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THREE ESSAYS ON HIV/AIDS RELATED ISSUES IN SOUTHERN AFRICA

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A dissertation submitted to the faculty of the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the Department of Health Policy and Management of the Gillings School of Global Public Health.

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ABSTRACT

I-HENG LEE: THREE ESSAYS ON HIV/AIDS RELATED ISSUES IN SOUTHERN AFRICA
(Under the direction of Sally Stearns)

For many years, the number of HIV/AIDS-related deaths in developing countries has been increasing at such an alarming rate that it is no longer whether it will be an epidemic, but rather how severe the epidemic will be. This study addresses three important aspects of the epidemic, including effects as well as causes.

The first paper identifies the potential effects of HIV on labor market participation, which affects economic outcomes. Using Heckman selection models and Demographic and Health Survey data from Lesotho, Malawi, Swaziland, and Zimbabwe, results show a significant negative association between being HIV positive and currently working, as well as having worked in the past 12 months, for men and women.

The second paper measures the spillover effects of fostering to help inform welfare policies. Linear probability models with fixed effects are estimated using data from the Cape Area Panel Study to quantify the effects of orphan fostering on the school enrollment, employment, and health status of young adults living in households which foster orphans. Results indicate that young adults from higher wealth quintile households which foster orphans have a higher probability of being enrolled in school.

The third paper highlights the role played by parental investment in influencing concurrent sexual partners, a risk factor affecting the rate of HIV transmission, which can help make HIV prevention campaigns more effective. Results from multinomial logistic regressions on data from the Cape Area Panel Study show that financial support from fathers significantly decreased the

probability of sexual concurrency among Black and Colored males, 11% of whom reported having been in sexually concurrent relationships.

The findings have important implications for the macroeconomic stability and future growth of the countries under investigation. The first paper suggests a need for employment protection for HIV positive individuals and their households. The second paper indicates that further research into subsidies for families taking on orphans is warranted. The third paper recommends health education programs on the risks of sexual concurrency for young adults. By providing empirical evidence, HIV policies can be made more effective, thereby mitigating any negative impacts on vulnerable individuals and families.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

AIDS	Acquired Immunodeficiency Virus
ATE	Average Treatment Effect
CAPS	Cape Area Panel Study
DHS	Demographic and Health Survey
EA	Enumeration Area
HIV	Human Immunodeficiency Virus
IV	Instrumental Variables
LPM	Linear Probability Model
MEASURE	Monitoring and Evaluation to Assess and Use Results
OR	Odds Ratio
PS	Propensity Score
SADC	Southern African Development Community
STI	Sexually Transmitted Infections
USAID	United States Agency for International Development

CHAPTER I: INTRODUCTION

Human Immunodeficiency Virus (HIV), and its full-blown state, Acquired Immunodeficiency Syndrome (AIDS), were first brought to the general public's attention in 1981 (World Health Organization, 2002). Southern Africa, which is currently home to the majority of the world's HIV population, also faces the dual misfortune of low economic development and limited human capital investments. Given the severity of the HIV/AIDS issue in southern Africa, exacerbated by existing poverty, I have chosen to focus on three separate but related aspects of the epidemic in the region.

Without widespread treatment for HIV positive individuals, the deterioration of health and reduced life span associated with the epidemic is likely to worsen levels of human capital. Chapter II investigates this link by looking at the association between being HIV positive and two labor market participation outcomes: whether the individual is currently working, and whether the individual worked in the past 12 months.

The AIDS epidemic has resulted in an increasing number of premature parental deaths, and thus a rising number of orphans. This problem is particularly acute in southern Africa, home to a majority of the world's population living with HIV. In this region, orphans are usually absorbed into a relative's household after losing their parents. However, in resource-limited settings, acquiring an orphan could generate negative externalities for the young adults already residing in such households. Chapter III assesses the validity of this hypothesis by testing the schooling, employment, and self-reported health outcomes of young adults who live in households which are fostering orphans.

Southern Africa currently has the highest HIV prevalence rates worldwide, even though the number of sexual partners of its inhabitants is comparable to that found in populations with lower HIV prevalence rates. The timing of partners is a potential explanation for the discrepancy, since

having overlapping partners has been shown to result in a faster spread of HIV. Thus, an understanding of the factors contributing to such sexual behavior is important as it likely influences HIV transmission rates. In particular, parental investment may play a significant role in determining whether their children engage in risky sexual behavior. Chapter IV thus attempts to ascertain the effect of various forms of parental investment on sexual concurrency of young adults.

While my three chapters look at effects as well as causes of the epidemic, the three investigations are tied together in the overarching goal of my dissertation, which is to inform HIV/AIDS policy. Chapter II identifies the potential effects of HIV on labor market participation, which affects economic policies. Chapter III provides empirical evidence of the spillover effects of fostering to help inform welfare policies. Chapter IV highlights the role played by parents in influencing sexual concurrency, a risk factor affecting the rate of HIV transmission, which can help make HIV prevention policies more effective. Chapter V summarizes the key findings from each of the investigations, and considers areas identified as potentially appropriate for government programs or policy interventions.

CHAPTER II: THE ASSOCIATION BETWEEN HIV AND LABOR MARKET PARTICIPATION IN THE SOUTHERN AFRICAN DEVELOPMENT COMMUNITY

Introduction

The human suffering and declines in health associated with HIV/AIDS have been well-documented; however, the disease also has consequences for the economic wellbeing of a country. HIV/AIDS strikes adults in their prime working years, which impairs their ability to work and invest in their future, thereby exacerbating existing poverty and inequality. Thus far, the African continent has borne the significant brunt of the damage resulting from the HIV epidemic, which will likely remain as one of its biggest challenges in the new millennium. In particular, sub-Saharan Africa is currently the most affected region, home to just over 10% of the world's population but more than two-thirds of those living with HIV. Within the region, southern Africa has been the most severely affected (Joint United Nations Programme on HIV/AIDS, 2007).

