)	(0.13)	(0.26)	(0.13)	(0.27)	(0.13)
Urban residence	1.997	0.303	2.014	0.281	2.068	0.330	1.114	0.689	1.152	0.598	1.312	0.666
	(3.06)	(1.10)	(3.10)	(1.09)	(3.03)	(1.11)	(2.10)	(0.93)	(2.20)	(0.94)	(2.17)	(0.94)
Education years	-0.487	-0.079	-0.501	-0.141	-0.428	-0.152	-0.382	-0.061	-0.375	-0.146	-0.351	-0.148

	(0.79)	(0.25)	(0.82)	(0.25)	(0.75)	(0.25)	(0.54)	(0.25)	(0.58)	(0.26)	(0.55)	(0.27)
Education years squared	0.007	-0.006	0.007	-0.003	0.002	-0.002	0.005	-0.003	0.005	0.001	0.004	0.001
	(0.04)	(0.02)	(0.04)	(0.02)	(0.04)	(0.02)	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)	(0.02)
Chronic	-0.702	-0.607	-0.680	-0.679	-0.452	-0.616	-0.030	-0.593	-0.032	-0.715	0.108	-0.655
	(1.87)	(0.77)	(1.88)	(0.76)	(1.75)	(0.78)	(1.51)	(0.75)	(1.51)	(0.78)	(1.46)	(0.76)
Acute	1.725	0.249	1.747	0.337	1.501	0.309	0.519	0.064	0.514	0.204	0.424	0.197
	(2.73)	(0.78)	(2.74)	(0.78)	(2.82)	(0.79)	(1.98)	(0.64)	(1.98)	(0.63)	(2.00)	(0.63)
Constant	5.185	0.723	5.132	0.628	6.811	0.832	4.281	1.160	4.344	1.244	5.398	1.193
	(7.00)	(3.11)	(6.87)	(3.15)	(7.39)	(3.16)	(4.63)	(2.67)	(4.39)	(2.74)	(4.65)	(2.74)
N	121	234	121	234	121	234	170	328	170	328	170	328

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8.15: PLWHA categories and CD4 cell count by gender (Full model)

	(1) Male	(2) Female	(3) Male	(4) Female	(5) Male	(6) Female	(7) Male	(8) Female	(9) Male	(10) Female	(11) Male	(12) Female
(Reference MOHPLWHA)												
TASOPLWHA			1.472	**1.241***					0.721	**1.753****		
			(2.07)	(0.70)					(1.68)	(0.76)		
(Reference TASOWL)												
TASOART					1.731	1.610					0.435	**2.257****
					(2.96)	(1.09)					(2.56)	(1.09)
TASOWL					-0.815	0.003					-1.514	-0.032
					(2.92)	(1.21)					(2.51)	(0.94)
MOHART					-0.426	-0.056					-1.071	-0.092
					(2.53)	(1.09)					(2.07)	(0.80)
Wage-Original	3.0E-5*	6.2E-6***	3.1E-5*	6.0E-6***	3.0E-5*	5.7E-6***						
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)						
Wage-MM							3.4E-5**	6.6E-6***	3.5E-5**	6.2E-6***	3.3E-5*	5.9E-6***
							(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
CD4-worst	0.001	-0.002	0.001	-0.002	0.001	-0.002	-0.002	1.4E-3	-0.002	-0.000	-0.002	0.000
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Age	0.477	-0.016	0.431	-0.030	0.430	-0.057	0.298	-0.113	0.287	-0.142	0.284	-0.171
	(0.33)	(0.16)	(0.33)	(0.16)	(0.33)	(0.16)	(0.23)	(0.15)	(0.23)	(0.15)	(0.22)	(0.16)
Age squared	-0.004	-0.001	-0.004	-0.001	-0.004	-0.001	-0.003	0.001	-0.003	0.001	-0.003	0.001
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Number children ≤ 5Years	1.480	-0.157	1.539	-0.120	1.572	-0.084	1.279	0.254	1.323	0.240	1.308	0.251
	(1.13)	(0.41)	(1.15)	(0.42)	(1.19)	(0.42)	(0.97)	(0.32)	(0.99)	(0.32)	(1.03)	(0.33)
Number children 6-18 years	-0.035	-0.028	-0.061	-0.086	-0.125	-0.081	-0.125	-0.119	-0.145	-0.176	-0.166	-0.177
	(0.38)	(0.17)	(0.38)	(0.18)	(0.40)	(0.18)	(0.31)	(0.14)	(0.31)	(0.14)	(0.31)	(0.14)
(Reference Rural)												
Urban Residence	1.096	-0.829	1.011	-0.835	1.157	-0.758	-0.038	-0.017	-0.251	-0.103	-0.013	-0.011
	(3.26)	(1.15)	(3.33)	(1.18)	(3.35)	(1.17)	(2.09)	(0.98)	(2.31)	(1.01)	(2.32)	(0.98)
Education years	-0.225	-0.078	-0.232	-0.130	-0.139	-0.152	-0.236	-0.073	-0.260	-0.174	-0.215	-0.179
	(0.66)	(0.21)	(0.67)	(0.22)	(0.61)	(0.22)	(0.46)	(0.23)	(0.50)	(0.25)	(0.47)	(0.25)
Education years squared	-0.005	-0.012	-0.006	-0.010	-0.012	-0.008	0.005	-0.008	0.005	-0.003	0.002	-0.002

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	(0.04)	(0.02)	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)	(0.01)	(0.03)	(0.01)	(0.02)	(0.01)
Log (Stock of wealth)	0.059	0.111	0.071	0.126	0.048	0.129	-0.107	0.201***	-0.109	0.222***	-0.106	0.230***
	(0.23)	(0.09)	(0.22)	(0.09)	(0.24)	(0.09)	(0.21)	(0.07)	(0.21)	(0.07)	(0.22)	(0.08)
Chronic	0.434	-0.697	0.440	-0.764	0.376	-0.696	0.855	-1.014	0.867	-1.169	0.889	-1.088
	(1.96)	(0.79)	(1.96)	(0.78)	(1.83)	(0.78)	(1.56)	(0.82)	(1.57)	(0.84)	(1.52)	(0.82)
Acute	2.534	-0.254	2.601	-0.144	2.422	-0.207	1.522	-0.631	1.562	-0.475	1.441	-0.541
	(2.86)	(0.74)	(2.88)	(0.74)	(2.99)	(0.75)	(2.11)	(0.65)	(2.12)	(0.63)	(2.16)	(0.64)
(Reference Married)												
Single	2.116	-1.011	1.447	-1.338	0.992	-1.528	-0.235	-0.365	-0.526	-0.690	-0.955	-0.962
	(4.27)	(1.35)	(4.77)	(1.40)	(4.89)	(1.47)	(3.37)	(1.08)	(3.74)	(1.13)	(3.65)	(1.17)
Divorced	6.836	0.940	6.725	0.666	6.353	0.596	4.630	0.566	4.558	0.335	4.065	0.377
	(9.17)	(1.21)	(8.89)	(1.19)	(8.67)	(1.20)	(6.36)	(1.06)	(6.18)	(1.08)	(6.22)	(1.06)
Widowed	-3.116*	0.488	-3.212**	0.017	-3.339**	-0.047	-3.237**	1.165	-3.358**	0.768	-3.193**	0.741
	(1.59)	(1.28)	(1.61)	(1.28)	(1.64)	(1.29)	(1.36)	(1.04)	(1.34)	(1.04)	(1.24)	(1.03)
(Reference Agricultural Occupation)												
Other occupation	-0.509	-2.606**	0.075	-2.592**	0.166	-2.648**	-2.093	-1.854*	-1.899	-1.935*	-1.723	-2.010*
	(3.91)	(1.08)	(3.97)	(1.09)	(4.10)	(1.07)	(3.02)	(1.09)	(3.02)	(1.09)	(3.09)	(1.07)
Non-agricultural occupation	6.707***	4.157***	7.038***	4.207***	6.867***	4.202***	5.486***	3.552***	5.617***	3.656***	5.595***	3.735***
	(2.29)	(0.91)	(2.47)	(0.90)	(2.48)	(0.90)	(1.92)	(0.83)	(2.05)	(0.81)	(2.06)	(0.81)
Male household head	-2.271	-0.833	-2.121	-0.856	-2.414	-1.097	-0.657	0.062	-0.617	0.094	-0.901	-0.133
	(2.08)	(1.06)	(1.97)	(1.08)	(2.05)	(1.15)	(1.89)	(0.90)	(1.86)	(0.92)	(1.79)	(0.97)
Constant	-5.800	10.036**	-5.262	10.279**	-4.400	10.966**	1.580	8.133**	1.770	8.689**	2.849	9.296**
	(10.74)	(4.06)	(11.06)	(4.03)	(11.59)	(3.99)	(8.10)	(3.58)	(8.28)	(3.63)	(8.21)	(3.69)
N	116	229	116	229	116	229	163	322	163	322	163	322

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Further analyses to control for HIV.AIDS severity involves controlling for the WHO HIV-stage and duration on ART. The WHO HIV-stage results are similar results to the CD4 cell count results with females from TASOPLHWA households supplying more labour hours compared to females from MOHPLWHA for both wage-original and imputed wage, and females from TASOART supplying more hours of labour for the imputed wage. However, for the months on ART results, the wage-original female TASOART coefficient also becomes significant (and the coefficients for female TASOPLWHA and TASOART are larger for the imputed wage). The results controlling for WHO- HIV-stage and months on ART are presented in Appendix E.7 (Tables E.71 and E.72).

Couple Analysis of household labour supply

The previous labour supply models investigate individual and gender labour supply, and imply labour supply decisions by the individual. However, in reality, the decision regarding supply of labour may be decided at the household level rather than the individual level. The final analysis of this chapter therefore, explores couple bargaining power using the collective household model. The analysis investigates the household labour supply of a household comprising of a couple as members using OLS and 2SLS. The analysis also explores household labour supply given bargaining power of the male and female in the household, and the PLWHA categories associated with the couple. It’s important to note that in the couple analysis, the model does not control for who has HIV among the couple, and hence we do not know who is HIV positive in the couple. The possibility is that either the male or female has HIV/AIDS or both the male and female have HIV/AIDS

Table 8.16 shows the analysis of labour supply and the bargaining power variable, male-female age difference in this case (assumed exogenous). The Table also shows the relationship between PLWHA categories including ARTP with total couple labour supply hours. The association between the difference between the male and female’s age and labour supply is positive, meaning the greater the age difference, the more likely it is to increase the household total labour supply. With the addition of the other bargaining power variables, the association between labour supply and the male bargaining power variable is negative, while that of the female spouse is positive. This means that males tend to reduce contribution to household labour supply, while women on the other hand tend to increase contribution to total household labour supply.

Table 8.16: Couple labour supply, bargaining power and PLWHA categories

	(1) BPV[52]	(2) PLWHA	(3) TASO/MOH	(4) ARTP
(Reference non-PLWHA)				
PLWHA		-1.119		
		(1.263)		
(Reference Non-PLWHA)				
TASOPLWHA			-2.126	
			(1.390)	
MOHPLWHA			-0.383	
			(1.538)	
(Reference Non-PLWHA)				
TASOART				**-2.933****
				(1.472)
TASOWL				-0.103
				(2.268)
MOHART				-1.251
				(1.803)
MOHWL				1.044
				(2.096)
Agemf§	**1.026****	**1.035****	**0.990****	**1.032****
	(0.485)	(0.486)	(0.486)	(0.474)
(Agemf)squared*log(Stock of wealth)	**-0.038****	**-0.039****	**-0.037****	**-0.039****
	(0.016)	(0.016)	(0.016)	(0.016)
(Agefm)squared*log(Stock of wealth)	**0.038****	**0.039****	**0.037****	**0.039****
	(0.016)	(0.016)	(0.016)	(0.016)
Constant	15.072***	15.822***	15.813***	15.883***
	(0.844)	(1.088)	(1.081)	(1.071)
N	466	466	466	466

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$: Agemf§ is (maleage-femaleage) Agefm is (femaleage-maleage)

[52] Bargaining Power Variable

The PLWHA categories coefficients for PLWHA, TASOPLHWA and non-PLWHA reveal a negative association with total household labour supply implying that couples from PLWHA, TASOPLWHA and MOHPLWHA households supply less total labour compared to couples from non-PLWHA households (note that coefficients are insignificant).
Column 4 of Table 8.16 includes the PLWHA categories in terms of ARTP. The results reveal that a couple from TASOART households provides about 3 hours less of labour compared to a couple from non-PLWHA households. The male and female age variable is significant and this implies that total household labour allocation is affected by the couple age difference with males reducing contribution to total household labour while females increase contribution to total household labour (recall that the model does not indicate who has HIV in the couple).

The partial model and full model for the wage variables are shown in Tables 8.17 and 8.18. Results in Table 8.16 indicate couples from PLWHA categories to supply less labour compared to couples from non-PLWHA households and this is maintained for the imputed wage variables but changes for wage-original (PLWHA and MOHPLWHA coefficients are positive) for Tables 8.17 and 8.18 though insignificant. Furthermore, the TASOART effect becomes insignificant in both models.

The other variables including agricultural occupation and wage are quite similar to the individual OLS and 2SLS results. The wage variable is positively associated with couple labour supply and significant for all wage variables while non-agricultural occupation is associated with 7 more hours of labour for couples' labour supply compared to agricultural occupation. The partial model indicates an inverted U relationship between male-age and couple labour supply and this is significant for the imputed wage variable, implying couple labour supply first increases with male-age, then decreases with further increase in male-age. The significance of male-age disappears for the full model but the U shaped relationship is maintained for all wage variables. A similar inverted U relationship exists for education years though not significant for all analyses. There is no apparent association between couple labour supply and urban residence or number of children in the household for the couple analysis partial and full models shown in Tables 8.17 and 8.18.

Table 8.17: Couple total labour supply, bargaining power and PLWHA categories (Partial model)

	(1) PLWHA	(2) TASO/MOH	(3) ARTP	(4) PLWHA	(5) TASO/MOH	(6) ARTP	(7) PLWHA	(8) TASO/MOH	(9) ARTP
(Reference non-PLWHA)									
PLWHA	0.951			-1.176			-1.187		
	(1.437)			(1.252)			(1.252)		
(Reference non-PLWHA)									
TASOPLWHA		-0.215			-1.971			-1.999	
		(1.661)			(1.399)			(1.398)	
MOHPLWHA		1.682			-0.633			-0.632	
		(1.749)			(1.503)			(1.503)	
(Reference non-PLWHA)									
TASOART			-1.432			**-2.704***			**-2.729***
			(1.771)			(1.519)			(1.518)
TASOWL			2.392			-0.270			-0.305
			(2.761)			(2.212)			(2.209)
MOHART			1.170			-1.305			-1.303
			(2.136)			(1.754)			(1.754)
MOHWL			2.409			0.467			0.466
			(2.398)			(2.114)			(2.116)
Wage-Original	6.1E-5**	6.0E-5**	5.9E-5**						
	(0.000)	(0.000)	(0.000)						
Wage-MM				5.6E-5**	5.5E-5**	5.4E-5**			
				(0.000)	(0.000)	(0.000)			
Wage-HD							5.6E-5**	5.5E-5**	5.4E-5**
							(0.000)	(0.000)	(0.000)
Agemf§	**1.942*****	**1.865*****	**1.884*****	**1.115****	**1.074****	**1.106****	**1.122****	**1.079****	**1.111****
	(0.613)	(0.649)	(0.612)	(0.466)	(0.469)	(0.462)	(0.466)	(0.469)	(0.462)
(Agemf)squared*log(stock wealth)	**-0.063*****	**-0.061*****	**-0.062*****	**-0.041*****	**-0.039****	**-0.041*****	**-0.041*****	**-0.040****	**-0.041*****
	(0.020)	(0.021)	(0.020)	(0.015)	(0.016)	(0.015)	(0.015)	(0.016)	(0.015)
(Agefm)squared *log(stock wealth)	**0.063*****	**0.060*****	**0.061*****	**0.041*****	**0.040****	**0.041*****	**0.041****	**0.040****	**0.041*****
	(0.020)	(0.021)	(0.020)	(0.015)	(0.016)	(0.015)	(0.015)	(0.016)	(0.015)

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Age*male	-0.007	-0.021	-0.028	0.065*	0.055*	0.047	0.065*	0.055*	0.047
	(0.052)	(0.050)	(0.049)	(0.034)	(0.033)	(0.032)	(0.034)	(0.033)	(0.032)
Age squared*male	-0.001	-0.000	-0.000	-0.002**	-0.001*	-0.001*	-0.002**	-0.001*	-0.001*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Education years	0.591	0.608	0.578	0.242	0.252	0.235	0.236	0.246	0.229
	(0.392)	(0.395)	(0.390)	(0.319)	(0.318)	(0.317)	(0.318)	(0.318)	(0.317)
Education years squared	-0.039	-0.040	-0.041	-0.015	-0.016	-0.016	-0.015	-0.015	-0.015
	(0.025)	(0.025)	(0.025)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)
Chronic	0.287	0.420	0.517	0.453	0.515	0.491	0.456	0.519	0.495
	(1.413)	(1.429)	(1.454)	(1.084)	(1.090)	(1.109)	(1.084)	(1.090)	(1.109)
Acute	1.837	1.762	1.806	0.155	0.141	0.168	0.167	0.152	0.179
	(1.693)	(1.656)	(1.646)	(1.149)	(1.138)	(1.150)	(1.149)	(1.138)	(1.151)
Constant	11.519***	11.514***	11.801***	14.182***	14.180***	14.375***	14.193***	14.191***	14.385***
	(1.957)	(1.959)	(1.948)	(1.562)	(1.563)	(1.558)	(1.561)	(1.562)	(1.556)
N	299	299	299	464	464	464	464	464	464

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; Agemf§ is (maleage-femaleage) Agefm is (femaleage-maleage)

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Table 8.18: Couple total labour supply, bargaining power and PLWHA categories (Full model)

	(1) PLWHA	(2) TASO/MOH	(3) ARTP	(4) PLWHA	(5) TASO/MOH	(6) ARTP	(7) PLWHA	(8) TASO/MOH	(9) ARTP
(Reference non-PLWHA)									
PLWHA	0.533			-0.899			-0.906		
	(1.377)			(1.221)			(1.221)		
(Reference non-PLWHA)									
TASOPLWHA		-0.345			-1.140			-1.160	
		(1.539)			(1.322)			(1.321)	
MOHPLWHA		1.056			-0.753			-0.752	
		(1.643)			(1.425)			(1.426)	
(Reference non-PLWHA)									
TASOART			-1.324			-1.563			-1.579
			(1.588)			(1.438)			(1.437)
TASOWL			1.661			-0.201			-0.223
			(2.757)			(2.151)			(2.149)
MOHART			0.870			-1.472			-1.470
			(2.059)			(1.691)			(1.691)
MOHWL			1.308			0.450			0.450
			(2.103)			(1.879)			(1.881)
Wage-Original	4.3E-5***	4.2E-5***	4.2E-5***						
	(0.000)	(0.000)	(0.000)						
Wage-MM				3.9E-5***	3.9E-5***	3.7E-5**			
				(0.000)	(0.000)	(0.000)			
Wage-HD							3.9E-5***	3.9E-5***	3.7E-5**
							(0.000)	(0.000)	(0.000)
Agemf§	**1.532*****	**1.496*****	**1.556*****	**0.927****	**0.916****	**0.939****	**0.931****	**0.920****	**0.943****
	(0.528)	(0.547)	(0.527)	(0.400)	(0.405)	(0.405)	(0.400)	(0.405)	(0.405)
(Agemf)squared*log(stock wealth)	**-0.049*****	**-0.048*****	**-0.050*****	**-0.034****	**-0.034****	**-0.035****	**-0.034****	**-0.034****	**-0.035****
	(0.017)	(0.017)	(0.017)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
(Agefm)squared*log(stock wealth)	**0.049*****	**0.047*****	**0.050*****	**0.035****	**0.034****	**0.035****	**0.035*****	**0.034****	**0.035****
	(0.017)	(0.017)	(0.017)	(0.013)	(0.013)	(0.014)	(0.013)	(0.013)	(0.014)

Age*male	-0.094*	-0.103*	-0.105*	-0.057	-0.059	-0.062	-0.057	-0.059	-0.062
	(0.055)	(0.055)	(0.055)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)
Age squared*male	0.001	0.001	0.001	0.000	0.001	0.001	0.000	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Education years	0.517	0.530	0.514	0.234	0.237	0.233	0.230	0.232	0.229
	(0.390)	(0.392)	(0.388)	(0.315)	(0.315)	(0.314)	(0.315)	(0.315)	(0.314)
Education years squared	-0.042	-0.043*	-0.044*	-0.022	-0.022	-0.022	-0.022	-0.022	-0.022
	(0.026)	(0.026)	(0.025)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)
Chronic	0.741	0.846	0.892	0.186	0.209	0.172	0.187	0.211	0.174
	(1.454)	(1.475)	(1.488)	(1.048)	(1.052)	(1.071)	(1.048)	(1.052)	(1.071)
Acute	0.791	0.766	0.846	-0.375	-0.375	-0.336	-0.367	-0.366	-0.328
	(1.457)	(1.443)	(1.421)	(1.098)	(1.098)	(1.104)	(1.098)	(1.098)	(1.104)
Number children ≤ 5Years	0.079	0.098	-0.059	-0.173	-0.175	-0.244	-0.175	-0.178	-0.246
	(0.771)	(0.771)	(0.827)	(0.578)	(0.576)	(0.606)	(0.578)	(0.576)	(0.606)
Number children 6-18 years	0.049	0.102	0.150	-0.199	-0.189	-0.177	-0.200	-0.189	-0.177
	(0.376)	(0.372)	(0.374)	(0.305)	(0.306)	(0.304)	(0.305)	(0.306)	(0.304)
Urban residence	1.003	1.082	0.820	-0.459	-0.432	-0.599	-0.468	-0.439	-0.605
	(2.166)	(2.128)	(2.047)	(1.674)	(1.663)	(1.640)	(1.674)	(1.662)	(1.640)
(Reference Agricultural Occupation)									
Occupation-Other	-0.392	-0.652	-0.637	1.059	0.971	0.933	1.062	0.970	0.932
	(2.484)	(2.403)	(2.369)	(2.068)	(2.028)	(2.022)	(2.068)	(2.026)	(2.021)
Non-Agricultural occupation	7.263***	7.138***	7.094***	6.924***	6.882***	6.865***	6.923***	6.878***	6.861***
	(1.932)	(1.855)	(1.900)	(1.469)	(1.429)	(1.437)	(1.471)	(1.430)	(1.438)
Constant	10.192***	10.046***	10.299***	13.985***	13.971***	14.162***	13.999***	13.983***	14.173***
	(2.549)	(2.579)	(2.654)	(2.011)	(2.015)	(2.051)	(2.008)	(2.013)	(2.049)
N	298	298	298	462	462	462	462	462	462

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; Agemf§ is (maleage-femaleage) Agefm is (femaleage-maleage)

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Table 8.19 shows the 2SLS results, which are quite similar to the OLS results except that the original wage variable becomes insignificant. A test of the null hypothesis for exogeneity indicates that the original wage model cannot have the null rejected while the imputed wage models reject the null hypothesis of exogeneity at 5% level of significance. This means that for the imputed wages, it is better to use 2SLS results given that they are more consistent but this should be with caution given that IV estimators in small samples have substantial bias (Wooldridge 2005).

The bargaining power variables have similar results to the OLS results except that the coefficients for 2SLS are larger than the OLS results. Also, the non-agricultural coefficient is similar to OLS results; with a positive association with couple labour supply though the coefficients are smaller for 2SLS.Similarly, the inverted U relationship between couple labour supply and education years is maintained though insignificant for 2SLS.

Testing the joint hypothesis that the bargaining power variable (θ) (shown in equation 8.26) has no effect on couple labour supply for both OLS and 2SLS (with instrumented wage) indicates that the assumption of the unitary model of pooling of household resources, labour supplied in this case, is rejected. The results are shown in Appendix E.8 and E.9 for both OLS and 2SLS regressions. This implies that male-female age difference affects household labour supply for the couple contrary to the unitary model assumption.

Table 8.19: Couple total labour supply, bargaining power and PLWHA categories (2SLS-All wages)

	(1) PLWHA	(2) TASO/MOH	(3) ARTP	(4) PLWHA	(5) TASO/MOH	(6) ARTP	(7) PLWHA	(8) TASO/MOH	(9) ARTP
(Reference non-PLWHA)									
PLWHA	0.519			-1.017			-1.065		
	(1.332)			(1.217)			(1.219)		
(Reference Non-PLWHA)									
TASOPLWHA		0.031			-0.829			-0.945	
		(1.480)			(1.338)			(1.325)	
MOHPLWHA		0.800			-1.129			-1.136	
		(1.556)			(1.425)			(1.434)	
(Reference non-PLWHA)									
TASOART			-1.019			-1.311			-1.419
			(1.500)			(1.444)			(1.430)
TASOWL			2.130			0.182			0.033
			(2.625)			(2.093)			(2.083)
MOHART			1.060			-1.214			-1.195
			(1.979)			(1.677)			(1.680)
MOHWL			0.324			-1.094			-1.140
			(2.052)			(1.999)			(2.014)
Wage-Original	1.64E-4	1.56E-4	1.51E-4						
	(0.000)	(0.000)	(0.000)						
Wage-MM				2.54E-4*	2.53E-4*	2.58E-4*			
				(0.000)	(0.000)	(0.000)			
Wage-HD							2.58E-4*	2.65E-4*	2.64E-4*
							(0.000)	(0.000)	(0.000)
Agemf§	**1.744*****	**1.713****	**1.798*****	**1.212****	**1.218****	**1.263****	**1.254****	**1.257****	**1.300****
	(0.516)	(0.524)	(0.498)	(0.431)	(0.438)	(0.440)	(0.434)	(0.441)	(0.443)
(Agemf)squared*log(stock wealth)	**-0.057*****	**-0.055****	**-0.058*****	**-0.045****	**-0.045****	**-0.047****	**-0.047****	**-0.047****	**-0.048****
	(0.017)	(0.017)	(0.016)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
(Agefm)squared*log(stock wealth)	**0.056*****	**0.055****	**0.058*****	**0.045****	**0.046****	**0.047****	**0.047****	**0.047****	**0.049****
	(0.017)	(0.017)	(0.016)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)

age*male	-0.064**	-0.061**	-0.058**	-0.060***	-0.060***	-0.059***	-0.059***	-0.059***	-0.059***
	(0.024)	(0.023)	(0.022)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)
Education years	0.503	0.511	0.491	0.176	0.173	0.167	0.146	0.145	0.138
	(0.393)	(0.393)	(0.390)	(0.332)	(0.331)	(0.333)	(0.333)	(0.333)	(0.335)
Education years squared	-0.047	-0.047	-0.047	-0.027	-0.027	-0.027	-0.025	-0.025	-0.026
	(0.028)	(0.028)	(0.027)	(0.024)	(0.024)	(0.025)	(0.024)	(0.024)	(0.024)
Chronic	0.424	0.507	0.597	-0.135	-0.152	-0.146	-0.138	-0.149	-0.139
	(1.403)	(1.413)	(1.414)	(1.064)	(1.073)	(1.075)	(1.068)	(1.080)	(1.081)
Acute	1.581	1.517	1.527	0.430	0.426	0.485	0.512	0.510	0.564
	(1.556)	(1.558)	(1.485)	(1.167)	(1.179)	(1.178)	(1.176)	(1.186)	(1.185)
Number children ≤ 5Years	0.025	0.035	-0.123	-0.166	-0.164	-0.218	-0.185	-0.184	-0.236
	(0.748)	(0.744)	(0.794)	(0.582)	(0.580)	(0.610)	(0.583)	(0.580)	(0.609)
Number children 6-18 years	0.189	0.213	0.268	-0.076	-0.086	-0.076	-0.077	-0.083	-0.074
	(0.365)	(0.358)	(0.358)	(0.315)	(0.311)	(0.311)	(0.315)	(0.311)	(0.311)
Urban residence	0.836	0.888	0.709	-0.895	-0.914	-0.974	-0.964	-0.976	-1.029
	(2.067)	(2.036)	(1.932)	(1.611)	(1.609)	(1.584)	(1.613)	(1.609)	(1.583)
(Reference Agricultural Occupation)									
Occupation other	0.625	0.439	0.432	2.998	3.053	3.043	3.084	3.118	3.099
	(2.401)	**(2.331)**	**(2.316)**	**(2.212)**	**(2.219)**	**(2.241)**	**(2.223)**	**(2.217)**	**(2.241)**
Non-Agricultural occupation	**5.737****	**5.751****	**5.790****	**5.089****	**5.135****	**5.016****	**5.017****	**5.048****	**4.937****
	(2.091)	(1.999)	(2.006)	(1.902)	(1.874)	(1.880)	(1.920)	(1.900)	(1.903)
Constant	9.369***	9.303***	9.468***	12.479***	12.508***	12.600***	12.518***	12.537***	12.632***
	(2.714)	(2.734)	(2.787)	(2.600)	(2.625)	(2.695)	(2.590)	(2.615)	(2.683)
N	298	298	298	462	462	462	462	462	462

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; Agemf§ is (maleage-femaleage) Agefm is (femaleage-maleage)

Other bargaining power variables investigated include the male-female wage difference and education share of the male both of which were not significant. Results for education share are shown in Appendix E.10. The wage variable is significant and positively associated with couple labour supply. Similarly, male-age is negatively associated with couple labour supply and significant but note that the association between male-age and couple labour supply is U shaped unlike the inverted U relationship when male-female age difference is used as the bargaining power variable. Comparable to the previous bargaining power analysis, non-agricultural occupation is positively associated with couple labour hours compared to agricultural occupation (supply 7 more hours of couple labour compared to agricultural occupation at 1% level of significance).

The severity of HIV is controlled for in the couple analysis by including the CD4 cell count, WHO HIV-stage and months on ART. For male-female age difference, the bargaining power variable effect disappears and CD4 cell count has no effect on labour supply (Table 8.20). The wage effect is positive and significant for the imputed wage variables but insignificant for wage-original. Couples in non-agricultural occupation work about 9-10 hours more compared to couples in the agricultural occupation and this is significant for all wage variables.

For variables that are not significant; TASOPLWHA becomes positively associated with couple labour supply compared to MOHPLWHA (contrary to results in Tables 8.19 Columns 4 and 7) while ARTP categories including MOHART, TASOART and TASOWL maintain the negative association. The association of CD4 cell count and couple labour supply is negative, implying less labour supply with increase in CD4 cell count contrary to the expectation (since healthier people have a greater CD4 cell count and are expected to supply more hours of labour). Male-age and couple analysis have a U relationship while education has an inverted U relationship for the imputed wage variables. Similar to the previous analysis (2SLS without controlling severity of HIV/AIDS), the association between couple labour supply and other occupation is positive compared to agricultural occupation.

Table 8.20: Couple labour supply controlling for CD4 cell count (All wages)

	(1) Wage-O	(2) Wage-O	(3) Wage-MM	(4) Wage-MM	(5) Wage-HD	(6) Wage-HD
(Reference MOHPLWHA)						
TASOPLWHA	0.384		0.459		0.444	
	(2.067)		(1.552)		(1.548)	
(Reference MOHWL)						
TASOART		0.214		-0.289		-0.303
		(3.134)		(2.621)		(2.624)
TASOWL		0.167		-2.480		-2.490
		(5.032)		(3.988)		(3.981)
MOHART		-0.253		-1.570		-1.569
		(4.002)		(3.118)		(3.121)
Wage-Original	2.79E-5	2.77E-5				
	(0.000)	(0.000)				
Wage-MM			2.98E-5*	2.83E-5*		
			(0.000)	(0.000)		
Wage-HD					2.96E-5*	2.81E-5*
					(0.000)	(0.000)
Agemf§	0.515	0.480	0.030	-0.055	0.034	-0.052
	(0.812)	(0.840)	(0.424)	(0.420)	(0.425)	(0.421)
(Agemf)squared*log(SW)	-0.015	-0.013	-0.002	0.001	-0.002	0.001
	(0.026)	(0.026)	(0.015)	(0.015)	(0.015)	(0.015)
(Agefm$^{)}$squared*log(SW)	0.014	0.013	0.002	-0.000	0.002	-0.000
	(0.026)	(0.026)	(0.015)	(0.015)	(0.015)	(0.015)
CD4-worst	0.001	0.001	-0.003	-0.004	-0.003	-0.004
	(0.005)	(0.006)	(0.004)	(0.004)	(0.004)	(0.004)
Age*male	-0.074	-0.073	-0.039	-0.040	-0.039	-0.040
	(0.076)	(0.077)	(0.057)	(0.057)	(0.057)	(0.057)
Age squared*male	0.001	0.001	0.000	0.000	0.000	0.000
	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Education years	-0.099	-0.102	0.202	0.186	0.201	0.185
	(0.620)	(0.636)	(0.493)	(0.507)	(0.494)	(0.507)
Education years squared	-0.006	-0.005	-0.019	-0.016	-0.019	-0.016
	(0.050)	(0.052)	(0.037)	(0.039)	(0.037)	(0.039)
Chronic	2.983	2.989	1.325	1.290	1.325	1.291
	(3.188)	(3.225)	(2.165)	(2.216)	(2.164)	(2.215)
Acute	2.299	2.285	0.453	0.340	0.458	0.344
	(2.920)	(3.095)	(2.340)	(2.437)	(2.340)	(2.438)
Number children ≤ 5Years	2.202	2.197	1.533	1.465	1.532	1.464
	(2.058)	(2.098)	(1.608)	(1.671)	(1.607)	(1.671)
Number children 6-18 years	0.015	0.011	-0.456	-0.455	-0.457	-0.456
	(0.726)	(0.741)	(0.466)	(0.466)	(0.467)	(0.467)
Urban Residence	0.015	0.002	-0.402	-0.429	-0.420	-0.445
	(5.472)	(5.475)	(3.751)	(3.698)	(3.755)	(3.703)
(Reference Agricultural occupation)						
Occupation other	6.479	6.432	5.620	5.463	5.620	5.463
	(5.424)	(5.277)	(4.198)	(4.088)	(4.199)	(4.090)
Non-Agricultural	10.886**	10.891**	9.295***	9.470***	9.295***	9.471***
	(4.470)	(4.458)	(3.466)	(3.436)	(3.466)	(3.436)
N	129	129	188	188	188	188

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; Agemf§ is (maleage-femaleage)
Agefm is (femaleage-maleage); SW is stock of wealth

Controlling for WHO HIV-stage, both the share of education model and male-female age difference model have WHO HIV-stage variable significant (for all wage types) as shown in Tables 8.21 and 8.22. An increase in the value of the WHO HIV-stage leads to almost 5-6 hours reduction (Table 8.22 Column 4; Table 8.21 Column 2) in the labour hours supplied by the couple. This is expected given that a high value for WHO HIV-stage indicates greater progression of HIV due to reduced immunity and hence more vulnerability to opportunistic diseases, implying less likelihood of being able to work.

The PLWHA categories results are similar to the CD4 cell count results (Table 8.20) except that TASOART becomes positive though insignificant (Table 8.21 Column 4 and 6). The imputed wage variables are positively associated with couple labour supply and significant (Table 8.21 Column 3-6).

The original wage maintains the significant association of the bargaining power variable (male-age difference) for wage-original but not for the imputed wage variables, implying that even after controlling for HIV/AIDS severity, bargaining power between a couple impacts on the household total labour allocation, refuting the unitary model assumption of resource pooling that implies that the identity of the household member does not affect household resource allocation. The male-age U shaped relationship with couple labour supply is maintained though not significant, and being employed in a non-agricultural occupation is positively associated with couple labour supply compared with being employed in an agricultural occupation and significant (9-10 hours more supplied (Tables 8.2 and 22)). Being employed in another occupation other than agricultural or non-agricultural is positively associated with couple labour supply compared to agricultural occupation but insignificant (Tables 8.21 and 8.22).

Table 8.21: Couple labour supply controlling for WHO HIV-Stage (All wages)

	(1) Wage-O	(2) Wage-O	(3) Wage-MM	(4) Wage-MM	(5) Wage-HD	(6) Wage-HD
(Reference MOHPLWHA)						
TASOPLWHA	-0.620		0.417		0.408	
	(1.921)		(1.613)		(1.611)	
(Reference MOHWL)						
TASOART		0.334		0.360		0.352
		(2.878)		(2.613)		(2.613)
TASOWL		-4.098		-4.111		-4.114
		(3.849)		(3.497)		(3.492)
MOHART		0.190		-1.232		-1.230
		(3.244)		(2.913)		(2.916)
Wage-Original	2.11E-5	1.83E-5				
	(0.000)	(0.000)				
Wage-MM			2.66E-5*	2.25E-5		
			(0.000)	(0.000)		
Wage-HD					2.67E-5*	2.25E-5
					(0.000)	(0.000)
Agemf§	**1.634****	**1.529****	0.486	0.320	0.489	0.322
	(0.700)	(0.647)	(0.490)	(0.482)	(0.490)	(0.482)
(Agemf)squared*log(stock wealth)	**-0.052****	**-0.048****	-0.019	-0.013	-0.019	-0.013
	(0.022)	(0.020)	(0.016)	(0.016)	(0.016)	(0.016)
(Agefm)squared*log(stock wealth)	**0.052****	**0.048****	0.019	0.013	0.019	0.013
	(0.022)	(0.020)	(0.016)	(0.016)	(0.016)	(0.016)
WHO HIV-Stage	**-5.446*****	**-5.700*****	**-2.371***	**-2.608****	**-2.375****	**-2.611****
	(1.317)	(1.363)	(1.078)	(1.116)	(1.077)	(1.114)
Age*male	-0.090	-0.086	-0.051	-0.047	-0.051	-0.047
	(0.074)	(0.077)	(0.051)	(0.051)	(0.051)	(0.051)
Age squared*male	0.002	0.002	0.001	0.001	0.001	0.001

	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Education years	-0.291	-0.314	-0.023	0.010	-0.025	0.008
	(0.523)	(0.562)	(0.450)	(0.459)	(0.450)	(0.459)
Education years squared	-0.008	-0.004	-0.013	-0.011	-0.013	-0.011
	(0.045)	(0.048)	(0.034)	(0.036)	(0.034)	(0.036)
Chronic	2.144	1.959	0.637	0.566	0.635	0.565
	(2.909)	(2.885)	(2.027)	(2.043)	(2.027)	(2.043)
Acute	2.713	2.547	0.382	0.292	0.388	0.297
	(2.588)	(2.610)	(2.104)	(2.163)	(2.104)	(2.164)
Number children ≤ 5Years	2.562	2.810	1.467	1.577	1.467	1.576
	(1.861)	(1.890)	(1.454)	(1.488)	(1.454)	(1.488)
Number children 6-18 years	0.381	0.362	-0.469	-0.457	-0.470	-0.457
	(0.677)	(0.678)	(0.493)	(0.490)	(0.493)	(0.490)
Urban residence	3.887	4.452	-0.399	0.001	-0.413	-0.011
	(5.037)	(5.155)	(3.529)	(3.507)	(3.531)	(3.510)
(Reference Agricultural Occupation)						
Occupation other	4.303	4.501	5.257	5.333	5.261	5.335
	(4.441)	(4.303)	(3.783)	(3.717)	(3.785)	(3.718)
Non-agricultural	8.794**	8.949**	9.366***	9.723***	9.364***	9.722***
	(4.028)	(4.036)	(3.254)	(3.227)	(3.254)	(3.226)
Constant	19.136***	19.203***	17.096***	18.099***	17.110***	18.110***
	(3.924)	(5.708)	(3.575)	(5.143)	(3.574)	(5.145)
N	139	139	200	200	200	200

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; Agemf[§] is (maleage-femaleage) Agefm is (femaleage-maleage)

Table 8.22: Couple labour supply, Male education share controlling for Severity of HIV/AIDS

	(1) CD4-count	(2) CD4-count	(3) WHO-stage	(4) WHO-stage
(Reference MOHPLWHA)				
TASOPLWHA	0.292		-1.584	
	(1.831)		(1.789)	
(Reference MOHWL)				
TASOART		0.899		-0.165
		(2.705)		(2.817)
TASOWL		1.348		-5.162
		(4.003)		(4.069)
MOHART		1.024		0.639
		(3.487)		(3.276)
Wage-original	3.02E-5	3.11E-5	1.98E-5	1.91E-5
	(0.000)	(0.000)	(0.000)	(0.000)
Male share of education	32.477	36.476	40.608	47.744
	(90.792)	(95.203)	(81.200)	(82.787)
(Male share of education)squared*log(stock wealth)	-1.448	-1.572	-1.516	-1.716
	(2.811)	(2.970)	(2.481)	(2.545)
(Female share of education)squared*log(stock wealth)	0.574	0.695	1.085	1.400
	(3.228)	(3.369)	(2.964)	(3.038)
CD4_worst	-3.02E-5	-7.51E-5		
	(0.006)	(0.006)		
WHO HIV-Stage			**-4.399*****	**-4.667*****
			(1.357)	(1.536)
Age*male	-0.068	-0.071	-0.081	-0.093
	(0.078)	(0.083)	(0.071)	(0.083)
Age^{2}*male	0.001	0.001	0.001	0.002
	(0.002)	(0.002)	(0.001)	(0.002)
Number children ≤ 5Years	2.353	2.388	2.396	2.751
	(1.994)	(2.058)	(1.732)	(1.842)
Number children 6-18 years	-0.100	-0.113	0.209	0.141
	(0.654)	(0.646)	(0.627)	(0.620)
Urban Residence	-1.735	-1.789	1.481	2.364
	(5.824)	(6.017)	(5.385)	(5.740)
Education years	-0.282	-0.250	-0.389	-0.364
	(0.593)	(0.615)	(0.548)	(0.590)
Education years squared	0.005	0.002	-0.001	0.001
	(0.045)	(0.047)	(0.041)	(0.045)
Chronic	2.587	2.567	1.908	1.787
	(3.212)	(3.205)	(2.868)	(2.793)
Acute	1.398	1.358	1.661	1.569
	(2.981)	(2.978)	(2.618)	(2.566)
(Reference Agricultural Occupation)				
Occupation Other	4.332	4.335	2.278	2.577
	(5.307)	(5.304)	(4.444)	(4.382)
Non-Agricultural occupation	10.634**	10.591**	9.506**	9.513**
	(4.571)	(4.498)	(4.043)	(4.028)

Male household head	5.112*	5.471*	3.902	2.917
	(2.727)	(2.810)	(2.834)	(2.572)
Constant	-7.263	-10.473	-2.174	-5.590
	(48.077)	(50.988)	(43.118)	(44.657)
N	127	127	137	137

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

8.8. Conclusion and Implications

This chapter investigates the association between PLWHA categories including ARTP with adult labour supply at the individual level, by males and females separately, and as a couple representing the household. The chapter contributes new knowledge by revealing the association of ARTP and labour supply for adults living in households with a PLWHA compared to non-PLWHA households. The chapter also adds to the bargaining power literature by refuting the unitary models assumptions and revealing that bargaining between a couple (as portrayed by male-female age difference) impacts on total household labour supply.

Generally, adults from PLWHA households supply less hours of labour compared to adults from non-PLWHA households. With the disaggregation of the PLWHA variable to TASOPLWHA and MOHPLWHA, TASOPLWHA adults are found to supply less labour compared to non-PLWHA, although this finding is insignificant. However, when severity is controlled for using CD4 cell count, TASOPLWHA are indicated to supply more labour hours.