In the absence of a cure or affordable pharmaceutical therapy for all those afflicted, it is vital to better understand how HIV impacts the workforce. It is important to note the potential loss of a significant source of working ability in the household since those infected are often the major decision makers in their households. Traditionally, in this setting men are usually the primary breadwinners, contributing the majority of household income, whereas women play a bigger role in rearing children. The men's role in wealth accumulation may stem from cultural practices, whereby they have to pay *lobola* in order to obtain a bride to start their own families (Montgomery et al, 2008). However, this dichotomy of roles may be shifting, as more women find it necessary to bring home earnings[1].

[1]For example, 45.73% of male respondents in Lesotho reported covering at least half of household expenditures with their earnings, whereas the corresponding figure for women is lower (39.69%). For Malawi, 72.97% (57.29%) of men (women) covered at least half of household expenditures.

Recent Demographic and Health Surveys (DHS) include voluntary HIV testing with results linked to individuals. Cross-sectional DHS data from four countries in the Southern African Development Community (SADC) – Lesotho, Malawi, Swaziland, and Zimbabwe – were used to determine the association between HIV and current employment in order to better understand the effect of HIV on economic outcomes.

This study has important implications for the macroeconomic stability and future growth of the countries under investigation. By identifying the potential effects of HIV on labor market participation, it is hoped that appropriate policies can be designed to help all afflicted individuals and families.

Southern African Development Community (SADC)

In 1980, the Southern African Development Coordination Conference, an informal gathering of nine countries[2] came into being so as to lessen economic dependence on South Africa, then still under apartheid rule. SADC developed into its current legal form in 1992, and seeks, among justice and security goals, to improve the economic lives of those living in the region (SADC, 2008).

Four countries were included by virtue of having conducted HIV testing in their most recent DHS: Kingdom of Lesotho (2004), Republic of Malawi (2004), Kingdom of Swaziland (2006) and Republic of Zimbabwe (2005/2006), with the year in parentheses referring to the most recent DHS with HIV testing for that particular country. Table 2.1 provides background information for the four countries. The countries vary in terms of both geographical and population size, with Swaziland being the smallest and Zimbabwe being the largest in both measures. However, the populations residing in the four countries are similar in a number of ways. The majority of each country's population resides in rural areas. The levels of human development are low, as measured through the Human Development Index (HDI) provided through the UN Development Project. Also, a high proportion of each country's population is living below threshold levels or poverty, as reflected through the Human

[2]These nine countries are: Angola, Botswana, Lesotho, Malawi, Mozambique, Swaziland, Tanzania, Zambia and Zimbabwe.

Poverty Index (HPI). Gender disparities are also prevalent (see Gender-related Development Index, GDI).

HIV/AIDS in SADC

In terms of the four countries included in this study, the HIV prevalence rate is currently the highest in Swaziland (26%). While the HIV prevalence rate is lowest in Malawi (12%), Malawi's rate is still considerably higher when compared to the countries in the rest of the world. Table 2.2 provides a snapshot of the number of HIV positive adults and adult HIV prevalence rates for the four countries.

The vast majority of HIV infections in the sub-Saharan region occur through heterosexual contact. Given the high HIV prevalence rates in the general population, substantial HIV transmission occurs during intercourse not directly involving prostitution. The continuum of sexual exchanges ranges from transactions involving money to sexual concurrency to monogamy. The prevalence is higher among women (who are biologically more susceptible), young people and in urban areas. Although the situation may seem bleak, improvements, such as a gradual drop in the number of new infections (UNAIDS, 2008) have occurred. While recent research has shown that the modes of HIV transmission in the region are more diverse than previous evidence would suggest, injection drug use and sex between men still do not play a significant role (UNAIDS, 2008; Avert, 2008). Since homosexuality is illegal (or highly stigmatized) in the four countries included in this study, no information is available on the number of infections resulting from that avenue.

Voluntary counseling and testing (VCT) has been available in the region since the mid 1990's; however, due to a fear of stigma, the number of individuals actually accessing VCT services is low. Anti-retroviral drugs (ARVs), which delay the onset of AIDS for HIV positive people, have been available since the early 2000's, with the number of people receiving them on the rise (without HIV treatment, the development of HIV into AIDS varies by individuals, depending on for example, nutrition). As the number of individuals receiving HIV treatment grows, so will the number of people living with HIV, reiterating the need to understand the association between labor market participation and HIV status. Nevertheless, while financial affordability is becoming less of an issue, access is still

a problem due to a shortage of medical staff and other problems such as lack of transportation in rural areas (Avert, 2008).

HIV/AIDS and the Labor Market

Although HIV/AIDS undoubtedly affects a country's economic growth, the evidence about its direction of influence has thus far been mixed. Bloom and Mahal (1997) used changes in prevalence of AIDS and rate of growth of GDP per capita to find that the AIDS epidemic had an insignificant effect. Using mortality by disease data, Acemoglu and Johnson (2006) came to a similar conclusion. Given the link between HIV/AIDS and reduced working years (both through deterioration in health and shorter lifespan), it is natural to expect a negative correlation between life expectancy and economic growth. However, they found that life expectancy has a smaller effect on current and future GDP than previously estimated. A variety of explanations are plausible. First, surplus labor exists to take the place of those who have succumbed to AIDS, thereby minimizing negative impacts in the short-term. Second, community based organizations and extended family networks may help to mitigate the loss in income. Third, projections for the number of individuals infected by HIV may be overstated as HIV/AIDS prevention practices become more widespread. In terms of behavioral change, HIV positive individuals may also increase their precautionary savings and limit their consumption in anticipation of the expected future drop in earnings. From simulations using data from South Africa, Young (2005) found that the AIDS epidemic actually results in higher per capita consumption since the reduction in fertility dominates the decline in educational attainment through 2050.

In contrast, even though HIV prevalence rates are starting to stabilize or even decline, simulations conducted using an overlapping generations model show that, in the absence of interventions, severe shrinkages in the size of the South African economy in the future can be expected (Bell, Devarajan, Gersbach, 2006). Bruhns (2006) used Kenyan data from 1920-2000 to forecast effects of HIV/AIDS for the years 2000-2040, and found that per capita income grew significantly more slowly after epidemic outbreak.

Despite the prevalence of diseases other than HIV/AIDS in southern Africa, such as malaria, the effects of HIV on economic outcomes are nevertheless thought to be greater in comparison (Beegle, 2005). HIV strikes adults in their prime working years, and there has also been evidence showing that more educated (and presumably wealthier) individuals are more likely to be HIV positive (Fortson, 2008). Indeed, if HIV was limited to the poor and uneducated, the effects on economic growth would be similarly constrained to that population.