The simple analysis of males and females is undertaken to further highlight individual labour supply decisions by adults. Gender analysis indicates that men from TASOPLWHA and TASOART households (also TASOWL) supply less labour compared to men from non-PLWHA households. This implies that men from households with a person living with HIV/AIDS that receive additional social support from TASO (in addition to ART and septrin) reduce their supply of labour compared to men from a household without a known PLWHA. This is contrary to expectations where such social support is intended to reduce the challenges that come with being HIV positive and aid consumption smoothing hence make such households allocate resources more effectively. The fact that social support is a disincentive to males in HIV affected households may be due to the fact that normally males are the breadwinners and are responsible for the survival of the household (Silberschmidt 2001; Silberschmidt 2005). As breadwinners, the males need to work hard and provide food for the household, provide children needs and the entire household family needs. Provision of such social support releases males from the pressure of being a breadwinner and hence the result may be a reduction in work in the form of reduced labour hours. This disincentive is not observed for MOH males that do not receive such social support. This is similar to disincentives associated with welfare in developed countries where welfare for the low income earners has been shown to reduce the motivation to work (Kodras 1986; Ong 1998; McIntyre 2011).

To test the possibility that the labour supplied is probably less because TASO males are sicker, severity of HIV/AIDS is controlled for; males from TASOART households still supplied 4.3 hours less than males from MOHWL households for the simple model, while female TASOPLWHA supplied 1.3 more hours of labour compared to MOHPLWHA. Further analysis still reveals female TASOPLWHA to supply more hours (1.7-2.3 hours more) of labour than female MOHPLWHA, while female TASOART also supplied more labour hours (2.3 to 3.3 hours more) compared to female MOHWL. The results further imply that unlike TASO males that tend to reduce labour hours as explained above, TASO females tend to increase labour hours supplied. This may be due to the fact that empowerment of women through the TASO social support program encourages labour participation for such women and hence benefit females by enabling them supply labour more efficiently.

Couple analysis further confirms the results above by revealing that a couple from a household that had a PLWHA receiving ART from TASO (TASOART) supplied 3 hours less per week compared to a couple from a household with a non-PLWHA. Bargaining further reveals that males are less likely to contribute to total household labour supply hours while females are more likely to contribute to total household labour supply hours. The model implies that despite the males' reduced labour supply (at the individual level), at the household level, it is likely that females contribute more to the total household labour, in order to absorb the reduction in labour hours' by the males in the household.

The collective model assumes the household comprises of two members only and excludes children. Children are known to contribute to household labour allocation as evidenced in Chapter Six of this thesis, and are therefore likely to reduce the male labour supply reduction in the household to maintain total labour supply. The couple analysis implies that bargaining power between a couple may affect individual labour supply that contributes to total household labour supply.

The empirical evidence also highlights the fact that the pooling of resources for couples does not occur, and hence rejects the unitary model assumptions, thereby supporting the collective model of resource allocation. This may imply that any generalisation of the response of household labour needs to consider the power dynamics between the genders in order to be effective. However, in formulating policy that pertains to resource allocation, it is possible that the variable type used (for bargaining among couples) may give different implications as portrayed by the difference in the bargaining power variables used.

Other factors that generally affect supply of labour include the type of occupation, wage, being widowed and urban residence. For all analyses that is individual, gender and couple analyses, being employed in a non-agricultural occupation compared to an agricultural related occupation leads to more labour hours supplied while the reverse is true for other occupations (for the individual and gender analysis). Also, adults residing in urban areas generally supply less hours of labour compared to adults from the rural areas. Importantly, for robustness of the model wage is positively related to labour supply. Gender analysis additionally reveals widowed males supply less hours of labour compared to married males.

As illustrated by the exclusion of children in the couple collective model, this study has limitations. The collective model assumes a household to comprise of two adult members but some households comprise of more than two adults and these most likely affect household labour decisions. For polygynous households, the implication would be decision making between three or more spouses and this cannot be modelled using the collective household model. Likewise, the analyses that controlled for the severity of HIV/AIDS are limited given that the identity of the individual that had HIV/AIDS is not explicit. Furthermore, there is possible bias due to TASO clients' self-selection into TASO given the perceived better services offered by TASO compared to MOH. This has been partly accounted by controlling for some of the attributes that are biased towards TASO clients including absence or presence of a chronic disease (to control for sickness), wealth, education status (TASO clients are more educated and better off), marital status and gender (given that most TASO clients are women and mostly widowed). However, results should be taken with caution given that the unobservable TASO treatment effects have not been explicitly accounted for in the analyses.

Regardless of the limitations mentioned above, this study reveals that social support provided in addition to treatment for a people living with HIV from TASO impacts male labour supply disincentivising their supply of labour compared to males from households without a known person living with HIV/AIDS or males from a household with a person living with HIV receiving septrin from MOH. This has implications for welfare policies in that policies may have unexpected outcomes that are at odds with the initial objective. In this case, a support program results in higher workloads for females, as they compensate for the lowered labour hours provided by the males in the household. Interestingly, women from TASOPLWHA households and TASOART households provide more labour hours which may imply that social support programs provided by TASO are alternatively empowering females and increasing their opportunities to participate in the labour market.

This chapter also suggests that blanket policies targeted at households to impact labour supply may not have the intended outcome if the differences in gender response to labour supply and gender bargaining power between couples are ignored. Policies need to take into consideration the role of gender in household labour supply decisions to have effective responses and outcomes.

Chapter 9 - Summary, Policy Implications and Further Research

This chapter summarises the primary findings of the thesis. It also highlights the lessons learnt from the 2010/2011 CUHS, further discusses the policy implications, indicates the limitations of the research, and outlines some areas for future research.

9.1. Summary of findings

The HIV/AIDS epidemic has led to profound changes especially in Sub-Saharan Africa (SSA) where the burden of the disease is greatest. The global community has been committed to the fight against HIV/AIDS as evident in the immense funds that have been spent on HIV/AIDS prevention and care. At the start of the AIDS epidemic, treatment was expensive and hence inaccessible to the poor from developing countries. However, with the development of cheap generics from January 1996 and the increased global commitment to the fight against HIV/AIDS, access to antiretroviral therapy (ART) for the poor became a reality. Nonetheless, despite the efforts of combating the disease, prevalence in the most affected countries is still high, especially in SSA. This thesis uses several datasets to investigate factors that are associated with HIV risk and the use of HIV services like Voluntary Counselling and Testing for HIV/AIDS. Results from this research are important in informing HIV prevention policy. Furthermore, the thesis explores children and adults resource allocation for households that have a person living with HIV/AIDS. The main interest was determining whether the nature of treatment for HIV/AIDS, termed as Antiretroviral Treatment Package (ARTP) has any effect on the allocation of household resources especially for PLWHA households.

9.1.1. Voluntary Counselling and Testing

The utilisation of VCT is still low (even with more recent data from the 2008/2009 KDHS). The results in Chapter 2, which analyses DHS data from the 2003 Kenya Demographic Health Survey, reveal that women residing in rural areas, who are poor, less educated and never married, are less likely to utilise VCT services. The majority of 'never married' women had been sexually active (only 17% had never been sexually active) hence are at greater risk of contracting HIV/AIDS.

9.1.2. Risk Factors for HIV/AIDS

Chapter 3 identifies the socio-economic and demographic factors that are associated with HIV/AIDS risk for women in Kenya and Uganda using DHS data from the 2003 Kenya Demographic and Health Survey and 2004 Uganda AIDS Indicator Survey. Contrary to the HIV/AIDS epidemic theory, which hypothesises that people of higher socio-economic status have a greater risk for HIV during the early stages of the epidemic, which translates to individuals of lower socio-economic status as the epidemic matures; the thesis reveals that women of higher socio-economic status are more vulnerable than women of low socio-economic status. This is despite the fact that the epidemic in the two countries has existed for three decades. That is, the wealthier, more educated, professional and urban resident women are more vulnerable to HIV/AIDS risk. Comparison of Kenya and Uganda reveals that the risk factors for HIV/AIDS for women in both countries are similar with the exception of women from Nyanza region having had the greatest risk of HIV/AIDS.

9.1.3. The 2010/2011 CUHS

This thesis makes a major contribution by availing a new dataset that explores antiretroviral treatment packages and resource allocation. Chapter 4 of this thesis outlines the 2010/2011 Centre for Health Economics Uganda HIV Survey (CUHS) that was undertaken in Central Uganda. The chapter elaborates on the survey design including the location and list of health centres covered. It also gives a description of the ART providers sampled for the survey.

Furthermore, the chapter mentions organisations involved in ethics approval and indicates the author's motivation for undertaking primary data collection.

9.1.4. ART and Additional Support

A major contribution of this thesis is providing empirical evidence of whether additional support in the form of social support from ART service providers to PLWHA makes a difference to outcomes of adult individuals residing in such households (Chapter Five). Here, both OLS and Probit models are used for the different outcomes investigated. TASO is an ART service provider that provides additional support in addition to ART while the MOH provides only ART.

- **Direct physical health outcomes:** A Probit equation is used to investigate the differences in occurrence of an acute disease (four weeks prior to the survey) and a chronic disease (occurred for a period of six months before the survey) for individuals in a household with a TASO PLWHA compared to MOH PLWHA household. The results suggested that individuals from TASO households are 6 percent more likely to have a chronic disease. There is no evidence of any differences in occurrence of an acute disease.

- **Indirect physical health outcomes:**
    - This is used as a proxy for productivity. For cash at hand, using multivariate approach, individuals from TASO households are more likely to have cash at hand than individuals from MOH households. There is no evidence of differences in having a savings account for individuals from TASO and MOH households.
    - Labour allocation: Adults from TASO households had more hours of non-wage labour (housework and own farm production) than individuals from MOH, an indication of higher levels of productivity than MOH households.

9.1.5. Children's Resource allocation

Child work for PLWHA Households. The thesis in Chapter 6 models participation of children in family and domestic work and the level of participation using a two-part model comparing children from PLWHA households and non-PLWHA households. Children from PLWHA households are more likely to participate in family farm work. This provides empirical evidence of the vulnerability of children from PLWHA households not only to paid work but to unpaid work within the household. The results also reveal that female children are more likely to participate in domestic work while male children are more likely to participate in farm work. Orphan children are more vulnerable to both farm and domestic work compared to non-orphans.

Enrolment in school increases the likelihood of participating in both farm work and domestic work but has a protective effect by reducing the number of hours spent on these activities. Having household savings reduces children's participation in domestic work while experiencing a shock increases children's vulnerability to domestic work hours. The thesis highlights the paradox of the relationship between child work and wealth with children from wealthy households more likely to participate in family farm work contrary to expectations.

Schooling outcomes, Formal Assistance and ARTP. The thesis in Chapter 7 contributes new knowledge on the association of formal assistance to schooling outcomes of children for both primary level and secondary level age residing in a household with a PLWHA. Formal assistance in the form of Home Based Care (HBC), Health Outreach (HOR) and Education Related Assistance (ERA) is explored. All formal assistance types have no effect on children's school enrolment rates and school participation. However, HBC, HOR and ERA lead to more schooling hours and HBC and ERA increase children's progression in school.

Furthermore, the effect of the nature of treatment in terms of Antiretroviral Treatment Packages (ARTP) on schooling outcomes is explored. ARTP in the form of receiving ART from TASO (which also provides additional support) termed TASOART, and ART from the MOH (without additional support) termed MOHART influences children's school enrolment with TASOART giving better enrolment rates. On the contrary, ARTP has no effect on children's schooling participation and school hours. Considering only enrolled children, only TASOART influences school progression, while all ARTP are associated with schooling progress when all children are considered whether enrolled or not. Children from a household with a PLWHA receiving TASOART, septrin from TASO (TASOWL) and MOHART have better school progression than a PLWHA receiving septrin from the MOH (MOHWL) with TASOART outcomes better than all other treatment types.

There is no evidence of ART-plus, which is receiving additional support from TASO in the form of TASOART and TASOWL, consistently giving better schooling outcomes. Only TASOART gives consistently better schooling outcomes. Nevertheless, the research reveals the fact that ART-plus in the same treatment type is superior to mere ART. TASOART gives consistently better outcomes than MOHART and TASOWL gives consistently better outcomes than MOHWL.

Finally, older children of secondary school age have the worst schooling outcomes compared to younger children of primary school age.

9.1.6. Adult Resource Allocation

The thesis provides new evidence of the relationship between labour supply for adults and the nature of treatment package - ARTP associated with the household. Males from households with a PLWHA from TASO (which provides social support in addition to treatment (ART or septrin) provide less hours of labour compared to males from non-PLWHA households or males from households with a PLWHA from MOH receiving septrin even when severity of HIV/AIDS is controlled for. This implies that receiving social support may be a disincentive for such males, whose burden of being a household's breadwinner is reduced by such social support. Couple analysis additionally reveals the male partner to contribute less to total household labour, while the female partner seems to contribute more to the total household labour suggesting that the identity of an individual affects household labour supply. This is similar to previous studies that have indicated women in SSA to engage more in labour activities than men (UNECA 2012). This confirms the rejection of the unitary household pooling assumption.

9.2. Lessons learned from this PhD research, namely, the Centre for Health Economics Uganda HIV Survey fieldwork/project

Ethics Application: The ethics approval process was arduous with multiple ethics approval applications filed at three different organisations in Australia and Uganda. Given the stigma associated with HIV, the research was ranked as a high risk research and stringent requirements including a face to face interview with the Monash Human Research Ethics committee was paramount to ensure the safety of the intended research participants. Additionally, obtaining letters of approval from TASO and the MOH took a while.

For non-government agencies like TASO, contacting the personnel responsible for research programmes a couple of months before ethics application is done is important in ensuring a quicker process in obtaining the ethics letter from the organisation. Most organisations have research committees and these need to have meetings to approve the proposal or amend it and hence all this needs to be taken into consideration in planning to apply for ethics. Some organisations demand that gifts or appreciation to their clients need to be taken into consideration and hence the research budget may need to account for such gifts.

Similar to many government agencies in low income countries, the process of obtaining ethics approval is slow due to bureaucracy or even backlog of projects that need to be approved. Ample time is needed before ethics for the project is put forth (at least 6 months) to ensure that the acceptance letter delay does not interfere with the project timeline.

Access to Clinic Records: For TASO, their record keeping system is computerised and is quite organised, hence, it is quite easy to locate the patient of interest using the patient number. However, there was a challenge in accessing this data because of power outages, internet surges and internet server related problems. Researchers need to plan for such challenges when planning the timeline of the research.

For MOH clinics, most of the clinic records were paper based and saved in patient files. Record keeping was quite poor, with patient entries, even within the same clinic differing. Additionally, most of the files were poorly kept, some lacking proper cabinets and some had no defined storing order, which made obtaining information needed so challenging. In one instance, for the team leader to obtain the required clinic information, he needed to compile a list comprising of 15 PLWHA from this particular clinic; it took the team leader and the clinic HIV councillor more than 4 hours to compile the list. This was because the filing system was unordered, so inconsistent and data recording was poor with missing information. The fact that the sun set while we were compiling the list and we had to use a phone torch as source of light for reading made matters worse and reminded us of the need to be prepared (with a torch no matter how the day light may deceive you), as the brownie's motto advises.

Surprisingly, none of the MOH clinics had operational computers and hence all data was paper based. There is potential to improve the way the clinic data is stored by investing in computers and encouraging storage of information in this way. Government and MOH can advocate for investing in non-paper data storage, and such storage of information can be harmonised in all MOH clinics which can make comparison of service delivery in all MOH clinics possible.

Networking: The TASO connection between the clients and service providers is excellent. TASO's development of Community Drug Distribution Points (CDDPs) framework is very good in connecting PLWHA at the grass roots and overcomes access issues to the distantly placed TASO centres. CDDPs bring ART services nearer to the people who desperately need them.

MOH on the other hand had a very weak network between the clients and service providers. The approach we used in accessing clients from the MOH was flexible in order to make use of all the resources available. In some instances, we worked with the clinic health personnel, in other cases, we worked with the PLWHA group and in some instances, we were assisted by individual PLWHA and this enabled us maximise the means of contacting the clients we were interested in interviewing for the survey.

Clinic data information: From the clinic level data collected, we discovered that two different approaches are used in diagnosis of HIV/AIDS. One approach is using the number of CD4 cell count, upon which individuals with a CD4 cell count of <=200 is started in ART; and the other is using the WHO HIV stage for diagnosis. For a majority of the clients, it would be desirable to take note of their CD4 cell count pre-ART initiation but this was not the case for some patients. A number of patients did not have their CD4 cell count recorded, probably because hardly of these clinics have the machinery necessary, but usually regional or district hospitals/clinics do exist where samples can be sent for this to be done. The challenge, though, is keeping samples in the absence of power. However, harmonising of the type of records collected at HIV diagnosis is important to enable comparison and evaluation of such projects. The MOH needs to formulate policy, which will ensure uniform collection of minimum data at HIV diagnosis, which will make tracking the progression of HIV across different patients and clinics possible.

Other important lessons:

Timing of season and roads: Before undertaking a survey, the time of season when the survey is being undertaken must be taken into account. During the rainy season, the seasonal roads are problematic and the transport planned to be used need to be able to traverse such pathetic roads. Some rural roads are so run down and difficult to travel-we had several cases of nails puncturing the car tyres and having a well-equipped tool box is handy given that service stations are hard to come by in the rural areas. Having a spare tyre or two is a must.

Data entry challenges: Power shortages made timely entry of data a challenge. The project time line must accommodate such delays and having a backup generator is helpful in instances where power outages are the norm.

Elections: The CUHS was undertaken at a time when the parliamentary and presidential campaigns were taking place. To reduce on the effect of the campaign on the survey coverage rate, we ensured that a timetable of the campaigns was obtained and our booking was in such a way that it avoided working in the same area on the same day as the campaign day. This ensured that respondents concentrated on the survey interview.

Engagement: The survey team ensured that it was engaged with leaders at all levels of the community; and working with the local community leaders at the grass root for MOH, other than the ART clinic nurses helped in averting stigma related to HIV. For TASO, engaging with the CDDP local leader was helpful and made connectivity between the researchers and clients very easy.

Incentives: The survey involved a wide range of stakeholders at different levels and all these needed to be compensated for the immense time they invested in the survey. For TASO, this comprised of the clinic officials that helped with compiling the lists of clients, the field workers and local community support agents. For the MOH, this included the PLWHA volunteers and clinic nurses. Providing incentives for the personnel involved made them committed to the survey and enhanced the survey operation and coverage. Additionally, given the intensity of the household survey questionnaire, the interviews required an average of at least 3 hours, hence significantly affecting the interviewee's day schedule. Accordingly, the interviewee's were compensated with a gift to compensate for their time.

9.3. Policy Implications

The multidimensional nature of HIV/AIDS makes policy formulation complex and challenging especially given resource constraints in developing countries like Uganda and Kenya. This thesis can inform policy by providing empirical evidence on HIV/AIDS prevention that incorporates the many facets of HIV/AIDS. The thesis can also inform policy in regard to the effect of HIV/AIDS care and how adults and children affected by HIV/AIDS may have better outcomes in household resource allocation given additional support despite the challenges of living with HIV/AIDS.

Access to services: Women from rural areas, who are poor and less educated have lower utilisation of VCT services. Policies that can improve access to services including introduction of mobile and door to door VCT can enhance utilisation. Increasing utilisation can also be improved by normalising of HIV testing through routine and diagnostic HIV testing which can fight stigma that discourages testing. Investing in the improvement of the often run-down rural facilities can improve utilisation of VCT services for women. Government policy that supports private providers can be helpful in bridging the gap due to public sector limitations.

High socio-economic status: The research concludes that higher socio-economic class is not a protective factor, hence HIV/AIDS prevention policies need not concentrate on the lower socio-economic class but should also include the better off women for HIV prevention policy targeting for both Uganda and Kenya. The Nyanza region had exceptional risk of HIV/AIDS and policies to discourage the inheritance of widows and encourage circumcision in this non-circumcising community are important for HIV prevention.

Additional support to ART: This research has found evidence that additional support leads to better wellbeing of household members and has the potential to improve productivity through increased labour hours. ART service providers should consider incorporating additional support to ART in order to maximise the benefits from ART. ART is necessary but not sufficient to ensure that results from ART are maximised given constraints faced by households with a PLWHA. Improving outcomes from additional support may require changing the current mode of delivery for example for income generating activities, it may be better to change focus from a group PLWHA to individual PLWHA household for better outcomes to be realised. Most additional support programs are short term hence the need to develop integrated HIV and livelihood programmes to ensure that benefits from additional support can be sustained for households impacted by HIV/AIDS.

Child work: This thesis reveals that enrolling children in school makes them less vulnerable to long working hours. Policies that encourage children to stay in school especially for older children need to be developed to protect such children from exploitative child work and inevitably child labour. Government needs to come up with policies that cushion households against shocks given that shocks make children vulnerable to longer working hours. Empowering communities to deal with shocks through community based saving schemes and use of social capital are initiatives that can reduce the impact of shock.

Formal Assistance: Formal assistance to PLWHA is limited. This research provides evidence that formal assistance in the form of home based care, health outreach and education related assistance influences children's schooling hours and progression. Government policies like conditional cash transfers to households with a PLWHA, conditional on children's schooling will be a great way of ensuring that children affected by HIV/AIDS stay in school and progress normally, which is important for human development investment and hence future economic growth.

Antiretroviral Treatment Package: ART provided by TASO gives better schooling outcomes than septrin provided by TASO, ART provided by MOH and septrin provided by

MOH. Encouraging provision of additional support to ART (ARTplus) for ART service providers will give better schooling outcomes compared to other treatment types. Also, ART is superior irrespective of whether additional support is included or not (TASOART and MOHART better than TASOWL and MOHWL) for school enrolment and progression. This has implications for ART initiation policy. This may imply that initiation of ART in Uganda may need to change from the current practise of ART initiation at $\leq$ 200cells/mm^3 to the WHO recommended of $\leq$ 350 cells/mm^3. As expected, the research confirms that additional support gives better outcomes within each treatment type. ART provided by TASO, which provides additional support gives better schooling outcomes than ART provided by the MOH which lacks additional support, while septrin by TASO (with additional support) generally gives better outcomes than septrin provided by the MOH (without additional support). This confirms that treatment for PLWHA is good but may need additional support to obtain better outcomes for PLWHA. Strategies to incorporate additional support to each treatment type are important to maximise PLWHA benefits from treatment.

Labour supply and ARTP: Social support programs to households with PLWHA have different impacts on male and female labour supply. Social support programs targeting households affected by HIV/AIDS may be effective in enhancing female labour participation but reduce labour supply by males in such households, and may have unintended consequences of increased labour demands for females in such households. The results from this thesis imply that social support policies to households affected by HIV/AIDS need to consider the differential impact of such programs on male and female labour supply and ensure that the incentives from greater labour supply outweigh the disincentives for labour supply so that such households can supply household labour in an efficient manner.

Labour supply and bargaining power among couples: The thesis indicates that the identity of the individual within a household matters in determining total household labour supply. This implies that blanket policies targeted at the household ‘black box’ to improve household labour may not be effective if such differences within the household are ignored.

Adoption of programs: The study reveals benefits to households in terms of schooling outcomes for children and better livelihood through having more cash and provision of non-wage labour hours for households associated with additional support programs implemented by TASO. Such programs are important in providing evidence based information in the effectiveness of interventions aimed at enhancing the lives of PLWHA and have the potential to justify adoption of such beneficial programs by government public programs. This is likely to enhance performance and delivery of services in public health facilities which is usually lacking in many developing countries like Uganda.

9.4. Limitations of Research and Potential Future Research

KDHS and Uganda AIS Data Issues. The data used in Chapters 2 and 3 is quite old and more recent data would have been better at estimating current utilisation rates for VCT and risk factors for HIV. The Kenya DHS has a new survey with HIV information (KDHS 2008) but Uganda is yet to obtain new data with individual HIV status information. Obtaining new data with individual HIV status will enable comparison of current HIV risk for Uganda and Kenya in the future. However, the study is a good indication of associations of SES and HIV risk. Cross sectional data used make it impossible to determine the temporal sequencing of the exposures in relation to HIV status.

Selection models indicated downward bias in the Kenya HIV sample; hence results are more useful in indicating the direction of associations. Also, participation bias is a challenge of the DHS surveys given absence and refusals between regions and countries but there is evidence that such surveys are adequate53 to provide reliable and useful results (Calleja *et al.* 2005).

CUHS Data. The data used are only from Central Uganda, which has relatively better HIV/AIDS services than the other regions in Uganda and hence, may not be representative on a national scale. Inclusion of other regions for future research can be undertaken to investigate the effect of ARTP further. Likewise, the study coverage encompasses only TASO and MOH as the AIDS service providers. Given the numerous agencies in HIV service provision in Uganda, especially Central Uganda, more research including other agencies would give a better picture of the effect of ARTP on household resource allocation for Uganda as a whole. Also, inclusion of major hospitals would have been desirable but this was

[53] For the KDHS, 2003, results indicated that those who were interviewed but not tested (refused or absent) had a lower HIV risk and probably a lower prevalence of HIV than those that consented and were tested. The predicted difference from the results of those tested was negligible Way, A. and Cross, A. (2003). Evaluating the impact of no response on the KDHS HIV prevalence estimates, Presented to Ministry of Health Surveillance Stakeholders Meeting; Nairobi, Kenya, November 2003.

impossible given that approval by MOH does not guarantee approval of research at the hospital. The research had a limited period and the major hospitals required initiation of ethics approval at the hospital level, and this was not possible given the project's tight programme. However, health centres are more locally based and have better coverage of the remotely placed rural population compared to the major hospitals that are mostly located in the major towns or cities

CUHS TASO compared to MOH. TASO as an ART service provider has made a reputation of having great experience in HIV care and treatment. As mentioned in Chapter Four, there may be endogenous treatment effects due to client's self-selection into TASO. The analyses have controlled for most of the observables that may have contributed to the endogenous treatment effect but have not been able to control for the unobservables like preference of TASO given the good reputation. These unobservables can lead to bias and hence results need to be interpreted with caution

Timing of ART and Additional Support. The benefits of ART have been indicated to be best captured during the early stages of ART initiation (Graff Zivin *et al.* 2009). However, the data collected information from PLWHA that had had initiation of ART from 6 months to 5 years given the limited number of people that had been on ART for just a few months. The effect of additional support can also be best explored at an early stage of obtaining that additional support but most of the TASO clients that were receiving additional support had been clients for two years and above. Future research can be undertaken in instances where a PLWHA is initiating ART and receiving additional support to best capture the influence of ARTP on household resource allocation for adults and children in PLWHA households.

Formal Assistance. The prevalence of formal assistance in the sample is small; but this was expected given the evidence of very limited formal assistance to families affected by HIV in SSA. Increased interest from organisations in assisting households affected by AIDS is needed to make such data available for future research. Similarly, the data used is cross sectional, which has limitations in capturing the accumulated effect of formal assistance on schooling outcomes overtime. It is hoped that in the future longitudinal type datasets like the Demographic Health Surveys (DHS) will incorporate formal assistance to make similar analyses more effective.

Labour supply. Labour supply was aggregated to include any type of economic activity irrespective of whether it was self-employment on the farm, off-farm self-employment, off-farm wage employment or on-farm wage employment. Disaggregation of labour supply would have given a better association of the labour supply to ARTP given that the different labour activities are quite different and may be affected differently by ARTP. However, given the limited data, disaggregation of labour supply by activity was not possible but this is an area that can be explored for future research.

Wages. Collection of data relating to earnings in Uganda is usually suspect, and respondents have a tendency to under report wages and income. Analysing the gender dimensions of labour supply that is affected by wages and earnings is not dependable given bias to under report and tendency of couples not to share income and earnings information. In the future, expenditure data may be a better alternative to analysing gender dimensions of resource allocation for households. Given that the survey sample size was small, expenditure could not be explored given that many households had one of the couple specialise in purchasing goods and services. However, with a larger survey, this may not be a problem and this can be explored in the future when such data becomes available.

9.5. Conclusion

In conclusion, this thesis provides new evidence of the benefits of social support in addition to ART in Uganda. The findings imply that providers of antiretroviral therapy in Sub-Saharan Africa, including Uganda, must consider incorporating additional support to services provided to People Living With HIV/AIDS to improve the well-being of individuals and households affected by HIV/AIDS. Additionally, the results have implications for policies relating to earlier initiation of ART for health care systems in Sub-Saharan Africa which usually delay ART initiation due to resource constraints. Given evidence of bargaining power within the household, it is essential for policies aimed at improving resource allocation within households in Sub-Saharan Africa to consider the power dynamics of the intended recipient in the household for the interventions to be effective. The thesis implies that the application of blanket policies to entire households in Sub-Saharan Africa may be ineffective within households, given bargaining power among household members.

The key findings of this thesis highlight the importance of social support for People Living With HIV/AIDS especially in the advent of antiretroviral therapy where more people are able to live with the disease much longer hence, face challenges relating to their well-being rather than survival. Given increasing access to antiretroviral therapy in Sub-Saharan Africa, aspects relating to how those infected with the virus will manage to live with the disease will increasingly be a challenge. This thesis provides evidence that the provision of social support to the individual or household with a person living with HIV/AIDS has the potential to assist in managing to live will the HIV/AIDS disease

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Appendix A - Appendix to Chapter 2

Table A.1: VCT multivariate analysis excluding wealth index

Variable	**Marginal effects**	**P value**
HIV positive	0.111	0.276
Age	0.0544*	0.046
Age squared	-9.860E-4*	0.026
Urban resident	**0.277*** **	**<0.001**
Education (Reference: no education)		
Primary	0.302*	0.021
Secondary	0.670***	<0.001
Higher	0.980***	<0.001
Male head	-0.185*	0.013
Household head age	0.00307	0.251
Religion (Reference: Muslim)		
Roman catholic	0.630***	<0.001
protestant/other Christian	0.585***	0.000
no religion	0.0859	0.788
Region dummies (Reference: Nairobi)		
Central	-0.0851	0.479
Coast	-0.234*	0.037
Eastern	-0.280	0.070
Nyanza	-0.457***	0.001
Rift valley	-0.354**	0.005
Western	-0.547***	<0.001
Marital status (Reference: never married)		
Married polygynously	0.275	0.056
Married monogamously	0.556***	<0.001
Widowed	0.581**	0.001
Separated or divorced	0.585***	<0.001
Constant	-2.928***	<0.001
Observations	3217	
R-squared	0.1139	
p-values*p<0.05	** p<0.01	*** p<0.001

Table A.2: VCT multivariate analysis excluding HIV status and age in years

Used VCT	Marginal effects	SE[a]	P-value
Current age	0.023	0.003	0.000***
Current age squared	-0.0004	0.00006	0.000***
Education (Reference group: No education)			
Primary	0.020	0.018	0.256
Secondary	0.084	0.019	0.000***
Higher	0.155	0.023	0.000***
Male head	-0.036	0.010	0.000***
Household head age	0.0007	0.0004	0.054*
Urban residence	0.043	0.014	0.002***
Wealth Index (Reference group: Poorest)			
Poorer	0.039	0.017	0.024**
Middle	0.067	0.017	0.000***
Richer	0.067	0.018	0.000***
Richest	0.081	0.020	0.000***
Religion (Reference group: Muslim)			
Roman Catholic	0.054	0.020	0.007***
Protestant/other Christians	0.045	0.019	0.021**
No religion	0.004	0.036	0.904
Other religion	0.044	0.065	0.498
Region of residence (Reference group: Nairobi)			
Central	-0.009	0.017	0.608
Coast	-0.076	0.019	0.000***
Eastern	-0.061	0.022	0.005***
Nyanza	-0.060	0.020	0.003***
Rift valley	-0.032	0.018	0.079*
Western	-0.084	0.019	0.000***
North Eastern	-0.226	0.050	0.000***
Marital Status (Reference group: Never married)			
Married Polygynously	0.060	0.019	0.001***
Married Monogamously	0.101	0.013	0.000***
Widowed	0.102	0.022	0.000***
Divorced/Separated	0.079	0.018	0.000***

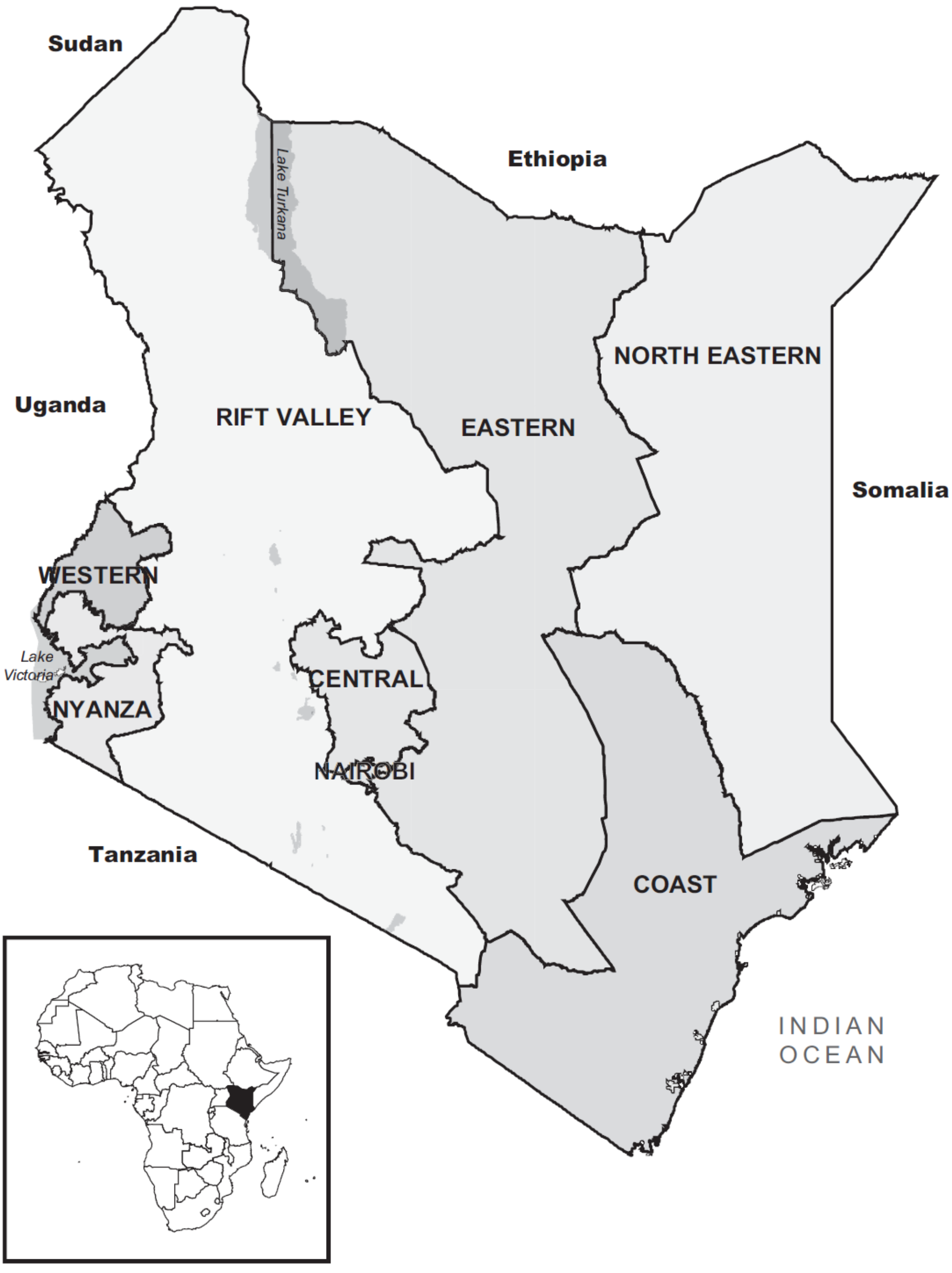
Wald chi2(27) = 553.63 N = 8040 Log pseudolikelihood = -3033.92

Pseudo R2 = 0.1206 Prob > chi2 = 0.000

*** Significant at 1%, ** Significant at 5%, * significant at 10%
SE[a] Unconditional standard error adjusted for 400 clusters

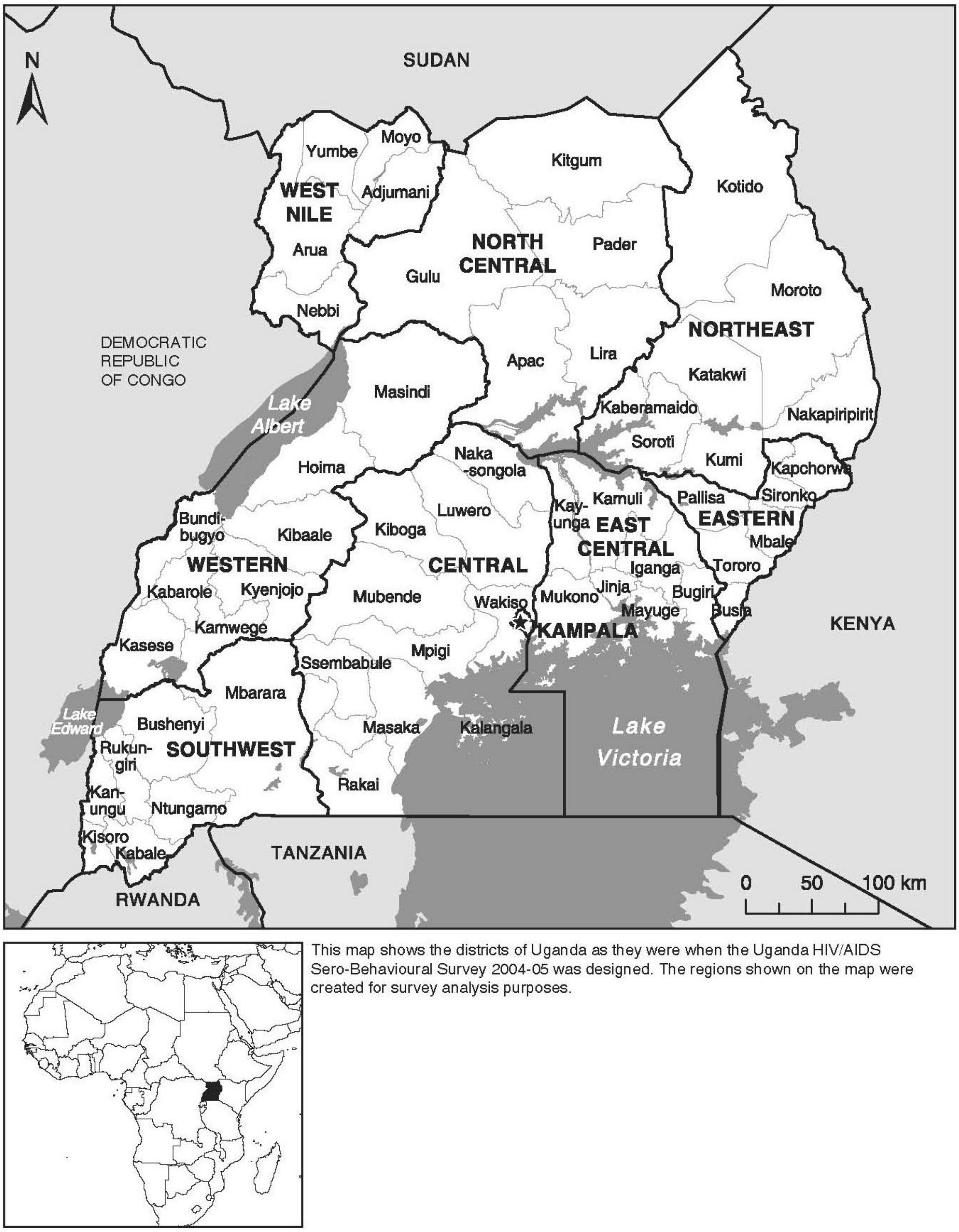
Appendix B - Appendix to Chapter 3

Figure B.1: Map of Kenya showing the different regions covered for the Kenya DHS-2003



Source: Kenya Demographic and Health Survey, 2003(CBS *et al.* 2004)

Figure B.2: Map of Uganda showing the different regions covered for the Uganda AIS-2004



Source: Uganda HIV/AIDS Sero-Behavioural Survey 2004-2005 (MOH and ORC Macro 2006)

Table B.1: Statistics relating to risky sex for women in Kenya and Uganda

Variable	Kenya	N=8 195	Uganda	N =10826	T-test value
Condom use first sex	12.6	8195	29.1	10826	12.67***
Condom use last sex	5.9	5678	8.7	7694	6.07***
Condom use risky sex	31.30	131	54	261	4.45***
Partner circumcised[a]	83.7	3363	24.9	8010	***
Mean age at first sex	16.9 (3.11)	6 429	16.5 (2.73)	9 413	9.40***

Partner circumcised[a]; Statistics obtained from CBS, MOH and ORC Macro (2004) and MOH and ORC Macro (2006). * ***, **, * significant at 1%, 5% and 10% respectively; values are mean (SD) or %. For mean, ttest assuming equal means; for proportions, chi squared test.

Table B.2: Selection model for KDHS HIV tested sample

Variable	Coefficient	Robust SE	P Value
HIV positive			
Age (Ref 15-19)			
20-24	0.117	0.064	0.068
25-29	0.201	0.081	0.013
30-34	0.141	0.074	0.058
35-39	0.104	0.071	0.141
40-45	0.035	0.071	0.625
46-50	-0.151	0.114	0.185
Male head	-0.031	0.034	0.354
Head age	-0.002	0.001	0.169
Urban	0.202	0.054	<0.001
Wealth Index (Ref. poorest)			
Poorer	0.088	0.075	0.242
Middle	0.113	0.081	0.162
Richer	0.175	0.099	0.078
Richest	0.211	0.104	0.042
Religion (Ref. Muslim)			
Roman Catholic	0.209	0.126	0.096
Protestant-Other	0.199	0.127	0.117
No religion	0.203	0.175	0.248
Region (Ref. Central)			
Nairobi	0.002	0.062	0.981
Coast	0.035	0.061	0.572
Eastern	0.030	0.051	0.561
Nyanza	0.222	0.099	0.025
Rift Valley	0.008	0.050	0.875
Western	0.023	0.056	0.685
Marital status (Ref. Never married)			
Currently married	0.100	0.063	0.111
Widowed	0.558	0.231	0.016
Divorced	0.270	0.119	0.024
Risk of AIDS (Ref. No risk)			
Small risk	0.029	0.056	0.609
Moderate risk	<0.001	0.071	0.999
Great risk	0.078	0.083	0.349
Constant	-0.516	0.464	0.266
Select			
Education attainment (No education)			
Primary	0.059	0.037	0.108
Secondary	-0.009	0.042	0.823

Higher	-0.062	0.057	0.274
Small risk	0.055	0.035	0.121
Moderate risk	0.093	0.042	0.026
Great risk	0.040	0.057	0.482
Urban		0.038	<0.001
HIV tested	0.021	0.031	0.502
Arthrho	1.996	0.604	0.001
Rho	-0.964	0.043	
Wald test of independence (rho=0):		Prob chi2 =0.001	
N = 8025 Wald chi2 (28) = 40.16			Prob chi2 =0.064

Appendix C - Appendix to Chapter 4

Appendix C.1 - Household Questionnaire

Appendix C.2 - Clinic Questionnaire

Appendix C.3 - Ethics Approval Letters

Monash Ethics letter

MONASH University

Monash University Human Research Ethics Committee (MUHREC)
Research Office

Human Ethics Certificate of Approval

Date:	**5 October 2010**
Project Number:	**CF10/1036 - 2010000543**
Project Title:	**Chronic disease treatment packages, intra-household resource allocation and quality of life**
Chief Investigator:	**Prof Bruce Hollingsworth**
Approved:	**From: 5 October 2010 to 5 October 2015**

Terms of approval

1. The Chief investigator is responsible for ensuring that permission letters are obtained, if relevant, and a copy forwarded to MUHREC before any data collection can occur at the specified organisation. **Failure to provide permission letters to MUHREC before data collection commences is in breach of the National Statement on Ethical Conduct in Human Research and the Australian Code for the Responsible Conduct of Research.**
2. Approval is only valid whilst you hold a position at Monash University.
3. It is the responsibility of the Chief Investigator to ensure that all investigators are aware of the terms of approval and to ensure the project is conducted as approved by MUHREC.
4. You should notify MUHREC immediately of any serious or unexpected adverse effects on participants or unforeseen events affecting the ethical acceptability of the project.
5. The Explanatory Statement must be on Monash University letterhead and the Monash University complaints clause must contain your project number.
6. **Amendments to the approved project (including changes in personnel):** Requires the submission of a Request for Amendment form to MUHREC and must not begin without written approval from MUHREC. Substantial variations may require a new application.
7. **Future correspondence:** Please quote the project number and project title above in any further correspondence.
8. **Annual reports:** Continued approval of this project is dependent on the submission of an Annual Report. This is determined by the date of your letter of approval.
9. **Final report:** A Final Report should be provided at the conclusion of the project. MUHREC should be notified if the project is discontinued before the expected date of completion.
10. **Monitoring:** Projects may be subject to an audit or any other form of monitoring by MUHREC at any time.
11. **Retention and storage of data:** The Chief Investigator is responsible for the storage and retention of original data pertaining to a project for a minimum period of five years.