Past research on how HIV affects labor market participation in developing countries has been inconclusive. Werker et al (2006) found that the AIDS epidemic has thus far not had a measurable impact on economic behavior. McKelvey (2007) used a similar approach by taking advantage of the fact that male circumcision reduces the risk of contracting HIV for obtaining identification, and found that HIV does reduce labor force participation for men in certain developing nations. Research has also shown that anti-retroviral therapy does help HIV positive patients in the workforce. In Kenya, such therapy increases the likelihood of labor force participation and the number of hours worked per week (Thirumurthy et al, 2007). Habyarimana et al (2007) found a significant long-term drop in absenteeism among diamond mineworkers in Botswana workers who participated in a treatment program. Finally, Levinsohn (2008) used 2005 data from South Africa to find that the impact of HIV on the labor market varies significantly between genders as well as for different age groups, with more unemployment among women and younger workers.

Methods

Data

This study utilized cross-sectional data from the most recently completed Demographic and Health Surveys (DHS) for Lesotho, Malawi, Swaziland, and Zimbabwe. The DHS was conducted by the Monitoring and Evaluation to Assess and Use Results (MEASURE) program, which is sponsored by the United States Agency for International Development (USAID) as well as contributions from other donors. A standardized questionnaire addressing fertility, family planning, maternal and child health, child survival, HIV/AIDS, malaria, and nutrition was administered to a large number of

households in developing nations in these surveys. Households were randomly chosen so as to be nationally representative. This process was conducted repeatedly for many countries, and repeated within each country, so that comparisons across country and over time are possible (surveys are typically conducted every five years, but with different households in each survey year). Given the origins of the DHS – a systematic data collection process to provide data and analysis on the population, health and nutrition of women and children in developing countries – the number of female respondents far outnumber that of male respondents. Furthermore, earlier surveys only collected data for the household and women, with no separate modules for men.

Beginning in the early 2000's, surveys from certain countries also included voluntary HIV testing for a portion of respondents using blood spots. Some countries offered testing to all respondents, while others only tested a fraction of the population. While such tests are anonymous and individuals are not given their results, referrals for free voluntary counseling and testing as well as AIDS educational materials are provided. HIV test results are linked to individual surveys for research purposes.

Theoretical Model

Given that most households in SADC are without income generating assets (such as land), individuals will choose to work when the existing wage rate exceeds the marginal rate of substitution (MRS) between consumption and leisure and people should work until wage rate=MRS. For the former, healthier individuals are more productive, which influences wage rates and results in substitution and income effects. With the latter, health is valued of its own accord i.e. affects utility directly. Hence, a labor participation function $L = L(H, S, A, B, \varepsilon)$ where H is health, S is schooling, A is individual attributes, B is household attributes, and ε are the unobservables can be estimated to identify the effects (Strauss and Thomas, 1998).

Empirical Model

Although my analysis was done on people who were randomly chosen to be tested, these individuals may be different from those who were not chosen due to sampling error. To check the

representativeness of the sample drawn for testing, comparisons were made of the individuals chosen for testing versus the individuals who were not chosen for testing through descriptive statistics and simple t-tests of means.

Average Treatment Effects (ATE) of HIV status on Employment

Researchers and policymakers are often interested in the average effect of receiving or not receiving a binary treatment with the assumption that this treatment satisfies exogeneity or unconfoundedness. The treatment in this study is an HIV positive diagnosis (so treatment = 1 if an individual is diagnosed as being HIV positive, and = 0 if HIV negative). This approach assumes that the receipt of treatment is independent of potential outcomes if observable covariates are controlled for. In turn, the independence of treatment assignment implies that differences in outcomes between treated and control units with the same covariate values can be attributed to the treatment (Imbens, 2004).

Heckman Selection Models for Willingness to be Tested

Individuals who were randomly selected to be tested have the option of refusing to be tested. People who refuse testing may be inherently different from those who choose to be tested (for example, they may be more likely to be HIV positive and also work less), and hence bias my results. To address selection, I ran a Heckman selection model to obtain consistent results, where the first step is a probit model ran on the full sample to determine the probability of accepting an HIV test and the second step is also a probit model to determine the association between HIV status and labor market participation.

The relationships of interest are:

(1) Selection Equation: $\Pr(z_i = 1) = \Phi(w_i \gamma)$

(2) Outcome Equation: $\Pr(y_i = 1) = \Phi(x_i \beta)$

Here z_i represents whether the individual accepted the HIV test, w_i are interviewer fixed effects, y_i is whether the respondent is currently working/worked in the past 12 months, and x_i are the control

variables (listed below). Thus, the selection equation addresses whether the respondent accepted the HIV test, and the outcome equation looks at whether the individual is currently working/worked in the past 12 months.

To obtain identification, I use an instrumental variables strategy in the selection equation in the form of interviewer fixed effects which is an exogenous factor that affects probability of test refusal but affects neither HIV status nor labor market participation. For instance, it is plausible that specific interviewer characteristics such as gender are likely to influence whether a respondent agrees to an HIV test. Essentially, this approach imposes the exclusion restriction that $w \neq x$. Tests of rho indicated where sample selection is a concern, and Heckman Selection models were used where appropriate.

Propensity Score (PS) for the endogeneity of HIV status

ATE can be estimated with a number of methods. I also used regression adjustment in which the propensity score is included as a covariate where necessary for this study since it has an advantage over traditional regression methods in that the propensity score is nonparametric and does not impose a functional form.

The use of PS to reduce bias when assessing ATE in nonrandomized, observational data was first introduced by Rosenbaum and Rubin (1983). Instead of directly adjusting for all covariates, one can also adjust for differences in the propensity score, $p(X)$, defined as the conditional probability of receiving treatment given pretreatment characteristics. In this study, the propensity score is the predicted probability of being HIV positive rather than HIV negative. PS reduces bias by comparing the outcomes of treated and control groups who are plausible counterfactuals – i.e. individuals who are virtually identical except for treatment and are equally likely to be in the treated or the control group. Since multiple characteristics can be used, the propensity score method summarizes the baseline characteristics into a single variable and thereby avoids any problems with dimension (Becker and Ichino, 2002).