[redacted]

Professor Ben Canny
Chair, MUHREC

Cc: Prof Brett Inder; Ms Julie Namazzi

Postal – Monash University, Vic 3800, Australia
Building 3E, Room 111, Clayton Campus, Wellington Road, Clayton
Telephone +61 3 9905 5490 Facsimile +61 3 9905 3831
Email muhrec@monash.edu.au http://www.monash.edu.au/researchoffice/human/
ABN 12 377 614 012 CRICOS Provider #00008C

TASO Ethics Letter

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TASO (U) Ltd.

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Fax: 0454 461 042

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WESTERN
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Fax: 0485 420 496
E-mail: tasowr@utlonline.co.ug

NORTHERN
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Tel: 0471 432 993

TRAINING CENTRE

TASO TRAINING CENTRE
Kanyanya, Off Gayaza Road
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P. O. Box 10443, Kampala
Tel: 0414 567 637
Fax: 0414 566 704
E-mail: tasodata@imul.com

12th August 2010

Prof. Bruce Hollingsworth
Center for Health Economics
Faculty of Business and Economics
Clayton Campus
Monash University, Australia

Dear Sir,

RE: PERMISSION TO CONDUCT RESEARCH IN TASO

Greetings from TASO Uganda!
Following review of your research proposal entitled **"Chronic Disease treatment packages, intra-household resource allocation and quality of life"**, the committee has granted you permission to go ahead and collect data at TASO. While at the TASO center, please ensure you observe the TASO values and not to interrupt the smooth flow of the service delivery.

It is a requirement by the institution that you submit a copy of your report findings after completion of your research and inform the institution whenever findings are to be presented in fora not agreed upon earlier by the two parties.

The institution may call upon you to make presentations of research findings in various fora.

Wishing you good luck.

Sincerely,

[redacted]

Mr. Mwesigwa Robert
Chairman, TASO Institutional Review Committee (IRC)

UNCST Ethics letter

Uganda National Council For Science and Technology

(Established by Act of Parliament of the Republic of Uganda)

UNCST

Your ref: ....

HS 821

Our ref: ....

Date : 25/08/2010

Prof. Bruce Hollingsworth
International Food Policy Research Institute
Plot 15, East Naguru Road
P.O Box 28565
Kampala

Dear Prof. Hollingsworth,

RE: RESEARCH PROJECT, "CHRONIC DISEASE TREATMENT PACKAGES, INTRA HOUSEHOLD RESOURCE ALLOCATION AND QUALITY OF LIFE"

The above research project was reviewed and approved by the Uganda National Council for Science and Technology (UNCST) on August 16, 2010. Clearance to study districts is still being processed by the Research Secretariat Office of The President. However given the limited timeline for the PhD research, we are granting Ms. Julie A. Namazzi a provisional approval to begin with the pre-testing and research arrangement.

Once we have obtained feedback from the Research Secretariat, Office of the President, we shall then issue you with formal approval letter and research identity cards for the entire team.

Yours sincerely,

[redacted]

Jane Nabbuto
for: Executive Secretary
UGANDA NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY

LOCATION / CORRESPONDENCE
Plot 3/5/7, Nasser Road
P.O. Box 6884
Kampala, Uganda

COMMUNICATION
TEL: (256) 414-250 499, (256) 414 705 500
FAX: (256)414-234 579
EMAIL: uncst@starcom.co.ug
WEBSITE: http://www.uncst.go.ug

MOH Ethics Approval

TELEPHONE: General office
340874/231563/9
PS's office: 340872
TELEFAX: 231584
TELEX: 61372 HEALTH UGA.

In ANY CORRESPONDENCE ON
THIS SUBJECT PLEASE QUOTE NO.
ADM. 130/313/05

THE REPUBLIC OF UGANDA

MINISTRY OF HEALTH
P.O. Box 7272
KAMPALA
UGANDA

29 September 2010

Professor Bruce Hollingsworth
Centre for Health Economics
Monash University
Clayton, Victoria 3800
AUSTRALIA

RESEARCH PROJECT PROPOSAL ENTITLED "CHRONIC DISEASE TREATMENT PACKAGES, INTRA HOUSEHOLD RESOURCE ALLOCATION AND QUALITY OF LIFE AT HIV/AIDS CLINICS IN UGANDA

Thank you for your letter dated 28 June 2010 requesting to be granted permission to conduct the above stated study in Chronic AIDS Care/ART facilities in Central Uganda. We have reviewed the protocol, and note that the study is exploring an important aspect of Chronic AIDS Care and Treatment. This study is pertinent given that we have different implementing partners of ART services in the country, that are based on slightly different models of ART service delivery. The study has the potential of informing discussions on the future direction of ART service delivery in the country.

We have noted that you have already obtained clearance from the Uganda National Council of Science and Technology as well as ethical clearance from Institutional Review Committee of TASO. However, we have not seen the ethical clearance from Monash University. We would like to request that you provide a copy of that clearance.

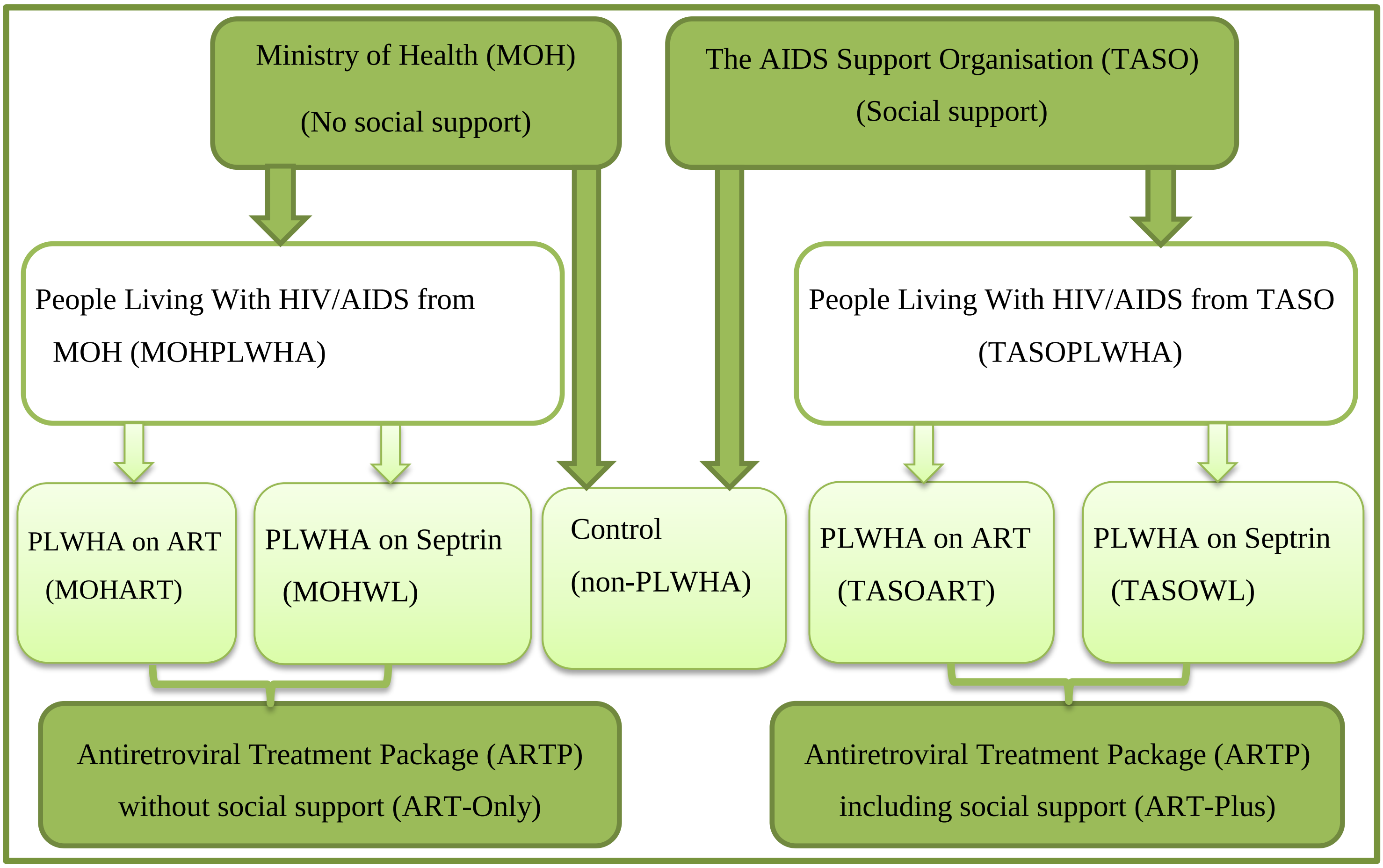
In the meantime, the Ministry is delighted to grant permission to you to conduct the study. We would like to advise that as a collaborative study involving the Ministry, you need to work closely with the STD/AIDS Control Programme and preferably have a member of the Ministry on the investigating team. Furthermore, we would like to request you to provide regular progress reports to the Ministry and share with us of the results of this study.

Thank you. [redacted]

Dr Nathan Kenya-Mugisha ,
For: DIRECTOR GENERAL HEALTH SERVICES

Copy to: Dr Zainab Akol, Programme Manager, STD/AIDS Control

Figure C.1: Centre for Health Economics Uganda HIV Survey Sampling Framework



Appendix D - Appendix to Chapter 6

Table D.1: Heckman selection model for farm work and domestic work

	Farm hours		Domestic work hours	
Variable	**Coefficient**	**Robust SE**	**Coefficient**	**Robust SE**
PLWHA	0.718	0.695	0.781	0.690
age6_9	-0.931	3.102	2.003*	0.967
age10_12	0.724	2.93	4.385***	1.027
age13_16	0.961	2.74	4.598***	1.057
age17_18	2.516	3.04	6.482***	1.419
Girl child	0.029	0.650	0.917*	0.437
Enrolled in School	-8.511***	1.80	-5.347***	1.299
Chronic disease	-1.275*	0.561	-1.540**	0.504
Orphan	-0.600	0.703	-0.219	0.570
Mother resident	0.834	0.655	-0.685	0.536
Head agricultural	0.200	1.042	-3.420*	1.538
Head non-agricultural	2.073	1.160	-1.427	1.559
Head Primary educ	-0.396	0.854	1.057	0.673
Head secondary+	-1.749	1.147	1.176	1.498
Number adult males	0.111	0.531		
High wealth	1.277	1.439	-0.660	0.797
Average wealth	-0.220	1.334	-0.788	0.734
Savings	-0.654	0.891	-1.292	0.702
Loan	0.458	0.911	0.0765	0.691
Experienced shock	1.878	1.031	3.534***	0.767
Own land	0.053	0.829	-0.378	0.636
Urban residence	0.931	1.206	-1.001	0.783
Head Catholic	2.337*	1.1667	-1.366	1.135
Head Anglican	0.820	1.089	-1.436	1.168
Head Muslim	3.361	1.764	-0.922	1.214
Domestic participation	-5.347***	1.338		
Number adult females			-0.840*	0.390
Farm work participation			1.525**	0.540
Constant	12.31**	4.528	11.61***	2.838
Select				
PLWHA	0.340*	0.134	0.0203	0.123
age6_9	1.183***	0.189	1.301***	0.155
age10_12	1.792***	0.190	1.977***	0.182
age13_16	1.681***	0.191	1.632***	0.174
age17_18	1.626***	0.219	1.392***	0.204
Girl child	-0.131	0.085	0.120	0.100
Enrolled in School	0.290*	0.145	0.378**	0.138
Chronic disease	0.205	0.111	0.137	0.124
Orphan	0.228	0.126	0.159	0.135
Mother resident	-0.068	0.113	-0.0840	0.121

Age of head	0.010	0.006	0.00811	0.006
Head separated	-0.022	0.183	0.0770	0.170
Head widowed	-0.070	0.168	0.0563	0.150
Head agricultural	0.807**	0.313	-0.590*	0.292
Head non-agricultural	0.647*	0.324	-0.691*	0.299
Head primary	-0.203	0.118	-0.200	0.114
Head secondary+	0.376	0.259	0.359	0.352
Number of adults	0.071	0.097		
Number adult males	-0.104	0.137		
Wealth high	0.655***	0.164	0.128	0.155
Wealth middle	0.630***	0.162	0.151	0.162
Savings	0.162	0.127	-0.415**	0.131
Loan	-0.042	0.129	0.174	0.137
Experienced shock	0.106	0.162	-0.0352	0.162
Own land	0.327*	0.127	-0.0423	0.125
Urban residence	-0.319	0.175	0.380*	0.180
Head Catholic	0.327	0.211	0.519*	0.251
Head Anglican	0.422	0.237	0.685**	0.264
Head Muslim	0.374	0.237	0.511	0.266
Number adult females			-0.0473	0.081
Constant	-4.168***	0.546	-1.002	0.519
Athrho	-0.030	0.111	0.0107	0.088
Lnsigma	1.857***	0.114	1.864***	0.035
Wald test of indep. Eqns. (rho=0): prob >chi2=0.7855			prob >chi2=0.9031	
N	1296		1296	

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table D.2: Two-Part Model for farm work including older girls

	Probit		OLS	
	Farm Participation	**Robust SE**	**Farm hours**	**Robust SE**
PLWHA	0.111**	0.038	0.599	0.751
girlage6_9	0.293***	0.085	1.816	1.556
girlage10_12	0.410***	0.084	2.646*	1.186
girlage13_16	0.462***	0.084	3.260**	1.074
girlage17_18	0.385***	0.104	5.175*	2.343
Girl child	-0.418***	0.079	-2.990**	1.112
Enrolled in school	0.086*	0.037	-8.859***	1.844
Chronic disease	0.054	0.031	-1.353*	0.592
Orphan	0.074*	0.034	0.095	0.740
Mother resident	-0.007	0.031	0.637	0.688
Male household head	0.119	0.095	-0.665	0.969
Age household head	0.004*	0.002	-0.030	0.027
Head separated	0.076	0.098	-0.448	1.832
Head widowed	0.079	0.098	-1.643	1.199
Head agricultural	0.266**	0.085	-0.345	1.163
Head nonagricultural	0.239**	0.088	1.201	1.355
Head primary	-0.036	0.033	-0.521	0.937
Head secondary+	0.082	0.066	-0.973	1.009
Number adult males	-0.025	0.021	0.187	0.567
High wealth	0.167***	0.044	1.666	1.592
Average wealth	0.169***	0.041	-0.145	1.392
Savings	0.095**	0.036	-0.722	0.937
Loan	-0.025	0.036	0.521	0.926
Experienced shock	0.014	0.045	1.812	1.073
Own land	0.096**	0.035	-0.061	0.883
Urban residence	-0.124*	0.477	1.232	1.303
Head Catholic	-0.009	0.045	-1.259	1.853
Head Anglican	-0.001	0.058	-2.822	1.893
Head other Christians	-0.083	0.062	-3.799*	1.923
Domestic participation	0.431***	0.034	-5.071**	1.556
Constant	-4.303***		19.47***	4.092
N	1296		640	

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table D.3: Two-Part Model including PLWHA enrolled in school

	Farm Particip'n	Robust SE	Farm Hours	Robust SE	Domestic Particip'n	Robust SE	Domestic Hours	Robust SE
PLWHA	0.084	0.097	-3.769	3.781	<0.001	0.050	-0.327	3.001
age6_12	0.284***	0.060	0.840	2.524	0.229***	0.026	3.174***	0.913
age13_18	0.347***	0.061	2.153	2.334	0.218***	0.032	4.809***	0.995
Girl Child	-0.053*	0.025	-0.078	0.625	0.040*	0.020	0.756	0.445
Enrolled in School	0.052	0.099	-12.62***	3.239	0.073	0.052	-6.611*	2.595
PLWHA enrolled school	0.029	0.107	4.741	3.804	-0.015	0.057	1.339	2.958
Chronic disease	0.049	0.031	-1.400*	0.603	0.004	0.025	-1.630**	0.520
Orphan	0.078*	0.035	0.132	0.746	0.020	0.026	0.447	0.666
Mother resident	-0.019	0.032	0.158	0.714	-0.024	0.024	-0.459	0.553
Male head	0.114	0.086	-1.094	1.096	-0.059	0.041	0.721	1.152
Head age	0.003	0.002	-0.052	0.031	0.001	0.001	0.057	0.034
Head separated	0.073	0.091	-1.007	1.923	-0.030	0.049	0.850	1.259
Head widowed	0.050	0.088	-2.807	1.598	-0.030	0.039	-0.511	1.176
Head Agricultural	0.266**	0.084	-0.304	1.260	-0.154**	0.056	-2.957	1.522
Head nonagricultural	0.232**	0.087	1.075	1.297	-0.158**	0.057	-0.917	1.550
Head primary	-0.043	0.033	-0.694	0.966	-0.031	0.023	1.316	0.705
Head secondary+	0.074	0.069	-1.386	1.194	0.033	0.068	1.160	1.627
Number of adults	0.024	0.024	1.178	0.756	-0.015	0.012	-0.782*	0.355
Number adult males	-0.055	0.036	-1.098	1.004	0.029	0.018	0.178	0.577
High Wealth	0.186***	0.047	2.250	1.893	-0.012	0.032	-0.961	0.843
Average Wealth	0.183***	0.043	0.520	1.601	0.004	0.032	-1.124	0.785
Savings	0.091*	0.036	-0.650	0.893	-0.101***	0.026	-1.224	0.698
Loan	-0.027	0.036	0.544	0.950	0.035	0.028	0.248	0.714
Experienced shock	0.017	0.046	1.886	1.033	-0.008	0.032	3.118***	0.808
Own Land	0.099**	0.036			-0.028	0.025		
Urban residence	-0.125**	0.047	0.838	1.451	0.094**	0.035	-0.883	0.802
Head Catholic	-0.004	0.046	-0.883	1.616	0.009	0.028	-0.118	0.794
Head Anglican	0.004	0.057	-2.585	1.778	0.040	0.036	-0.221	0.888
Head other Christians	-0.071	0.061	-3.737	1.937	-0.059	0.049	1.147	1.246
Domestic Participation	0.398***	0.035	-4.654***	1.245				
Farm Participation					0.239***	0.023	1.718**	0.551
Constant	-5.117***		20.62***	5.531	0.181		8.621*	3.629
N	1296		640		1296		1033	

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ Prticip'n is participation

Appendix E - Appendix to Chapter 8

Appendix E.1 - Stock of wealth variable (SW)

The SW variable was developed from consumer durables and assets owned by individuals in each household. The household questionnaire indicated the total number of items owned in the household and the owner personal identification number (PID) for each consumer durable or productive asset owned in the household. Also, the current value of the items was also recorded.

For each item, the maximum number of people identified as the owners was three given questionnaire space constraints. This included three people in the household that had the highest number of the asset or consumer durable of interest.

Using the PID count, the number of people that owned the asset per household was obtained (pidnumber). The value of asset per household member was obtained by dividing the current value of the asset by the number of people that owned that asset in the household, giving the asset value per household member (nlypphhd). Financial assets were collected at the household level and were not included in the calculation of individual or household stock of wealth.

The questionnaire consumer durables and productive assets page does not include the household member names but only the PID of each member that owned an asset. To link the PID to the corresponding name of the household member, the asset ownership page was linked to the demographics page in stata using the household identification number (hhdid) and individual line which comprises of the hhdid and PID. The data was saved and exported to excel where the final summation of each household member's stock of wealth was calculated.

Within excel, the names of the members of each household, individual PID (hhdpid) and the asset listing were in long data format but the PID that correspond to each asset owned were in the wide data format (ownerpid1, ownerpid2, ownerpid3) (See example of one household in Table E.1). The total stock of wealth for each individual in a household is a summation of the value of all assets owned. For each individual whose PID is associated with a given asset, the stock of wealth per person in the household (nlypphhd) for each asset is summed up to give the total value of stock of wealth (SW). All household members' SW was summed up to give the total household stock of wealth (HSW).

For excel extract for example; Kaggwa Deo is PID=1 and owns all items listed (Hoe, mortar, axe, house, bicycle, telephone, side board, tables, land owned, radio, chairs, panga and mosquito net) and the stock of wealth is obtained by summing up all the nlypphhd value for each asset type to give UGX 2,167,500 for Kaggwa Deo; UGX 1,933,333.34 for Nalubega Harriet (PID=2); UGX 33,333.34 for Nanfuka Pross (PID=3); UGX 5,666.67 for Kalungi Vincent (PID=4); UGX 60,666.67 for Kayiza Callist (PID=5) and; UGX 0 for Kalule John (PID=13).