The endogeneity of HIV status with respect to labor market participation needs to be addressed since HIV was not randomly assigned – random assignment of HIV status would be deemed unethical. The use of PS is thus appropriate since the probability of being HIV positive is based only on pretreatment factors, creating a quasi-randomized experiment (D'Agostino, 1998). Two-stage residual inclusion was used to test for endogeneity (Terza et al, 2008).

Combining Heckman Selection Models and Propensity Scores

Both Heckman selection models and propensity scores were used to resolve the problem of correlation between HIV status (the key explanatory variable) and the error term in the outcome equation. Propensity scores will be included in the outcome equation of the Heckman selection models as a covariate; specifically Heckman selection models will be run with and without the propensity scores to address any remaining bias.

The analysis was conducted at the individual level, for men and women aged 15 and above. This age cutoff corresponds to the DHS definition for adults. Weights provided by DHS were used. Finally, models were stratified by gender for each of the four countries as the association between HIV status and labor market participation is likely to differ between men and women given the context of the region.

Dependent Variables

DHS asked its respondents a variety of questions regarding their employment situation. Although the DHS does not ask for any wage information, it nevertheless has responses for labor market participation which are also important. While the questions differ slightly between the four countries, the following was common to all (possible responses given in parentheses):

- Is the respondent currently working (yes, no)?
- Has the respondent worked in the past 12 months (no, in the past year/currently working)?

Key Explanatory Variables

The key explanatory variables for the selection equation looked at whether individuals accepted HIV testing, namely, the interviewer fixed effects. Given the distribution of people per

interviewer, a dichotomous variable was created for each interviewer that had interviewed 100 or more individuals, while interviewers who had interviewed less than 100 individuals were grouped together.

The key explanatory variable for the labor market participation outcome equation was a binary measure of whether an individual was HIV positive or negative. Given the research question, the sample will be restricted to those who were tested for HIV, and will exclude the very few who had indeterminate or missing results. Interactions with age and rural/urban were included as effects may differ depending on the age of an individual, or their type of residence.

Control Variables

The following observed variables were controlled for in the first stage selection equation as they are likely to influence the decision of whether or not to accept an HIV test: age (and age squared), rural/urban residence, educational level (no schooling, primary schooling, secondary schooling, or higher levels), marital status (married or not married), family structure (whether a household has any children under the age of 5), and wealth. Since the DHS does not include commonly used indicators for household economic status, a durables index was constructed by summing asset ownership of the following: radio, television, refrigerator, bicycle, motorcycle/scooter, and car/truck (Case, Paxson, and Ableidinger, 2004). The same observables were controlled for in the second stage labor market participation outcome equation, and in the construction of the propensity score.

Results

Descriptive Statistics

Tables 2.3a.-2.3h. are the descriptive statistics, presented by country and stratified by gender. The p-values from t-tests of difference in means between groups “Not Chosen for testing” and “Chosen for testing” show that the groups usually only differed by sampling error. Note that in Zimbabwe, all individuals were chosen for testing, as were all Malawian men. The “Accepted” column under the group “Chosen for testing” contains the estimates of interest.

Women in Lesotho (36%) and Zimbabwe (36.5%) are less likely to report that they are currently working, followed by women in Swaziland (41.3%) and Malawi (57%). In all countries, a higher percentage of women reported having worked in the past 12 months, perhaps reflecting the seasonal nature of agriculture, a major source of employment. On average, women across the four countries are around 28 years of age (range: 15-49) with the majority residing in rural areas – Zimbabwe, at 67.4%, has the lowest percent of rural women. Wealth levels, as measured by the six item wealth index, range from Lesotho (0.9) to Swaziland (1.9). Education levels differ across the four countries. The majority of women in Lesotho (61.9%) and Malawi (62.6%) reported primary as their highest level of education, whereas the majority of women in Swaziland (50.6%) and Zimbabwe (58.9%) reported secondary level education. Since only a very small portion of women had received education beyond the secondary level, this group was combined with those whose highest level of schooling was secondary. Marriage rates ranged from the lowest (Swaziland, 44.1%) to the highest (Malawi, 77%). Except for Zimbabwean women, most individuals lived in households with at least one child under the age of five, reflecting the caretaking role often fulfilled by the female members of the household.

For women, refusal of HIV test is lowest in Swaziland (7.65%), which also has the highest HIV prevalence rate (31.70%). The HIV prevalence rates for the rest of the countries are: Lesotho (26.11%), Zimbabwe (20.70%), and Malawi (14.62%).

Men in Lesotho (31.3%) are least likely to report they are currently working, followed by Swaziland (50.7%), Malawi (59.2%) and Zimbabwe (65.5%). Similar to women, a higher percentage of men across all four countries reported having worked in the past 12 months. The average age is 30 years old for men in Lesotho and Malawi, and 26/27 for Swaziland/Zimbabwe respectively, with the majority residing in rural areas – Swaziland, at 67.7% has the smallest rural population. Wealth levels are distributed similarly to the women – the poorest being Lesotho (0.86) and the richest in Swaziland (1.91). Education levels differ across the four countries. The majority of men in Lesotho (56.1%) and Malawi (64.1%) reported primary as their highest level of education, whereas the majority of men in

Swaziland (48.3%) and Zimbabwe (63.1%) reported secondary level education. Since only a very small portion of men had received education beyond the secondary level, this group was combined with those whose highest level of schooling was secondary. Men are much less likely to be married than women, with marriage rates ranging from lowest (Swaziland, 32.2%) to the highest (67.8%). A majority of men in Malawi (64.6%) and Zimbabwe (83.7%) lived with children under the age of five in, whereas slightly less then half of men in Lesotho (46.2%) and Swaziland (49.1%) did.

For men, Swaziland again has the lowest HIV test refusal rate (12.90%) and the highest HIV prevalence rate (19.65%). The HIV prevalence rates for the rest of the countries are: Lesotho (18.68%), Zimbabwe (14.09%), and Malawi (10.10%).

HIV Prevalence Rate by Age Groups

As shown in Table 2.4a. HIV prevalence rates for women are highest in the age 30-39 group for Lesotho, Malawi, and Zimbabwe, and highest in the 20-29 age group in Swaziland, which has high rates in all four age groups. Hence, HIV prevalence rates increase with age, and appear to peak during the 30-39 years before dropping.

Table 2.4b. shows the same information for men. HIV prevalence rates are highest in the 30-39 age group in all four countries. Similar to the women, HIV prevalence shares a positive relationship with age, reaches a maximum during the 30-39 period, after which the relationship becomes negative – this is evident by the decreasing rates in the 40-49 and 50+ groups. Note that the HIV prevalence rates for the age 15-19 group are lower for men than for women

Estimated Models

Tables 2.5-2.8 contain the results for Lesotho, Malawi, Swaziland, and Zimbabwe, where models are stratified by gender. Tables labeled with a. are for women and b. for men. Within each table, columns (1) and (2) are the selection and outcome equations for outcome: currently working, and columns (3) and (4) are the selection and outcome equations for outcome: worked in past 12 months. Propensity score adjustment for endogeneity of HIV status was included where residuals from two stage residual inclusion were significant. Note that due to convergence issues, linear

probability models were used for the outcome equations for women in Malawi and Zimbabwe (instead of probit models, as was the case for all other models).

Selection Equations

Across all four countries, the coefficients from the selection equations show that men and women living in rural areas or with a young child in the household are more likely to accept an HIV test. Age was a significant predictor for HIV test acceptance for men from all countries, and women from Swaziland. Among Malawi women and Zimbabwean men, primary and secondary or higher education (as opposed to no education) meant individuals were more likely to accept an HIV test; however, the reverse is true for men and women from Lesotho and Swaziland, where a secondary education is associated with a higher probability of refusal. In all countries except Malawi, wealthier men and women are less likely to agree to an HIV test. Married men and women from Lesotho and married Zimbabwean man are also less likely to agree.

Since fixed effects models are likely to be more consistent, but random effects models are more efficient, Hausman tests were used to see if a random effects model is consistent. Such tests indicated that fixed effects were appropriate.

Outcome Equations

As expected, age is a significant predictor of employment across all countries and both gender. In Lesotho, women with a primary education are more likely to be working than those without any education. However, surprisingly, Lesotho men with secondary or higher education are less likely to be working than men with no schooling. This is perhaps a reflection of the types of jobs available. Also, men with more education may have a higher reservation wage which employers may not be willing to meet. In Malawi, rural women are more likely to be working, as are married women and women living in households with young children. This is plausible given that the majority of the Malawian population is involved in agriculture, and women may be able to care for young children while simultaneously working in the fields. Wealthier Malawian women are less likely to be working.

Men and women residing in rural areas of Swaziland and Zimbabwe are less likely to be working, perhaps because employment opportunities are not as plentiful in rural areas. Women from wealthier households are also more likely to be working; individuals who work are also more likely than those who do not to be able to afford assets. Married women and women with children under the age of five in the household from Swaziland and Zimbabwe are less likely to be working, reiterating the fact that childcare tasks are usually provided by the women of a household. Married Swazi and Zimbabwean men are more likely to be working than unmarried men, likely reflecting the need to take care of a family.

Marginal Effects

The marginal effects of being HIV positive were calculated by taking linear combinations of the relevant coefficients, based upon an average individual. Standard errors were calculated with the delta method. For example, judging from the descriptive statistics, an average Zimbabwean man would own one of the six household assets used to calculate the wealth index, live in a rural area, and have a secondary level education. As evident from table 2.9, being HIV positive has a significantly negative association with the outcomes currently working, and worked in the past 12 months.

Figure 2.1 plots the marginal effect of HIV versus age for an average Zimbabwean man. Being HIV positive has a significantly negative association with the outcome currently working. This negative marginal effect is largest in absolute value terms for men in the 30-39 age group, where HIV prevalence is highest. It should be noted that not everybody who is HIV positive has full-blown AIDS. The negative marginal effects may become larger as AIDS develops and one gets sicker. Since DHS does not observe the state of disease, the true effects of having AIDS may be bigger.

Discussion

The results show that for an average individual there is a significant negative association between being HIV positive and currently working, as well as having worked in the past 12 months for men and women. This finding for men is in line with that of McKelvey (2007) who used male circumcision for identification.

Being HIV positive may impair the ability of men to work more than it does women because in rural areas, men likely engage more in physical labor which requires good health. A description of the duties and tasks involved is needed to determine the validity of this explanation. Respondents who report being in agriculture work could be engaging in activities requiring strength (e.g, carrying heavy objects) or not (e.g. gathering of firewood). Or, since migrant labor is common in the region, men who are present in the household at the time of the survey are likely the ones that are unable to obtain work.

The direction of causality cannot be determined with cross-sectional data alone. It is possible that a positive HIV status is a byproduct of working, instead of vice versa. For example, individuals who work away from home may be more likely to engage in risky sexual relationships than an individual who works closer to home.

Regardless of the direction of influence, these countries cannot afford further slowdowns in economic growth. Unfortunately, the loss of working age individuals will result in a bimodal distribution of the population, consisting of large proportions of children and the elderly. Increasing numbers of children will be forced to enter the labor force instead of receiving an education. If children are HIV positive themselves, they will succumb to AIDS before reaching school going age or adulthood so will be unable to reap the benefits of what they learned. However, the lack of education will not only limit a child's earnings potential in the future, but on a macro level an uneducated labor force is unsustainable in the long run. As ARV drugs become more widespread, the growing number of HIV positive individuals may mean a diversion of limited resources away from other sectors into healthcare.

This study has looked at the quantity of laborers available; however, the quality of laborers is also a concern. For example, the spread of HIV may result in fewer teachers, leading to overcrowded

classrooms and negatively affecting students (Bennell et al, 2002)[3]. Furthermore, the high HIV prevalence rates may be a contributing factor to the "brain drain' problem suffered by the region, particularly in the health care sector, where educated individuals are choosing to pursue labor opportunities in more developed countries (Schrecker and Labonte, 2004).