Table E.1: Example of excel spread sheet used in calculation of stock of wealth per person in a household using assets and durables information

hhdid	headname	hhdpid	Owner name	ASSETINCOMEPP	itemname	itemnumb	Owner pid1	Owner pid2	hhdpidstr2	ownerpid3	hhdpidstr3	curval1item	pidnumber	nlyassets	nlypphhd
201,210.00	KAGGWA DEO	1.00	KAGGWA DEO	2,167,500.00	HOE	15.00	1.00	2.00	2.00	3.00	3.00	80,000.00	3.00	80,000.00	26,666.67
201,210.00	KAGGWA DEO	1.00	KAGGWA DEO		MORTAR	1.00	1.00	-9.00	-9.00	-9.00	-9.00	500.00	1.00	500.00	500.00
201,210.00	KAGGWA DEO	1.00	KAGGWA DEO		AXE	1.00	1.00	-9.00	-9.00	-9.00	-9.00	3,000.00	1.00	3,000.00	3,000.00
201,210.00	KAGGWA DEO	1.00	KAGGWA DEO		HOUSE	2.00	1.00	2.00	2.00	-9.00	-9.00	2,000,000.00	2.00	2,000,000.00	1,000,000.00
201,210.00	KAGGWA DEO	1.00	KAGGWA DEO		BICYCLE	1.00	1.00	-9.00	-9.00	-9.00	-9.00	50,000.00	1.00	50,000.00	50,000.00
201,210.00	KAGGWA DEO	1.00	KAGGWA DEO		TELEPHONE	4.00	1.00	4.00	4.00	5.00	5.00	180,000.00	3.00	180,000.00	60,000.00
201,210.00	KAGGWA DEO	1.00	KAGGWA DEO		SIDE BOARD	1.00	1.00	-9.00	-9.00	-9.00	-9.00	40,000.00	1.00	40,000.00	40,000.00
201,210.00	KAGGWA DEO	1.00	KAGGWA DEO		TABLES	2.00	1.00	-9.00	-9.00	-9.00	-9.00	30,000.00	1.00	30,000.00	30,000.00
201,210.00	KAGGWA DEO	1.00	KAGGWA DEO		LAND OWNED	2.00	1.00	2.00	2.00	-9.00	-9.00	1,800,000.00	2.00	1,800,000.00	900,000.00
201,210.00	KAGGWA DEO	1.00	KAGGWA DEO		RADIO	2.00	1.00	4.00	4.00	-9.00	-9.00	10,000.00	2.00	10,000.00	5,000.00
201,210.00	KAGGWA DEO	1.00	KAGGWA DEO		CHAIRS	1.00	1.00	-9.00	-9.00	-9.00	-9.00	45,000.00	1.00	45,000.00	45,000.00
201,210.00	KAGGWA DEO	1.00	KAGGWA DEO		PANGA	3.00	1.00	4.00	4.00	5.00	5.00	2,000.00	3.00	2,000.00	666.67
201,210.00	KAGGWA DEO	1.00	KAGGWA DEO		MOSQUITO NET	4.00	1.00	2.00	2.00	3.00	3.00	20,000.00	3.00	20,000.00	6,666.67
201,210.00	KAGGWA DEO	2.00	NALUBEGA HARRIET	1,933,333.34											
201,210.00	KAGGWA DEO	3.00	NANFUKA PROSS	33,333.34											
201,210.00	KAGGWA DEO	4.00	KALUNGI VICENT	5,666.67											
201,210.00	KAGGWA DEO	5.00	KAYIZA CALLIST	60,666.67											
201,210.00	KAGGWA DEO	13.00	KALULE JOHN	0.00											
201,210.00	KAGGWA DEO														
201,210.00	KAGGWA DEO				CASH AT HAND	-9.00	-9.00	-9.00	-9.00	-9.00	-9.00	-9.00	0.00		

Appendix E.2 - Generation of the weekly wage

The questionnaire collected information on the duration worked for the last 12 months. Given the last 12 months, the respondents indicated on average, how many months they had worked out of the 12 months, and for each month, how many weeks they had worked on average, and within a week, they indicated how many days they worked on average and how many hours they had worked per day on average. The information in each section was used to impute the total amount of hours worked in a year. This was later divided by 52 (the number of weeks in a year) to give the hours worked per week.

Additionally, information was obtained regarding the amount of income obtained for the work done. The income received per duration included amount paid per:

- hour
- day
- week
- month
- piece work
- season
- year

All payment rates were converted to a yearly payment to give the amount of Uganda Shillings earned per year. This was divided by 52 to give the amount earned by each individual per week. Linking the work duration information, the earnings information and question on whether an individual had worked or not, the total number of wage observations was 690/1054, meaning 364 were missing. Data relating to economic activities had 1187 observations (where 1054 indicated to be economically involved, 125 not involved and 8 were missing). Some details of the calculated original wage are indicated in the table below.

Table E.2: Descriptive characteristics of some important variables (Mean (SD) or %) by non-missing wage and missing wage

Variable	Wage non-missing (N=690)	Wage missing (N=364)
Hours per week	8.34*** (6.61)	6.15*** (6.08)
Age in years	39.19* (12.41)	37.13* (14.14)
Number of children<=5 years	0.98 (1.04)	1.01 (1.03)
Number of children 6-18 years	2.59 (2.04)	2.53 (1.99)
No Working	2.03** (0.96)	2.24** (0.95)
Stock of wealth (UGX)	4,738,854	3,517,088
Urban	25.80*	20.11*
Female	66.09**	59.07**
Les primo	55.80	54.95
Primary+	44.20	45.05
Head male	52.46	55.49
Acute	31.30	33.06
Chronic	46.67***	28.85***
Marital Status		
Married	45.51	50
Single	13.91***	22.38***
Divorced	14.06	12.71
Widowed	26.52***	14.92***
Occupation type		
Agricultural occupation	54.73**	63.09**
Non-Agricultural occupation	39.30***	26.17***
Other Occupation	5.97**	10.74**
ART provider		
TASO	53.63	53.09
MOH	46.37	46.91
ARTP		
TASO ART	26.81	30.02
TASO WL	13.91	10.19
MOH ART	21.30	22.59
MOH WL	13.91	12.95
PLWHA		
MOH PLWHA	35.22	35.54
TASO PLWHA	40.72	40.22
PLWHA	75.94	75.75
NON-PLWHA	24.06	24.24

***, **, * implies that the difference in means is significantly different at 1%, 5% and 10% respectively. For mean, ttest assuming equal means; for proportions, chi squared test.

Appendix E.3 - Wage imputation of missing wage

Nearest neighbour regression matching (also referred to as predictive mean matching) used to impute wage-MM

The general equation used in the estimation of missing wage values in outlined below.
original_wage = f (age, years of education, occupation type, number of household members working, marital status, gender (male), urban, number of children under 5 years, number of children 6-18 years), cluster (hhdid) (model E.1)

From model E.1, the estimated wage was predicted (wagehat)

Given the estimated wage (wagehat), means were obtained by:

- Years of education (wagehat_edyrs) for all individual years from 0-18 years of education.
- Gender (wagehat_gender for male or female)
- Occupation type (wagehat_occup for other-occupation, agricultural and non-agricultural)

The estimated missing wage values (wagehat) were sorted by the different categories; for example, education years were sorted and the mean in each year of education obtained. For example wagehat mean for years of education =1 was obtained and this was used to replace all missing wages that had one year of education. Means corresponding to all the individual years of education were calculated and used to replace the missing wage values given the education years.

Similarly, the means for the estimated wage (wagehat) given gender and occupation types were developed and these were used to replace the corresponding missing wage value in each corresponding category.

Finally, the wage averages over the three categories (years of education, gender and occupation type) were summed up and these were averaged over the classes to give the final estimated wage for all missing wage values for all individuals that were economically involved (wage_meantot). For the non-missing wages, the original wage values were used for this imputed wage.

Using donor observations (hot deck method), used to impute wage-HD

The donor wage (wagedonor) was sorted by education years, gender and occupation types. For each category, the mean in each level was calculated and used to replace the missing wage in that category. For example, for education (wagedonor_edyrs), the mean was calculated for all individual wage years (0-18 years) and this replaced the missing wage in each level of education years.

For each individual, the sum over the categories (wagedonor_sum) was generated by obtaining the row total of the three category means (rowtotal(wagedonor_edyrs wagedonor_gender wagedonor_occup) and; the average over these categories was developed to give the imputed wage (wagedonor_meantot) for all that were economically involved but with missing original wage. For non-missing wages, the original wage value is used.

Appendix E.4 - Quantile Regression and OLS

Table E.41: OLS and Quantile regression: Individual labour supply – PLWHA

	OLS	Q10	Q25	Q50	Q75	Q95
(Reference Non-PLWHA)						
PLWHA	0.114	-0.138	0.138	0.377	0.205	0.325
	(0.506)	(0.316)	(0.255)	(0.300)	(0.517)	(1.982)
Wage-Original	9.1E-6**	8.9E-6	7.7E-6	2.4E-5	1.9E-5	5.5E-5
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Age	0.053	-0.003	0.033	0.046	0.150	-0.079
	(0.099)	(0.054)	(0.060)	(0.071)	(0.113)	(0.335)
Age squared	-0.001	0.000	-0.000	-0.001	-0.002	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)
Number children ≤5 years	-0.082	-0.083	-0.020	-0.188	-0.187	-0.368
	(0.255)	(0.123)	(0.133)	(0.131)	(0.205)	(0.722)
Number children 6-18 years	0.013	0.071	0.032	0.113*	0.087	0.045
	(0.116)	(0.065)	(0.067)	(0.065)	(0.120)	(0.315)
Urban Residence	-0.138	-0.575*	-0.079	0.052	0.542	0.724
	(0.610)	(0.305)	(0.360)	(0.375)	(0.845)	(1.768)
Male	0.673	0.092	-0.044	0.077	0.229	2.762
	(0.627)	(0.319)	(0.215)	(0.280)	(0.531)	(2.061)
Education years	-0.024	0.057	0.002	-0.046	-0.071	0.509
	(0.142)	(0.076)	(0.078)	(0.095)	(0.148)	(0.390)
Education years squared	-0.008	-0.007	-0.000	0.002	-0.004	**-0.048****
	(0.008)	(0.005)	(0.004)	(0.005)	(0.008)	(0.023)
Log (Stock of wealth)	0.021	0.049	0.005	-0.002	-0.020	0.069
	(0.065)	(0.033)	(0.027)	(0.032)	(0.055)	(0.190)
Chronic	-0.380	-0.258	-0.058	-0.261	-0.368	-1.227
	(0.475)	(0.305)	(0.276)	(0.325)	(0.490)	(1.421)
Acute	-0.244	0.088	-0.026	-0.104	-0.282	-2.204
	(0.512)	(0.339)	(0.276)	(0.331)	(0.542)	(1.449)
(Reference Married)						
Single	-1.263	-0.042	0.012	-0.810	-1.378	-0.964
	(1.135)	(0.524)	(0.494)	(0.630)	(0.985)	(3.747)
Divorced	-0.327	-0.550	-0.382	0.037	-0.862	0.177
	(0.880)	(0.483)	(0.499)	(0.597)	(0.985)	(2.678)
Widowed	-0.511	-0.105	-0.002	-0.305	**-1.284***	1.161
	(0.751)	(0.462)	(0.458)	(0.468)	(0.766)	(2.118)
(Reference Agricultural Occupation)						
Other occupation	-2.541***	-1.392***	-3.398***	-4.506***	-4.264***	-0.485
	(0.824)	(0.316)	(0.446)	(0.539)	(0.920)	(2.999)
Non-agricultural occupation	4.962***	1.023***	1.203*	3.900***	8.080***	8.451***
	(0.624)	(0.384)	(0.660)	(0.741)	(0.895)	(1.734)
Male household head	-0.215	-0.175	0.043	-0.015	-0.551	-1.285
	(0.642)	(0.336)	(0.254)	(0.323)	(0.688)	(1.868)
Constant	6.176**	1.280	2.665*	4.470**	5.777**	16.881
N	779	779	779	779	779	779

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table E.42: OLS and Quantile regression: Individual labour supply - ARTP

	(1) OLS	(2) Q10	(3) Q25	(4) Q50	(5) Q75	(6) Q95
(Reference non-PLWHA)						
TASOART	0.627	0.242	0.343	0.458	0.711	2.405
	(0.620)	(0.329)	(0.340)	(0.369)	(0.643)	(2.230)
TASOWL	-0.418	-0.457	0.212	0.393	0.001	-1.096
	(0.659)	(0.454)	(0.469)	(0.389)	(0.748)	(2.387)
MOHART	-0.305	-0.358	-0.041	0.024	-0.162	-1.493
	(0.640)	(0.364)	(0.358)	(0.401)	(0.678)	(2.227)
MOHWL	0.354	-0.479	0.233	-0.013	0.521	1.769
	(0.925)	(0.509)	(0.532)	(0.618)	(1.160)	(3.454)
Wage-Original	8.8E-4**	8.8E-6	7.6E-6	2.5E-5	1.9E-5	1.0E-4
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Age	0.053	-0.005	0.044	0.028	0.138	-0.185
	(0.101)	(0.052)	(0.066)	(0.078)	(0.116)	(0.323)
Age squared	-0.001	-3.3E-5	-4.2E-4	-3.3E-4	-0.002	0.000
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.003)
Number children ≤5 years	-0.054	-0.070	-0.063	-0.175	-0.102	-0.093
	(0.257)	(0.110)	(0.148)	(0.148)	(0.243)	(0.762)
Number children 6-18 years	-0.016	0.067	0.047	0.129**	0.078	0.074
	(0.117)	(0.059)	(0.068)	(0.062)	(0.124)	(0.310)
(Reference Rural)						
Urban Residence	-0.129	-0.707***	-0.164	0.119	0.444	-0.143
	(0.608)	(0.270)	(0.337)	(0.399)	(0.846)	(1.672)
Male	0.676	0.075	-0.052	0.072	0.091	1.740
	(0.626)	(0.293)	(0.242)	(0.292)	(0.565)	(2.007)
Education years	-0.028	0.052	-0.014	-0.054	-0.098	0.361
	(0.144)	(0.075)	(0.091)	(0.094)	(0.158)	(0.388)
Education years squared	-0.008	-0.006	-0.000	0.002	-0.002	-0.045**
	(0.008)	(0.005)	(0.005)	(0.005)	(0.009)	(0.021)
Log (Stock of wealth)	0.026	0.043	0.014	0.004	-0.008	0.014
	(0.063)	(0.027)	(0.029)	(0.032)	(0.048)	(0.164)
Chronic	-0.354	-0.181	-0.091	-0.233	-0.750	0.391
	(0.475)	(0.292)	(0.334)	(0.353)	(0.526)	(1.596)
Acute	-0.262	0.027	-0.083	-0.083	-0.220	-3.251*
	(0.517)	(0.281)	(0.298)	(0.365)	(0.628)	(1.521)
(Reference Married)						
Single	-1.285	-0.521	-0.043	-0.907	-1.295	-1.911
	(1.173)	(0.520)	(0.579)	(0.684)	(1.133)	(3.345)
Divorced	-0.294	-0.509	-0.409	-0.123	-0.633	1.836
	(0.883)	(0.522)	(0.540)	(0.615)	(1.038)	(2.762)
Widowed	-0.550	-0.147	-0.152	-0.470	-0.660	0.457
	(0.755)	(0.460)	(0.535)	(0.509)	(0.902)	(2.182)
(Reference Agricultural Occupation)						
Other occupation	-2.481***	-1.311***	-3.231***	-4.371***	-4.303***	-1.764
	(0.809)	(0.308)	(0.492)	(0.516)	(0.987)	(2.868)
Non-agricultural occupation	4.980***	0.939**	1.340**	3.878***	8.060***	8.702***
	(0.629)	(0.382)	(0.664)	(0.732)	(1.041)	(1.868)

Male household head	-0.237	-0.214	0.076	-0.110	-0.283	0.555
	(0.629)	(0.323)	(0.296)	(0.334)	(0.701)	(1.916)
Constant	6.227*	1.799	2.401	4.811**	5.692*	19.160*
	(3.102)	(1.404)	(1.591)	(1.925)	(2.954)	(10.112)
N	779	779	779	779	779	779

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix E.5 - Individual analysis controlling for HIV/AIDS severity

Table E.51: Individual level analysis controlling for weight at CD4 recording for all wages

	(1) PLWHA	(2) TASO/MOH	(3) ARTP	(4) PLWHA	(5) TASO/MOH	(6) ARTP	(7) PLWHA	(8) TASO/MOH	(9) ARTP
(Reference MOHPLWHA)									
TASOPLWHA		0.914			**1.322****			**1.316****	
		(0.672)			(0.628)			(0.628)	
TASOART			0.633			0.911			0.895
			(1.321)			(1.086)			(1.086)
TASOWL			-0.859			-0.598			-0.612
			(1.214)			(0.966)			(0.964)
MOHART			-0.944			-1.181			-1.196
			(1.279)			(0.991)			(0.992)
Wage-Original	1.1E-4***	1.1E-4***	1.1E-4***						
	(0.000)	(0.000)	(0.000)						
Wage-MM				1.0E-4***	1.0E-4***	10.E-5***			
				(0.000)	(0.000)	(0.000)			
Wage-HD							1.0E-4***	1.04E-4***	1.0E-4***
							(0.000)	(0.000)	(0.000)
Weight at CD4 Record	0.001	-3.5E-4	-0.002	0.022	0.017	0.016	0.022	0.018	0.016
	(0.046)	(0.045)	(0.045)	(0.040)	(0.039)	(0.038)	(0.040)	(0.039)	(0.037)
Age	0.209	0.193	0.182	0.135	0.115	0.111	0.137	0.116	0.113
	(0.139)	(0.136)	(0.134)	(0.120)	(0.122)	(0.123)	(0.120)	(0.122)	(0.123)
Age squared	-0.003**	-0.002**	-0.002*	-0.002	-0.001	-0.001	-0.002	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Number children ≤5 years	0.410	0.457	0.485	0.582	0.621†	0.616	0.588	0.626†	0.621
	(0.496)	(0.494)	(0.502)	(0.400)	(0.400)	(0.411)	(0.401)	(0.401)	(0.412)
Number children 6-18 years	-0.139	-0.175	-0.202	-0.173	-0.210	-0.242†	-0.180	-0.217	-0.248†

	(0.181)	(0.176)	(0.180)	(0.159)	(0.153)	(0.154)	(0.159)	(0.154)	(0.154)
Urban Residence	-1.296	-1.261	-1.232	-0.565	-0.678	-0.617	-0.587	-0.699	-0.638
	(1.299)	(1.320)	(1.276)	(0.997)	(1.031)	(0.992)	(0.997)	(1.032)	(0.992)
Male	1.418	1.399	1.453	1.403†	1.358	1.371	1.409†	1.365†	1.376
	(1.106)	(1.094)	(1.114)	(0.891)	(0.883)	(0.892)	(0.892)	(0.884)	(0.893)
Education years	-0.150	-0.178	-0.173	-0.116	-0.183	-0.171	-0.114	-0.181	-0.169
	(0.201)	(0.209)	(0.204)	(0.214)	(0.226)	(0.220)	(0.214)	(0.226)	(0.220)
Education years squared	-0.010	-0.010	-0.009	-0.006	-0.004	-0.004	-0.006	-0.004	-0.004
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Log (Stock of wealth)	-0.093	-0.081	-0.084	0.003	0.017	0.024	0.002	0.016	0.023
	(0.117)	(0.113)	(0.112)	(0.089)	(0.088)	(0.088)	(0.089)	(0.088)	(0.088)
Chronic	0.228	0.239	0.331	-0.075	-0.105	-0.088	-0.074	-0.103	-0.086
	(0.806)	(0.806)	(0.785)	(0.759)	(0.761)	(0.763)	(0.759)	(0.760)	(0.763)
Acute	0.739	0.817	0.737	-0.112	0.021	-0.031	-0.083	0.049	-0.003
	(0.974)	(0.970)	(0.981)	(0.750)	(0.732)	(0.737)	(0.750)	(0.732)	(0.737)
Single	-0.684	-0.886	-1.116	-0.751	-1.008	-1.146	-0.734	-0.990	-1.127
	(1.862)	(1.939)	(1.952)	(1.452)	(1.503)	(1.513)	(1.454)	(1.505)	(1.514)
Divorced	0.574	0.486	0.324	0.436	0.338	0.291	0.416	0.319	0.271
	(1.557)	(1.538)	(1.509)	(1.225)	(1.207)	(1.196)	(1.225)	(1.206)	(1.195)
Widowed	-0.986	-1.163	-1.182	-0.058	-0.292	-0.264	-0.070	-0.302	-0.275
	(1.139)	(1.118)	(1.116)	(1.002)	(0.977)	(0.976)	(0.998)	(0.972)	(0.971)
Other occupation	-2.178^{*}	-2.081	-2.002	-1.696	-1.626	-1.560	-1.688	-1.619	-1.552
	(1.373)	(1.366)	(1.381)	(1.218)	(1.211)	(1.215)	(1.217)	(1.210)	(1.213)
Non-agricultural occupation	4.447^{***}	4.577^{***}	4.557^{***}	4.070^{***}	4.238^{***}	4.310^{***}	4.052^{***}	4.220^{***}	4.292^{***}
	(1.104)	(1.135)	(1.124)	(0.930)	(0.943)	(0.942)	(0.931)	(0.944)	(0.943)
Male household head	-1.498	-1.409	**-1.647†**	-0.492	-0.446	-0.576	-0.520	-0.474	-0.603
	(1.017)	(0.994)	(1.042)	(0.815)	(0.813)	(0.841)	(0.811)	(0.809)	(0.837)
Constant	4.540	4.584	5.775	2.123	2.459	3.459	2.117	2.453	3.459
	(4.247)	(4.174)	(4.456)	(3.473)	(3.493)	(3.661)	(3.473)	(3.494)	(3.660)
N	332	332	332	467	467	467	467	467	467

Standard errors in parentheses† $p < 0.12$, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table E.52: Individual Labour Analysis for all wages controlling for Months on ART