Gender discrimination is also likely to worsen, as girls are disproportionately pulled out of school to care for sick family members, worsening the already existent inequality between the sexes (Smith, 2002). Also, in subsistence economies, the loss of a male head of household may mean loss of land for the remaining females of the household. For families in rural areas who rely on their own farming for survival, food security may also be a concern (Haddad and Gillespie, 2001). Deteriorating labor input could lead to lower productivity and thus quantities produced, as well as lower quality of output as skills cannot be passed from one generation to the next. Not only is there a direct loss of labor time, but labor time is also lost to care for the sick)

As evident from the data, the population residing in SADC is poor. The problem is worsened in that the poorest are those who most need the income from labor, but also those least likely to be able to afford the necessary medications and care and for whom funeral expenses are likely to send families into debt. Furthermore, the low level of education means that most individuals will have to engage in informal labor activities which are usually physical in nature, and requires daily presence but provides neither financial security nor health insurance. Currently, social protection is inadequate to cover all those afflicted.

Some limitations of this study should be mentioned. In terms of methods, propensity scores only adjust for bias from observed covariates, and thus bias from unobservables is still a concern.

DHS are cross-sectional in nature and hence static, which did not allow me to address dynamic issues. Although more than one survey has been conducted in most countries, the households interviewed are usually different. There are also not enough cross-sectional surveys over

[3]Percent of study sample who are HIV positive and teachers: Lesotho men (22%), Lesotho women (30%), Malawi men (20%), Malawi women (19%), Swaziland men (28%), Swaziland women (22%), Zimbabwe men (21%), Zimbabwe women (18%).

time for the countries of interest to construct a synthetic panel (HIV testing is only available in the latest survey). In addition, the researcher cannot tell when HIV infection occurred. Since health evolves across time, there are both stock and flow components, the latter of which I am unable to capture. Similarly, the feedback loops between health and income requires a panel data set to really be investigated. It is also possible that the effect of HIV on labor market participation is only felt when it becomes full-blown AIDS, as poor individuals may attempt to work as long as they possibly can before reaching that stage. Additional information regarding the progression of disease would be very useful

Unfortunately, no questions are asked regarding wages. Furthermore, high unemployment rates may have resulted from slack in the labor market and hence be the cause of not working, rather than HIV. Finally, since there are no demand side data, the analysis focuses on a partial equilibrium. Linked to labor demand concerns, a further question is the long run implications of HIV for employers, beyond the rise in medical expenditures and absences (whether employees are ill themselves, or are absent from work to care for family members). For instance, Murray et al (2005) found an increase in injury rates among HIV-positive gold miners in South Africa. Furthermore, given the shortened working life span of HIV positive individuals, the incentive for employers to provide training decreases, which has long-term repercussions for the economic development of a country. Finally, stigmatism about HIV in the workplace and inaccurate knowledge about its transmission modes may result in employers becoming less inclined to hire individuals who may be HIV positive.

It should be noted that the due to DHS survey procedures (exclusion of non-household population), the results cannot be generalized to those residing in institutions or individuals who are homeless. Also, both of these populations may face different HIV prevalence rates.

Despite the data shortcomings, the advantage of having HIV testing and the labor outcomes for a nationally representative sample still make DHS the most appropriate to address this study. To my knowledge, few data sets (especially not panel) for the developing world include HIV testing and

detailed labor outcomes. Furthermore, the recent dates of implementation for DHS assist in making this study both timely and policy relevant.

Using various econometric methods to control for endogeneity, this study has found that HIV positive individuals are less likely to be currently working, and less likely to have worked in the past 12 months. Given the costs associated with being sick, this is likely to exacerbate the already weak financial position of many African households. Assistance from external parties is thus needed to alleviate this negative impact.

Table 2.1 Cross Country Comparison

	Lesotho	Malawi	Swaziland	Zimbabwe
Former name	Basutoland	Nyasaland		Rhodesia
Independence	1966	1964	1968	1980
Bordering countries	South Africa	Mozambique, Tanzania, Zambia	Mozambique, South Africa	Botswana, Mozambique, South Africa, Zambia
Geographical Size	30,355 sq km (slightly smaller than Maryland)	118,480 sq km (slightly smaller than Pennsylvania; Lake Nyasa occupies approximately 20% of area)	17,363 sq km (slightly smaller than New Jersey)	390,580 sq km (slightly larger than Montana)
Population Size	2.1 million	13.9 million	1.1 million	12.4 million
% Population in Urban areas	19	18	25	37
Human Development Index (HDI)	0.549 (138)	0.437 (164)	0.547 (141)	0.513 (151)
Human Poverty Index (HPI)	34.5 (71)	36.7 (79)	35.4 (73)	40.3 (91)
Gender-related Development Index (GDI)	0.541 (118)	0.432 (143)	0.529 (122)	0.505 (129)

Source: CIA World Factbook (2008) and UN Development Project (2007/2008).
HDI is a composite measure of life expectancy, literacy and schooling, and purchasing power parity. Higher HDI values indicate a higher level of development. For instance, the United States has a HDI of 0.950.
HPI focuses on proportion living below threshold level of the same measures (and are only measured for developing countries).
GDI measures inequalities in achievement between men and women (using the same dimensions as HDI, but adjusting for gender). For instance, the United States has a GDI of 0.937.
The rankings listed in parentheses are out of 177 countries.

Table 2.2 Current HIV situation in SADC

	Lesotho	Malawi	Swaziland	Zimbabwe
Adult (15+) living with HIV[1]	260 000	840 000	170 000	1 200 000
Adult (15-49) prevalence rate (%)				
UNAIDS/WHO Epidemiological Fact Sheets[1]	23.2	11.9	26.1	15.3
Demographic and Health Surveys[2]	23.5	12.0	26.0	18.0

Source: [1] 2008 Update. In countries with generalized epidemics, national estimates of HIV prevalence are generated from epidemiological models using data from antenatal clinics.
[2] Lesotho and Malawi (2004), Swaziland (2006) Zimbabwe (2005-2006). HIV prevalence rates are generated from results using ELISA tests with dried blood spots voluntarily provided by eligible respondents.

Table 2.3a Descriptive Statistics (unweighted) – Lesotho women

Total Sample Size (Lesotho Women): 6808

	Not Chosen for testing (n=3467)	**Chosen for testing (n=3341)**		
	Mean	**Mean**		**p-value***
		Refused (n=419, 12.54%)	**Accepted (n=2922, 87.46%)**	
Dependent Variables				
Currently Working	0.376	0.468	0.360	0.788
Worked in past 12 months	0.443	0.520	0.422	0.468
Control Variables				
Age (Range: 15-49)	28.184	29.313	28.159	0.619
Std Dev	9.886	9.886	10.017	
Wealth Index (Range: 0-6)	0.940	1.348	0.901	0.508
Std Dev	1.041	1.041	1.067	
Rural	0.724	0.511	0.755	0.972
No education	0.021	0.012	0.028	0.152
Primary level education	0.619	0.465	0.619	0.116
Secondary level education	0.347	0.489	0.341	0.293
Higher education	0.013	0.033	0.011	0.698
Married	0.565	0.535	0.581	0.408
Any children under 5	0.590	0.442	0.605	0.408

* test of difference in means for "Not Chosen for testing" with "Chosen for HIV testing"

HIV negative	2159 (73.89%)
HIV positive	763 (26.11%)

Table 2.3b Descriptive Statistics (unweighted) – Malawi women

Total Sample Size (Malawian Women): 11441

	Not Chosen for testing (n=7715)	**Chosen for testing (n=3726)**		
	Mean	**Mean**		**p-value***
		Refused (n=922, 24.75%)	**Accepted (n=2804, 75.25%)**	
Dependent Variables				
Currently Working	0.565	0.536	0.570	0.771
Worked in past 12 months	0.598	0.572	0.602	0.704
Control Variables				
Age (Range: 15-49)	27.764	27.107	28.114	0.581
Std Dev	9.207332	8.843	9.095	
Wealth Index (Range: 0-6)	1.284	1.262	1.261	0.251
Std Dev	0.995	0.982	0.961	
Rural	0.860	0.841	0.872	0.570
No education	0.231	0.268	0.238	0.091
Primary level education	0.626	0.592	0.626	0.364
Secondary level education	0.137	0.128	0.134	0.506
Higher education	0.006	0.012	0.002	0.497
Married	0.744	0.742	0.770	0.029
Any children under 5	0.731	0.725	0.756	0.049

* test of difference in means for "Not Chosen for testing" with "Chosen for HIV testing"

HIV negative	2394 (85.38%)
HIV positive	410 (14.62%)

Table 2.3c Descriptive Statistics (unweighted) – Swaziland women

Total Sample Size (Swazi Women): 4628

	Not Chosen for testing (n=16)	**Chosen for testing (n=4612)**		
	Mean	**Mean**		**p-value***
		Refused (n=353, 7.65%)	**Accepted (n=4259, 92.35%)**	
Dependent Variables				
Currently Working	0.500	0.561	0.413	0.540
Worked in past 12 months	0.438	0.567	0.434	0.959
Control Variables				
Age (Range: 15-49)	28.875	29.408	27.998	0.754
Std Dev	9.258	9.413	9.804	
Wealth Index (Range: 0-6)	2.063	2.646	1.900	0.770
Std Dev	1.063	1.580	1.408	
Rural	0.875	0.416	0.709	0.104
No education	0.125	0.042	0.086	0.542
Primary level education	0.375	0.201	0.337	0.681
Secondary level education	0.438	0.533	0.506	0.575
Higher education	0.063	0.224	0.071	0.771
Married	0.500	0.476	0.441	0.649
Any children under 5	0.563	0.516	0.668	0.428

* test of difference in means for "Not Chosen for testing" with "Chosen for HIV testing"

HIV negative	2909 (68.30%)
HIV positive	1350 (31.70%)

Table 2.3d Descriptive Statistics (unweighted) – Zimbabwe women

Total Sample Size (Zimbabwean Women): 8622

	Not Chosen for testing (n=0)	Chosen for testing (n=8622)		
	Mean	Mean		p-value*
		Refused (n=1362, 15.80%)	Accepted (n=7260, 84.20%)	
Dependent Variables				
Currently Working		0.390	0.365	
Worked in past 12 months		0.421	0.398	
Control Variables				
Age (Range: 15-49)		27.681	27.765	
Std Dev		9.345	9.437	
Wealth Index (Range: 0-6)		1.859	1.426	
Std Dev		1.531	1.442	
Rural		0.463	0.674	
No education		0.039	0.044	
Primary level education		0.300	0.342	
Secondary level education		0.612	0.589	
Higher education		0.049	0.025	
Married		0.595	0.595	
Any children under 5		0.405	0.390	

* test of difference in means for "Not Chosen for testing" with "Chosen for HIV testing"

HIV negative 5757 (79.30%)
HIV positive 1503 (20.70%)

Table 2.3e Descriptive Statistics (unweighted) – Lesotho men

Total Sample Size (Lesotho Men): 2674

	Not Chosen for testing (n=16)	**Chosen for testing (n=2658)**		
	Mean	**Mean**		**p-value***
		Refused (n=468, 17.61%)	**Accepted (n=2190,82.39%)**	
Dependent Variables				
Currently Working	0.188	0.455	0.313	0.205
Worked in past 12 months	0.438	0.571	0.464	0.716
Control Variables				
Age (Range: 15-59)	25.063	31.209	29.527	0.128
Std Dev	12.556	12.371	12.465	
Wealth Index (Range: 0-6)	1.250	1.297	0.860	0.242
Std Dev	1.390	1.275	0.995	
Rural	0.875	0.592	0.786	0.256
No education	0.125	0.169	0.202	0.475
Primary level education	0.688	0.427	0.561	0.230
Secondary level education	0.125	0.327	0.223	0.279
Higher education	0.063	0.077	0.015	0.353
Married	0.313	0.511	0.469	0.190
Any children under 5	0.688	0.361	0.462	0.095

* test of difference in means for "Not Chosen for testing" with "Chosen for HIV testing"

HIV negative	1781 (81.32%)
HIV positive	409 (18.68%)