	(1) PLWHA	(2) TASO/MOH	(3) ARTP	(4) PLWHA	(5) TASO/MOH	(6) ARTP	(7) PLWHA	(8) TASO/MOH	(9) ARTP
(Reference MOHPLWHA)									
TASOPLWHA		1.299			1.495			1.494	
		(1.053)			(0.965)			(0.965)	
(Reference MOHWL)									
TASOART			1.694			2.021			2.019
			(1.864)			(1.588)			(1.588)
TASOWL			-0.881			-0.827			-0.827
			(1.552)			(1.224)			(1.223)
MOHART			-0.460			-0.439			-0.439
			(1.604)			(1.269)			(1.269)
Wage-Original	6.7E-6***	6.6E-6***	6.3E-6***						
	(0.000)	(0.000)	(0.000)						
Wage-MM				7.0E-6***	6.8E-6***	6.4E-6***			
				(0.000)	(0.000)	(0.000)			
Wage-HD							7.0E-6***	6.8E-6***	6.4E-6***
							(0.000)	(0.000)	(0.000)
Months on ART	0.007	0.010	0.010	-0.000	0.002	0.001	-0.000	0.002	0.001
	(0.027)	(0.026)	(0.026)	(0.022)	(0.022)	(0.021)	(0.022)	(0.022)	(0.021)
Age	0.164	0.126	0.116	0.041	0.007	0.003	0.041	0.007	0.003
	(0.232)	(0.237)	(0.238)	(0.180)	(0.190)	(0.196)	(0.180)	(0.190)	(0.196)
Age squared	-0.003	-0.002	-0.002	-0.001	-0.000	-0.000	-0.001	-0.000	-0.000
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Number children ≤5 years	0.418	0.477	0.493	0.489	0.537	0.546	0.489	0.537	0.546
	(0.640)	(0.637)	(0.655)	(0.513)	(0.511)	(0.528)	(0.513)	(0.511)	(0.528)
Number children 6-18 years	0.055	-0.004	-0.022	0.045	-0.009	-0.023	0.044	-0.009	-0.023
	(0.236)	(0.230)	(0.235)	(0.189)	(0.182)	(0.184)	(0.189)	(0.182)	(0.185)
(Reference Rural)									
Urban Residence	0.071	0.126	0.058	0.325	0.216	0.157	0.323	0.214	0.156

	(1.733)	(1.749)	(1.739)	(1.277)	(1.305)	(1.292)	(1.278)	(1.305)	(1.292)
Male	1.788	1.698	1.712	1.677	1.598	1.628	1.677	1.598	1.628
	(1.391)	(1.352)	(1.342)	(1.104)	(1.085)	(1.076)	(1.104)	(1.085)	(1.076)
Education years	-0.154	-0.217	-0.202	-0.307	-0.385	-0.337	-0.307	-0.385	-0.337
	(0.311)	(0.332)	(0.322)	(0.298)	(0.325)	(0.309)	(0.298)	(0.325)	(0.309)
Education years squared	-0.007	-0.004	-0.005	0.003	0.006	0.004	0.003	0.006	0.004
	(0.021)	(0.022)	(0.021)	(0.018)	(0.019)	(0.018)	(0.018)	(0.019)	(0.018)
Log (Stock of wealth)	0.069	0.102	0.105	0.083	0.117	0.126	0.083	0.117	0.126
	(0.148)	(0.135)	(0.131)	(0.111)	(0.108)	(0.108)	(0.111)	(0.108)	(0.108)
Chronic	-0.225	-0.196	-0.269	-0.848	-0.877	-0.959	-0.848	-0.877	-0.959
	(1.110)	(1.113)	(1.107)	(0.975)	(0.974)	(0.975)	(0.975)	(0.974)	(0.975)
Acute	0.765	0.766	0.543	-0.114	-0.111	-0.232	-0.112	-0.110	-0.231
	(1.325)	(1.338)	(1.397)	(1.038)	(1.046)	(1.064)	(1.038)	(1.046)	(1.064)
(Reference Married)									
Single	0.129	-0.179	-0.415	-0.516	-0.907	-1.162	-0.513	-0.903	-1.159
	(2.594)	(2.726)	(2.690)	(1.935)	(2.044)	(2.067)	(1.935)	(2.044)	(2.067)
Divorced	3.043	2.918	2.579	0.993	0.876	0.736	0.992	0.875	0.736
	(1.990)	(1.953)	(1.897)	(1.592)	(1.567)	(1.548)	(1.592)	(1.567)	(1.548)
Widowed	0.285	-0.234	-0.512	0.660	0.139	-0.025	0.658	0.138	-0.026
	(1.560)	(1.515)	(1.493)	(1.302)	(1.234)	(1.200)	(1.301)	(1.233)	(1.200)
(Reference Agricultural Occupation)									
Other occupation	-1.728	-1.637	-1.520	-1.597	-1.474	-1.351	-1.597	-1.474	-1.351
	(1.886)	(1.883)	(1.892)	(1.556)	(1.540)	(1.545)	(1.556)	(1.540)	(1.545)
Non-agricultural occupation	4.808***	4.962***	4.983***	4.652***	4.806***	4.935***	4.651***	4.805***	4.935***
	(1.304)	(1.337)	(1.352)	(1.092)	(1.111)	(1.127)	(1.092)	(1.111)	(1.127)
Male household head	-0.645	-0.647	-1.180	-0.164	-0.237	-0.655	-0.166	-0.239	-0.657
	(1.207)	(1.189)	(1.300)	(1.057)	(1.061)	(1.108)	(1.057)	(1.061)	(1.108)
Constant	2.861	3.200	4.206	5.323	5.718	6.272	5.322	5.717	6.270
	(7.023)	(7.139)	(7.175)	(5.682)	(5.835)	(5.878)	(5.682)	(5.835)	(5.877)
N	249	249	249	355	355	355	355	355	355
R^2	0.215	0.220	0.228	0.160	0.168	0.179	0.160	0.168	0.179

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix E.6 - Gender analysis using imputed wages

Table E.61: Labour Supply by Gender for Wage-MM and Wage-HD (Partial model)

	(1) Male	(2) Female	(3) Male	(4) Female	(5) Male	(6) Female	(7) Male	(8) Female	(9) Male	(10) Female	(11) Male	(12) Female
(Reference non-PLWHA)												
PLWHA	-0.392	-0.109					-0.395	-0.109				
	(0.70)	(0.58)					(0.70)	(0.58)				
(Reference non-PLWHA)												
TASOPLWHA			-1.150	0.297					-1.154	0.298		
			(0.82)	(0.66)					(0.82)	(0.66)		
MOHPLWHA			0.422	-0.535					0.421	-0.534		
			(0.87)	(0.62)					(0.87)	(0.62)		
(Reference non-PLWHA)												
TASOART					-1.003	0.456					-0.994	0.456
					(1.00)	(0.73)					(1.00)	(0.73)
TASOWL					**-1.452***	0.005					**-1.483***	0.007
					(0.86)	(0.76)					(0.86)	(0.76)
MOHART					0.203	-0.702					0.206	-0.701
					(1.02)	(0.68)					(1.02)	(0.68)
MOHWL					0.756	-0.235					0.748	-0.233
					(1.26)	(0.75)					(1.26)	(0.75)
Wage-MM	6.0E-5*	9.2E-6***	5.8E-5*	9.0E-6***	5.8E-5*	8.9E-6**						
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)						
Wage-HD							6.E-5*	9.E-6***	5.9E-5*	9.E-6***	5.9E-5*	8.9E-6**
							(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Age	0.418***	0.136*	0.393***	0.133*	0.399***	0.135*	0.417***	0.136*	0.391***	0.133*	0.397***	0.134*
	(0.10)	(0.07)	(0.10)	(0.07)	(0.10)	(0.07)	(0.10)	(0.07)	(0.10)	(0.07)	(0.10)	(0.07)
Age squared	-0.005***	-0.002**	-0.004***	-0.002*	-0.004***	-0.002*	-0.005***	-0.002**	-0.004***	-0.002*	-0.004***	-0.002*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Number children ≤ 5Years	0.250	-0.130	0.213	-0.136	0.211	-0.137	0.248	-0.130	0.211	-0.136	0.210	-0.137

	(0.40)	(0.20)	(0.39)	(0.20)	(0.40)	(0.20)	(0.40)	(0.20)	(0.39)	(0.20)	(0.40)	(0.20)
Number children 6_18 years	-0.121	-0.069	-0.094	-0.092	-0.101	-0.099	-0.119	-0.069	-0.092	-0.091	-0.100	-0.099
	(0.17)	(0.10)	(0.18)	(0.11)	(0.18)	(0.11)	(0.17)	(0.10)	(0.18)	(0.11)	(0.18)	(0.11)
Urban residence	2.292**	0.927*	2.315**	0.956*	2.297**	0.960*	2.279**	0.927*	2.302**	0.956*	2.282**	0.960*
	(0.97)	(0.54)	(0.95)	(0.54)	(0.97)	(0.54)	(0.97)	(0.54)	(0.95)	(0.54)	(0.97)	(0.54)
Education years	0.153	0.050	0.172	0.027	0.171	0.024	0.149	0.050	0.168	0.027	0.168	0.024
	(0.27)	(0.16)	(0.28)	(0.16)	(0.27)	(0.16)	(0.27)	(0.16)	(0.27)	(0.16)	(0.27)	(0.16)
Education years squared	-0.018	-0.013	-0.018	-0.013	-0.018	-0.012	-0.018	-0.013	-0.018	-0.013	-0.018	-0.012
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Chronic	-0.931	0.113	-0.956	0.079	-0.935	0.089	-0.937	0.114	-0.961	0.079	-0.940	0.089
	(0.81)	(0.52)	(0.81)	(0.52)	(0.80)	(0.51)	(0.81)	(0.52)	(0.81)	(0.52)	(0.80)	(0.51)
Acute	-1.211	-0.197	-1.228	-0.180	-1.241	-0.185	-1.178	-0.197	-1.196	-0.181	-1.209	-0.185
	(0.91)	(0.44)	(0.90)	(0.44)	(0.91)	(0.44)	(0.91)	(0.44)	(0.90)	(0.44)	(0.91)	(0.44)
Constant	-0.764	4.258**	-0.424	4.507**	-0.503	4.506**	-0.742	4.264**	-0.400	4.513**	-0.480	4.512**
	(2.57)	(1.84)	(2.53)	(1.87)	(2.52)	(1.88)	(2.56)	(1.84)	(2.53)	(1.87)	(2.51)	(1.88)
N	423	728	423	728	423	728	423	728	423	728	423	728

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table E.62: Labour Supply by Gender for Wage-MM and Wage-HD (Full model)

	(1) Male	(2) Female	(3) Male	(4) Female	(5) Male	(6) Female	(7) Male	(8) Female	(9) Male	(10) Female	(11) Male	(12) Female
(Reference non-PLWHA)												
PLWHA	0.258	0.067					0.254	0.068				
	(0.67)	(0.56)					(0.67)	(0.56)				
(Reference non-PLWHA)												
TASOPLWHA			-0.202	0.614					-0.207	0.614		
			(0.76)	(0.64)					(0.76)	(0.64)		
MOHPLWHA			0.668	-0.436					0.665	-0.436		
			(0.86)	(0.58)					(0.86)	(0.58)		
(Reference non-PLWHA)												
TASOART					0.238	0.857					0.243	0.857
					(0.95)	(0.73)					(0.95)	(0.73)
TASOWL					-1.033	0.129					-1.055	0.129
					(0.90)	(0.70)					(0.89)	(0.70)
MOHART					0.667	-0.535					0.667	-0.535
					(0.99)	(0.62)					(0.99)	(0.62)
MOHWL					0.696	-0.289					0.688	-0.288
					(1.31)	(0.72)					(1.31)	(0.72)
Wage-MM	4.2E-5**	7.1E-6***	4.0E-5**	6.9E-6***	4.0E-5**	6.8E-6***						
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)						
Wage-HD							4.1E-5**	7.1E-6***	4.0E-5*	6.9E-6***	4.0E-5*	6.8E-6***
							(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Age	0.336**	-0.090	0.342**	-0.098	0.350**	-0.101	0.337**	-0.091	0.343**	-0.098	0.350**	-0.101
	(0.15)	(0.08)	(0.15)	(0.08)	(0.15)	(0.09)	(0.15)	(0.08)	(0.15)	(0.08)	(0.15)	(0.09)
Age squared	-0.003**	0.000	-0.003**	0.001	-0.003**	0.001	-0.003**	0.000	-0.003**	0.001	-0.003**	0.001
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Number children ≤ 5Years	0.212	-0.194	0.210	-0.210	0.253	-0.192	0.212	-0.194	0.209	-0.210	0.253	-0.192
	(0.40)	(0.18)	(0.40)	(0.19)	(0.41)	(0.19)	(0.40)	(0.18)	(0.40)	(0.19)	(0.41)	(0.19)
Number children 6-18 years	-0.030	-0.007	-0.016	-0.036	-0.038	-0.045	-0.030	-0.007	-0.016	-0.036	-0.039	-0.045
	(0.18)	(0.10)	(0.18)	(0.10)	(0.18)	(0.10)	(0.18)	(0.10)	(0.18)	(0.10)	(0.18)	(0.10)

Urban Residence	0.646	0.078	0.700	0.099	0.645	0.100	0.639	0.078	0.693	0.099	0.636	0.100
	(0.96)	(0.52)	(0.98)	(0.51)	(1.00)	(0.52)	(0.96)	(0.52)	(0.97)	(0.51)	(0.99)	(0.52)
Education years	0.003	-0.074	0.015	-0.107	0.033	-0.112	0.001	-0.074	0.013	-0.107	0.031	-0.112
	(0.24)	(0.15)	(0.25)	(0.15)	(0.24)	(0.15)	(0.24)	(0.15)	(0.25)	(0.15)	(0.24)	(0.15)
Education years squared	-0.004	-0.007	-0.004	-0.006	-0.005	-0.006	-0.004	-0.007	-0.004	-0.006	-0.005	-0.006
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Log (Stock of wealth)	-0.128	0.123***	-0.125	0.130***	-0.128	0.136***	-0.130	0.123***	-0.127	0.130***	-0.130	0.136***
	(0.10)	(0.05)	(0.10)	(0.05)	(0.11)	(0.05)	(0.10)	(0.05)	(0.10)	(0.05)	(0.11)	(0.05)
Chronic	-0.783	-0.193	-0.777	-0.238	-0.765	-0.220	-0.784	-0.193	-0.779	-0.238	-0.767	-0.220
	(0.80)	(0.50)	(0.80)	(0.51)	(0.79)	(0.50)	(0.80)	(0.50)	(0.80)	(0.51)	(0.79)	(0.50)
Acute	-0.240	-0.629	-0.253	-0.614	-0.286	-0.614	-0.218	-0.629	-0.231	-0.614	-0.264	-0.614
	(0.93)	(0.43)	(0.92)	(0.42)	(0.93)	(0.42)	(0.93)	(0.43)	(0.92)	(0.42)	(0.93)	(0.42)
Single	-0.174	-0.322	0.013	-0.477	0.010	-0.462	-0.164	-0.321	0.023	-0.476	0.020	-0.461
	(1.91)	(0.80)	(2.01)	(0.80)	(1.99)	(0.82)	(1.91)	(0.80)	(2.01)	(0.80)	(1.99)	(0.82)
Divorced	0.206	-0.369	0.312	-0.372	0.463	-0.316	0.187	-0.368	0.293	-0.371	0.449	-0.315
	(2.82)	(0.71)	(2.82)	(0.71)	(2.87)	(0.71)	(2.82)	(0.71)	(2.82)	(0.71)	(2.87)	(0.71)
Widowed	-3.002**	0.274	-2.910**	0.132	-2.878**	0.159	-2.994**	0.273	-2.902**	0.131	-2.869**	0.159
	(1.20)	(0.72)	(1.21)	(0.72)	(1.23)	(0.72)	(1.20)	(0.72)	(1.20)	(0.72)	(1.23)	(0.72)
Other occupation	-2.465	-2.307***	-2.537*	-2.210***	-2.545*	-2.200***	-2.472	-2.306***	-2.544*	-2.210***	-2.551*	-2.200***
	(1.52)	(0.65)	(1.49)	(0.65)	(1.53)	(0.65)	(1.51)	(0.65)	(1.49)	(0.65)	(1.53)	(0.65)
Non-agricultural occupation	5.549***	3.639***	5.478***	3.703***	5.512***	3.717***	5.537***	3.639***	5.466***	3.704***	5.500***	3.717***
	(0.96)	(0.54)	(0.96)	(0.54)	(0.97)	(0.54)	(0.96)	(0.54)	(0.96)	(0.54)	(0.97)	(0.54)
Male household head	-0.232	0.080	-0.370	0.148	-0.339	0.140	-0.224	0.080	-0.362	0.148	-0.329	0.139
	(1.15)	(0.58)	(1.12)	(0.58)	(1.06)	(0.58)	(1.15)	(0.58)	(1.12)	(0.58)	(1.06)	(0.58)
Constant	-0.183	8.217***	-0.400	8.511***	-0.567	8.568***	-0.181	8.221***	-0.398	8.515***	-0.567	8.572***
	(5.04)	(2.14)	(5.15)	(2.17)	(5.09)	(2.22)	(5.03)	(2.14)	(5.14)	(2.17)	(5.09)	(2.22)
N	400	708	400	708	400	708	400	708	400	708	400	708

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix E.7 - Gender analysis controlling for HIV/AIDS severity

Table E.71: Labour supply by gender controlling for WHO HIV stage for original wage and Wage-MM

	(1) Male	(2) Female	(3) Male	(4) Female	(5) Male	(6) Female	(7) Male	(8) Female	(9) Male	(10) Female	(11) Male	(12) Female
(Reference MOHPLWHA)												
TASOPLWHA			0.536	1.062					0.272	**1.681****		
			(1.84)	(0.67)					(1.46)	(0.72)		
(Reference MOHWL)												
TASOART					1.283	1.719					0.321	**2.264****
					(2.74)	(1.09)					(2.33)	(1.05)
TASOWL					-1.479	0.188					-1.764	0.007
					(2.81)	(1.11)					(2.28)	(0.90)
MOHART					0.055	0.327					-0.749	-0.029
					(2.45)	(1.14)					(1.99)	(0.81)
Wage-Original	2.9E-5**	6.4E-6***	3.0E-5**	6.2E-6***	3.0E-5*	6.0E-6***						
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)						
Wage-MM							3.1E-5*	7.0E-6***	3.2E-5*	6.3E-6***	3.0E-5*	5.9E-7***
							(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
WHO HIV Stage	-1.051	0.148	-1.009	0.195	-1.030	0.210	-0.194	-0.403	-0.184	-0.350	-0.188	-0.349
	(0.92)	(0.52)	(0.92)	(0.53)	(0.96)	(0.52)	(0.71)	(0.59)	(0.71)	(0.57)	(0.74)	(0.56)
Age	0.516	-0.016	0.496	-0.031	0.499	-0.061	0.395*	-0.064	0.388	-0.102	0.392*	-0.130
	(0.33)	(0.16)	(0.34)	(0.15)	(0.34)	(0.16)	(0.23)	(0.14)	(0.23)	(0.15)	(0.23)	(0.15)
Age squared	-0.005	-0.001	-0.005	-0.001	-0.005	-0.001	-0.004*	0.000	-0.004*	0.000	-0.004*	0.001
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Number children ≤5 years	1.438	-0.131	1.451	-0.109	1.555	-0.038	1.091	0.288	1.106	0.272	1.146	0.316
	(1.00)	(0.40)	(1.01)	(0.40)	(1.03)	(0.41)	(0.87)	(0.31)	(0.88)	(0.31)	(0.92)	(0.31)
Number children 6-18 years	0.037	-0.053	0.034	-0.105	-0.075	-0.115	-0.204	-0.093	-0.209	-0.148	-0.263	-0.163
	(0.36)	(0.17)	(0.36)	(0.17)	(0.39)	(0.17)	(0.31)	(0.14)	(0.31)	(0.13)	(0.32)	(0.13)
Urban Residence	0.674	-0.969	0.610	-0.929	0.781	-0.841	-0.302	-0.200	-0.383	-0.198	-0.178	-0.109
	(3.22)	(1.12)	(3.31)	(1.14)	(3.37)	(1.14)	(2.02)	(0.95)	(2.18)	(0.97)	(2.20)	(0.95)

Male	-0.269	-0.046	-0.274	-0.091	-0.133	-0.106	-0.326	-0.062	-0.333	-0.158	-0.257	-0.159
	(0.60)	(0.22)	(0.62)	(0.22)	(0.58)	(0.22)	(0.45)	(0.23)	(0.47)	(0.24)	(0.45)	(0.25)
Education years	-0.004	-0.015	-0.004	-0.013	-0.012	-0.012	0.008	-0.007	0.008	-0.004	0.004	-0.003
	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
Education years squared	0.051	0.105	0.054	0.117	0.026	0.117	-0.113	0.188**	-0.113	0.207***	-0.122	0.215***
	(0.20)	(0.09)	(0.19)	(0.09)	(0.20)	(0.08)	(0.19)	(0.07)	(0.19)	(0.07)	(0.20)	(0.07)
Log (Stock of wealth)	-0.204	-0.633	-0.181	-0.668	-0.312	-0.604	0.491	-1.031	0.504	-1.140	0.506	-1.086
	(1.86)	(0.77)	(1.88)	(0.77)	(1.76)	(0.76)	(1.50)	(0.83)	(1.51)	(0.85)	(1.45)	(0.83)
Chronic	3.175	-0.185	3.234	-0.139	3.010	-0.126	1.642	-0.552	1.674	-0.470	1.530	-0.471
	(2.77)	(0.72)	(2.76)	(0.72)	(2.82)	(0.72)	(2.01)	(0.60)	(2.01)	(0.59)	(2.04)	(0.59)
(Reference Married)												
Single	2.173	-1.221	1.924	-1.537	1.538	-1.756	0.513	-0.533	0.384	-0.885	0.004	-1.131
	(4.42)	(1.35)	(4.91)	(1.39)	(5.01)	(1.48)	(3.39)	(1.11)	(3.75)	(1.14)	(3.70)	(1.18)
Divorced	6.138	0.884	6.111	0.688	5.592	0.659	4.411	0.545	4.383	0.370	3.877	0.437
	(7.33)	(1.17)	(7.26)	(1.15)	(6.98)	(1.15)	(5.36)	(1.02)	(5.28)	(1.03)	(5.19)	(1.00)
Widowed	-3.679**	0.443	-3.640*	0.085	-3.813*	0.058	-3.726***	1.211	-3.734***	0.825	-3.605***	0.872
	(1.79)	(1.26)	(1.84)	(1.24)	(1.86)	(1.24)	(1.35)	(1.03)	(1.34)	(1.01)	(1.28)	(1.00)
(Reference Agricultural Occupation)												
Other occupation	-0.111	-2.419**	0.044	-2.384**	0.364	-2.461**	-2.080	-1.721	-2.026	-1.803*	-1.770	-1.858*
	(3.74)	(1.10)	(3.75)	(1.11)	(3.91)	(1.08)	(2.87)	(1.06)	(2.85)	(1.07)	(2.91)	(1.04)
Non-agricultural occupation	6.893***	4.374***	7.038***	4.447***	6.900***	4.410***	6.090***	3.507***	6.139**	3.646***	6.140***	3.695***
	(2.29)	(0.91)	(2.50)	(0.91)	(2.46)	(0.91)	(1.88)	(0.84)	(1.98)	(0.82)	(1.98)	(0.82)
Male household head	-1.914	-0.961	-1.826	-0.986	-2.157	-1.188	-0.473	0.200	-0.446	0.181	-0.770	0.009
	(1.94)	(1.05)	(1.81)	(1.06)	(2.00)	(1.10)	(1.83)	(0.87)	(1.77)	(0.87)	(1.73)	(0.90)
Constant	-4.199	9.208**	-4.108	9.261**	-3.467	9.755*	-0.415	7.821*	-0.337	8.329**	0.504	8.908**
	(11.05)	(4.10)	(11.27)	(4.12)	(11.67)	(4.05)	(8.72)	(4.02)	(8.91)	(4.08)	(8.83)	(4.14)
N	124	236	124	236	124	236	173	334	173	334	173	334

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table E.72: Labour supply by gender controlling for months on ART for original wage and Wage-MM

	(1) Male	(2) Female	(3) Male	(4) Female	(5) Male	(6) Female	(7) Male	(8) Female	(9) Male	(10) Female	(11) Male	(12) Female
(Reference MOHPLWHA)												
TASOPLWHA			0.697	**1.714***					0.756	**2.317****		
			(2.69)	(0.95)					(2.12)	(1.11)		
(Reference MOHWL)												
TASOART					1.381	**2.470***					0.853	**3.313****
					(3.87)	(1.36)					(3.34)	(1.63)
TASOWL					-3.232	0.772					-1.839	0.668
					(4.14)	(1.43)					(3.18)	(1.16)
MOHART					-0.814	0.353					-0.989	0.319
					(3.13)	(1.24)					(2.64)	(0.98)
Wage-Original	1.1E-4	6.0E-6***	1.1E-4	5.6E-6***	1.2E-4	5.6E-6***						
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)						
Wage-MM							1.2E-4*	6.1E-6***	1.2E-4*	5.8E-6***	1.2E-4*	5.5E-6***
							(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Months on ART	0.055	-0.018	0.054	-0.011	0.053	-0.009	0.030	-0.008	0.030	-0.002	0.029	-0.002
	(0.06)	(0.02)	(0.06)	(0.02)	(0.06)	(0.02)	(0.05)	(0.02)	(0.05)	(0.02)	(0.05)	(0.02)
Age	0.580	0.121	0.533	0.089	0.496	0.059	0.345	-0.100	0.312	-0.147	0.312	-0.167
	(0.54)	(0.23)	(0.57)	(0.22)	(0.57)	(0.23)	(0.33)	(0.20)	(0.34)	(0.21)	(0.34)	(0.22)
Age squared	-0.006	-0.003	-0.005	-0.002	-0.005	-0.002	-0.003	0.001	-0.003	0.001	-0.003	0.002
	(0.01)	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Number children ≤5 years	1.744	-0.052	1.778	-0.013	1.717	0.019	1.253	0.288	1.299	0.308	1.256	0.344
	(1.32)	(0.49)	(1.35)	(0.50)	(1.42)	(0.51)	(1.12)	(0.40)	(1.14)	(0.39)	(1.19)	(0.40)
Number children 6-18 years	-0.125	0.180	-0.121	0.045	-0.213	0.046	0.013	0.062	0.001	-0.055	-0.040	-0.048
	(0.50)	(0.21)	(0.51)	(0.23)	(0.52)	(0.23)	(0.37)	(0.17)	(0.37)	(0.17)	(0.38)	(0.17)
Urban Residence	-0.531	-0.578	-0.509	-0.378	-0.669	-0.391	-1.514	0.544	-1.702	0.619	-1.469	0.436
	(4.77)	(1.49)	(4.79)	(1.52)	(4.75)	(1.54)	(2.62)	(1.26)	(2.83)	(1.27)	(2.84)	(1.26)
Education years	-0.381	-0.144	-0.408	-0.243	-0.290	-0.249	-0.702	-0.162	-0.735	-0.296	-0.625	-0.273
	(0.81)	(0.27)	(0.89)	(0.28)	(0.85)	(0.28)	(0.59)	(0.30)	(0.66)	(0.34)	(0.61)	(0.33)
Education years squared	-0.000	-0.008	0.000	-0.003	-0.007	-0.003	0.027	-0.004	0.027	0.003	0.020	0.002
	(0.05)	(0.02)	(0.06)	(0.02)	(0.05)	(0.02)	(0.04)	(0.02)	(0.04)	(0.02)	(0.03)	(0.02)

Log (stock of wealth)	-0.043	0.137	-0.022	0.183*	-0.043	0.183*	-0.215	0.175**	-0.203	0.238**	-0.203	0.244**
	(0.30)	(0.11)	(0.28)	(0.11)	(0.27)	(0.10)	(0.24)	(0.08)	(0.24)	(0.09)	(0.24)	(0.09)
Chronic	0.262	-0.891	0.332	-0.859	0.072	-0.881	0.253	-1.317	0.317	-1.404	0.225	-1.456
	(2.71)	(0.98)	(2.80)	(0.97)	(2.76)	(0.96)	(2.08)	(1.07)	(2.13)	(1.08)	(2.06)	(1.09)
Acute	2.273	-0.241	2.328	-0.196	1.979	-0.276	1.731	-0.610	1.791	-0.624	1.694	-0.704
	(3.50)	(0.96)	(3.54)	(0.95)	(3.70)	(0.96)	(2.76)	(0.85)	(2.78)	(0.84)	(2.83)	(0.85)
(Reference Married)												
Single	2.756	0.011	2.435	-0.331	1.644	-0.558	-0.666	0.636	-1.007	0.230	-1.455	-0.196
	(5.89)	(1.69)	(6.58)	(1.74)	(6.72)	(1.81)	(3.92)	(1.45)	(4.39)	(1.50)	(4.25)	(1.58)
Divorced	7.508	2.481	7.307	2.383	5.807	2.267	4.558	1.421	4.420	1.376	3.528	1.297
	(10.08)	(1.51)	(9.79)	(1.47)	(9.39)	(1.48)	(8.07)	(1.34)	(7.84)	(1.34)	(7.88)	(1.36)
Widowed	-3.088	1.170	-3.332	0.432	-4.001	0.251	-3.745	2.013	-3.936*	1.286	-4.006*	1.123
	(3.10)	(1.56)	(2.91)	(1.52)	(2.84)	(1.55)	(2.32)	(1.29)	(2.20)	(1.23)	(2.06)	(1.24)
(Reference Agricultural Occupation)												
Other occupation	-0.174	-1.926	0.049	-2.082	0.700	-2.150	-0.763	-1.939	-0.602	-1.998	-0.331	-1.944
	(4.76)	(1.35)	(4.76)	(1.36)	(5.05)	(1.34)	(3.55)	(1.47)	(3.52)	(1.45)	(3.66)	(1.42)
Non-agricultural occupation	4.876*	3.968***	5.067*	3.928***	4.545	3.951***	5.349**	3.391***	5.426**	3.504***	5.346**	3.651***
	(2.56)	(1.14)	(2.98)	(1.16)	(3.00)	(1.16)	(2.27)	(1.03)	(2.39)	(1.01)	(2.41)	(1.00)
Male household head	-0.769	-0.511	-0.817	-0.453	-1.753	-0.785	1.282	0.697	1.249	0.727	0.741	0.311
	(2.87)	(1.25)	(2.96)	(1.25)	(3.24)	(1.35)	(2.55)	(1.19)	(2.61)	(1.16)	(2.55)	(1.29)
N	90	159	90	159	90	159	124	231	124	231	124	231

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix E.8 - Testing the Unitary Model Assumption-OLS –All wages

Original wage and PLWHA Categories
quietly eststo:regress Thhd_hrs agemf agemf2_lognly agefm2_lognly plwha Ttotwpwk2 agemale age2male hhdeduc educ2 chronic acute hhd u5 hhd6_18 urban2 indvocupnone indvocupnonagric, cluster (hhdid) robust

test (agemf=0) (agemf2_lognly=agefm2_lognly)

(1) agemf = 0
(2) agemf2_lognly - agefm2_lognly = 0

F(2,   193) =   4.27
Prob > F =   0.0153

quietly eststo:regress Thhd_hrs agemf agemf2_lognly agefm2_lognly tasoplwha mohplwha Ttotwpwk2 agemale age2male hhdeduc educ2 chronic acute hhdu5 hhd6_18 urban2 indvocupnone indvocupnonagric, cluster (hhdid) robust

. test (agemf=0) (agemf2_lognly=agefm2_lognly)

(1) agemf = 0
(2) agemf2_lognly - agefm2_lognly = 0

F(2,   193) =   3.75
Prob > F =   0.0252

quietly eststo:regress Thhd_hrs agemf agemf2_lognly agefm2_lognly tasoarv tasowl moharv mohwl Ttotwpwk2 agemale age2male hhdeduc educ2 chronic acute hhdu5 hhd6_18 urban2 indvocupnone indvocupnonagric, cluster (hhdid) robust

. test (agemf=0) (agemf2_lognly=agefm2_lognly)

(1) agemf = 0
(2) agemf2_lognly - agefm2_lognly = 0

F(2,   193) =   4.41
Prob > F =   0.0134

Wage-MM and PLWHA Categories
quietly eststo:regress Thhd_hrs agemf agemf2_lognly agefm2_lognly plwha Twage_meantot agemale age2male hhdeduc educ2 chronic acute hhdu5 hhd6_18 urban2 indvocupnone indvocupnonagric, cluster (hhdid) robust

. test (agemf=0) (agemf2_lognly=agefm2_lognly)

(1) agemf = 0
(2) agemf2_lognly - agefm2_lognly = 0

F(2,   232) =   5.54
Prob > F =   0.0045

quietly eststo:regress Thhd_hrs agemf agemf2_lognly agefm2_lognly tasoplwha mohplwha Twage_meantot agemale age2male hhdeduc educ2 chronic acute hhdu5 hhd6_18 urban2 indvocupnone indvocupnonagric, cluster (hhdid) robust

. test (agemf=0) (agemf2_lognly=agefm2_lognly)

(1) agemf = 0
(2) agemf2_lognly - agefm2_lognly = 0

F(2,   232) =   5.36
Prob > F =   0.0053

quietly eststo:regress Thhd_hrs agemf agemf2_lognly agefm2_lognly tasoarv tasowl moharv mohwl Twage_meantot agemale age2male hhdeduc educ2 chronic acute hhdu5 hhd6_18 urban2 indvocupnone indvocupnonagric, cluster (hhdid) robust

. test (agemf=0) (agemf2_lognly=agefm2_lognly)

(1) agemf = 0
(2) agemf2_lognly - agefm2_lognly = 0

F(2,   232) =   5.46
Prob > F =   0.0048

Wage-HD and PLWHA Categories

quietly eststo:regress Thhd_hrs agemf agemf2_lognly agefm2_lognly plwha Twagedonor_meantot agemale age2male hhdeduc educ2 chronic acute hhdu5 hhd6_18 urban2 indvocupnone indvocupnonagric, cluster (hhdid) robust

. test (agemf=0) (agemf2_lognly=agefm2_lognly)

(1) agemf = 0
(2) agemf2_lognly - agefm2_lognly = 0

F(2,   232) =   5.57
Prob > F =   0.0044

quietly eststo:regress Thhd_hrs agemf agemf2_lognly agefm2_lognly tasoplwha mohplwha Twagedonor_meantot agemale age2male hhdeduc educ2 chronic acute hhdu5 hhd6_18 urban2 indvocupnone indvocupnonagric, cluster (hhdid) robust test (agemf=0) (agemf2_lognly=agefm2_lognly)

(1) agemf = 0
(2) agemf2_lognly - agefm2_lognly = 0

F(2,   232) =   5.38
Prob > F =   0.0052

quietly eststo:regress Thhd_hrs agemf agemf2_lognly agefm2_lognly tasoarv tasowl moharv mohwl Twagedonor_meantot agemale age2male hhdeduc educ2 chronic acute hhdu5 hhd6_18 urban2 indvocup none indvocupnonagric, cluster (hhdid) robust

test (agemf=0) (agemf2_lognly=agefm2_lognly)

(1) agemf = 0
(2) agemf2_lognly - agefm2_lognly = 0

F(2,   232) =   5.47
Prob > F =   0.0048

Appendix E.9 - Testing the Unitary Model Assumption-2SLS –All wages

Wage-original and PLWHA Categories

quietly eststo:ivregress 2sls Thhd_hrs agemf agemf2_lognly agefm2_lognly plwha (Ttotwpwk2=age2 age3 hhdeduc age_educ age2educ age3 educ urban2 single divorced widowed indvocupnone indvocupnonagric male) agemale hhdeduc educ2 chronic acute hhdu5 hhd6_18 urban2 indvocupnone indvocupnonagric, cluster (hhdid) robust

. test (agemf=0) (agemf2_lognly=agefm2_lognly)

(1) agemf = 0
(2) agemf2_lognly - agefm2_lognly = 0

chi2(2) = 11.48
Prob > chi2 = 0.0032

quietly eststo:ivregress 2sls Thhd_hrs agemf agemf2_lognly agefm2_lognly tasoplwha mohplwha (Ttotwpwk2=age2 age3 hhdeduc age_educ age2educ age3educ urban2 single divorced widowed indvocupnone indvocupnonagric male) agemale hhdeduc educ2 chronic acute hhdu5 hhd6_18 urban2 indvocupnone indvocupnonagric, cluster (hhdid) robust

.
. test (agemf=0) (agemf2_lognly=agefm2_lognly)

(1) agemf = 0
(2) agemf2_lognly - agefm2_lognly = 0

chi2(2) = 10.69
Prob > chi2 = 0.0048

quietly eststo:ivregress 2sls Thhd_hrs agemf agemf2_lognly agefm2_lognly tasoarv tasowl moharv mohwl (Ttotwpwk2=age2 age3 hhdeduc age_educ age2educ age3educ urban2 single divorced widowed indvocupnone indvocupnonagric male) agemale hhdeduc educ2 chronic acute hhdu5 hhd6_18 urban2 indvocupnone indvocupnonagric, cluster (hhdid) robust

.
. test (agemf=0) (agemf2_lognly=agefm2_lognly)

(1) agemf = 0
(2) agemf2_lognly - agefm2_lognly = 0

chi2(2) = 13.10
Prob > chi2 = 0.0014

Wage-MM and PLWHA Categories

quietly eststo:ivregress 2sls Thhd_hrs agemf agemf2_lognly agefm2_lognly plwha (Twage_meantot=age2 age3 hhdeduc age_educ age2educ age3educ urban2 single divorced widowed indvocupnone indvocupnonagric male) agemale hhdeduc educ2 chronic acute hhdu5 hhd6_18 urban2 indvocupnone indvocupnonagric, cluster (hhdid) robust

. test (agemf=0) (agemf2_lognly=agefm2_lognly)

(1) agemf = 0
(2) agemf2_lognly - agefm2_lognly = 0

chi2(2) = 12.28
Prob > chi2 = 0.0021

quietly eststo:ivregress 2sls Thhd_hrs agemf agemf2_lognly agefm2_lognly tasoplwha mohplwha (Twage_meantot=age2 age3 hhdeduc age_educ age2educ age3educ urban2 single divorced widowed indvocupnone indvocupnonagric male) agemale hhdeduc educ2 chronic acute hhdu5 hhd6_18 urban2 indvocupnone indvocupnonagric, cluster (hhdid) robust

. test (agemf=0) (agemf2_lognly=agefm2_lognly)

(1) agemf = 0
(2) agemf2_lognly - agefm2_lognly = 0

chi2(2) = 12.02
Prob > chi2 = 0.0025

quietly eststo:ivregress 2sls Thhd_hrs agemf agemf2_lognly agefm2_lognly tasoarv tasowl moharv mohwl (Twage_meantot=age2 age3 hhdeduc age_educ age2educ age3educ urban2 single divorced widowed indvocupnone indvocupnonagric male) agemale hhdeduc educ2 chronic acute hhdu5 hhd6_18 urban2 indvocupnone indvocupnonagric, cluster (hhdid) robust

test (agemf=0) (agemf2_lognly=agefm2_lognly)

(1) agemf = 0
(2) agemf2_lognly - agefm2_lognly = 0

chi2(2) = 12.67
Prob > chi2 = 0.0018

Wage-HD and PLWHA Categories

quietly eststo:ivregress 2sls Thhd_hrs agemf agemf2_lognly agefm2_lognly plwha (Twagedonor_meantot=age2 age3 hhdeduc age_educ age2 educ age3educ urban2 single divorced widowed indvocupnone indvocupnonagric male) agemale hhdeduc educ2 chronic acute hhdu5 hhd6_18 urban2 indvocupnone indvocupnonagric, cluster (hhdid) robust

. test (agemf=0) (agemf2_lognly=agefm2_lognly)

(1) agemf = 0
(2) agemf2_lognly - agefm2_lognly = 0

chi2(2) = 12.66
Prob > chi2 = 0.0018

quietly eststo:ivregress 2sls Thhd_hrs agemf agemf2_lognly agefm2_lognly tasoplwha mohplwha (Twagedonor_meantot=age2 age3 hhdeduc age_educ age2educ age3educ urban2 single divorced widowed indvocupnone indvocupnonagric male) agemale hhdeduc educ2 chronic acute hhdu5 hhd6_18 urban2 indvocupnone indvocupnonagric, cluster (hhdid) robust

test (agemf=0) (agemf2_lognly=agefm2_lognly)

(1) agemf = 0
(2) agemf2_lognly - agefm2_lognly = 0

chi2(2) = 12.34
Prob > chi2 = 0.0021

quietly eststo:ivregress 2sls Thhd_hrs agemf agemf2_lognly agefm2_lognly tasoarv tasowl moharv mohwl (Twagedonor_meantot=age2 age3 hhdeduc age_educ age2educ age3educ urban2 single divorced widowed indvocupnone indvocupnonagric male) agemale hhdeduc educ2 chronic acute hhdu5 hhd6_18 urban2 indvocupnone indvocupnonagric, cluster (hhdid) robust

test (agemf=0) (agemf2_lognly=agefm2_lognly)

(1) agemf = 0
(2) agemf2_lognly - agefm2_lognly = 0

chi2(2) = 12.97
Prob > chi2 = 0.0015

Appendix E.10 - Couple labour Supply-Male Education share for Wage-Original

Table E.10: Couple labour supply-Male education share for Wage-Original

	(1) PLWHA	(2) MOH/TASO	(3) ARTP
(Reference non-PLWHA)			
PLWHA	0.610		
	(1.452)		
(Reference non-PLWHA)			
TASOPLWHA		-0.468	
		(1.587)	
MOHPLWHA		1.237	
		(1.729)	
(Reference non-PLWHA)			
TASOART			-1.057
			(1.668)
TASOWL			0.764
			(2.840)
MOHART			1.106
			(2.127)
MOHWL			1.432
			(2.169)
Wage-Original	3.7E-5***	3.6E-5**	3.6E-5**
	(0.000)	(0.000)	(0.000)
Male-Education share	7.114	10.996	10.577
	(41.171)	(41.614)	(40.935)
(Male-Education share)^2*log(Household Stock Wealth)	-0.663	-0.793	-0.788
	(1.271)	(1.295)	(1.279)
(Female-Education share)^2*log(Household Stock Wealth)	-0.194	-0.039	-0.076
	(1.490)	(1.499)	(1.477)
Age*male	-0.103*	-0.116**	-0.114**
	(0.058)	(0.056)	(0.058)
Age squared*male	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)
Number children ≤ 5Years	0.080	0.109	-0.002
	(0.733)	(0.731)	(0.794)
Number children 6_18 years	-0.013	0.055	0.090
	(0.348)	(0.349)	(0.354)
(Reference Rural)			
Urban residence	0.846	0.961	0.809
	(2.336)	(2.281)	(2.192)
Education years	0.229	0.238	0.213
	(0.416)	(0.415)	(0.416)

Education years squared	-0.027	-0.028	-0.027
	(0.025)	(0.025)	(0.026)
Chronic	0.608	0.734	0.748
	(1.466)	(1.482)	(1.496)
Acute	0.118	0.116	0.148
	(1.479)	(1.468)	(1.434)
(Reference Agricultural Occupation)			
Other Occupation	-1.220	-1.538	-1.534
	(2.437)	(2.327)	(2.319)
Non-agricultural occupation	7.585***	7.398***	7.398***
	(1.947)	(1.862)	(1.905)
Male household head	-0.217	-0.490	-0.243
	(3.938)	(4.025)	(3.943)
Constant	13.000	11.045	11.343
	(22.585)	(22.997)	(22.449)
N	295	295	295

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$