Table 2.3f Descriptive Statistics (unweighted) – Malawi men

Total Sample Size (Malawian Men): 3232

	Not Chosen for testing (n=0)	**Chosen for testing (n=3232)**		
	Mean	**Mean**		**p-value***
		Refused (n=836, 25.87%)	**Accepted (n=2396,74.13 %)**	
Dependent Variables				
Currently Working		0.568	0.592	
Worked in past 12 months		0.779	0.782	
Control Variables				
Age (Range: 15-54)		28.636	29.646	
Std Dev		10.374	10.274	
Wealth Index (Range: 0-6)		1.386	1.417	
Std Dev		0.987	0.933	
Rural		0.818	0.854	
No education		0.132	0.104	
Primary level education		0.634	0.641	
Secondary level education		0.213	0.239	
Higher education		0.022	0.017	
Married		0.621	0.678	
Any children under 5		0.629	0.646	

* test of difference in means for "Not Chosen for testing" with "Chosen for HIV testing"

HIV negative	2154 (89.90%)
HIV positive	242 (10.10%)

Table 2.3g Descriptive Statistics (unweighted) – Swaziland men

Total Sample Size (Swazi Men): 4123

	Not Chosen for testing (n=21)	**Chosen for testing (n=4102)**		
	Mean	**Mean**		**p-value***
		Refused (n=529, 12.90%)	**Accepted (n=3573, 87.10%)**	
Dependent Variables				
Currently Working	0.714	0.645	0.507	0.083
Worked in past 12 months	0.714	0.698	0.561	0.210
Control Variables				
Age (Range: 15-49)	27.714	28.938	26.196	0.576
Std Dev	10.140	8.832	9.553	
Wealth Index (Range: 0-6)	2.333	2.248	1.909	0.213
Std Dev	1.592	1.461	1.380	
Rural	0.286	0.490	0.677	0.000
No education	0.048	0.078	0.081	0.583
Primary level education	0.190	0.250	0.358	0.139
Secondary level education	0.571	0.493	0.483	0.428
Higher education	0.190	0.180	0.078	0.115
Married	0.381	0.431	0.322	0.663
Any children under 5	0.952	0.348	0.491	0.650

* test of difference in means for "Not Chosen for testing" with "Chosen for HIV testing"

HIV negative	2871 (80.35%)
HIV positive	702 (19.65%)

Table 2.3h Descriptive statistics (unweighted) – Zimbabwe men

Total Sample Size (Zimbabwean Men):
7116

	Not Chosen for testing (n=0)	**Chosen for testing (n=7116)**		
	Mean	**Mean**		**p-value***
		Refused (n=1601, 22.50%)	**Accepted (n=5515, 77.50%)**	
Dependent Variables				
Currently Working		0.655	0.655	
Worked in past 12 months		0.708	0.691	
Control Variables				
Age (Range: 15-54)		28.716	27.707	
Std Dev		10.274	10.598	
Wealth Index (Range: 0-6)		1.715	1.414	
Std Dev		1.463	1.401	
Rural		0.525	0.695	
No education		0.024	0.016	
Primary level education		0.254	0.308	
Secondary level education		0.633	0.631	
Higher education		0.089	0.046	
Married		0.529	0.479	
Any children under 5		0.738	0.837	

* test of difference in means for "Not Chosen for testing" with "Chosen for HIV testing"

HIV negative	4738 (85.91%)
HIV positive	777 (14.09%)

Table 2.4a HIV Prevalence Rates by Age Group – Women

	Lesotho	Malawi	Swaziland	Zimbabwe
Age 15-19	59/732 (8.06%)	18/524 (3.44%)	106/1063 (9.97%)	96/1740 (5.52%)
Age 20-29	310/1006 (30.82%)	189/1191 (15.87%)	642/1493 (43%)	587/2721 (21.57%)
Age 30-39	268/646 (41.49%)	131/661 (19.82%)	411/982 (41.85%)	569/1693 (33.61%)
Age 40-49	126/538 (23.42%)	72/428 (16.82%)	191/721 (26.49%)	251/1106 (22.69%)

Table 2.4b HIV Prevalence Rates by Age Group – Men

	Lesotho	Malawi	Swaziland	Zimbabwe
Age 15-19	12/605 (1.98%)	2/452 (0.44%)	20/1163 (1.72%)	44/1595 (2.76%)
Age 20-29	122/685 (17.81%)	69/881 (7.83%)	231/1267 (18.23%)	165/1866 (8.84%)
Age 30-39	165/417 (39.57%)	103/576 (17.88%)	295/694 (42.51%)	327/1128 (28.99%)
Age 40-49	71/242 (29.34%)	53/355 (14.93%)	156/449 (34.74%)	193/677 (28.51%)
Age 50-59	39/241 (16.18%)	15/132 (11.36%)		48/249 (19.28%)

Table 2.5a Heckman Selection Model – Lesotho women

	Outcome: Currently Working		Outcome: Worked in past 12 months	
	(1)	(2)	(3)	(4)
	Selection	Outcome	Selection	Outcome
HIV status		2.166***		2.390***
		(0.795)		(0.768)
Age * HIV status		-0.124**		-0.135***
		(0.0526)		(0.0505)
Age Squared * HIV status		0.00181**		0.00206**
		(0.000832)		(0.000800)
Rural * HIV status		-0.143		-0.222
		(0.153)		(0.149)
Age	-0.00205	0.166***	-0.00170	0.188***
	(0.0138)	(0.0283)	(0.0137)	(0.0252)
Age Squared	-8.99e-05	-0.00222***	-0.000101	-0.00260***
	(0.000219)	(0.000426)	(0.000219)	(0.000395)
Rural	0.602***	-0.306	0.561***	-0.201*
	(0.0658)	(0.316)	(0.0522)	(0.111)
Schooling (ref: none)				
Primary	-0.130	0.424**	-0.137	0.346**
	(0.111)	(0.206)	(0.126)	(0.175)
Secondary or Higher	-0.307***	0.432*	-0.320**	0.325*
	(0.114)	(0.242)	(0.129)	(0.182)
Wealth index	-0.135***	0.0699	-0.129***	0.0615*
	(0.0270)	(0.0572)	(0.0188)	(0.0330)
Married	0.104**	0.0923	0.0965**	0.0948
	(0.0423)	(0.0764)	(0.0435)	(0.0644)
Any child under 5 years old	0.105**	-0.0906	0.107***	-0.0725
	(0.0460)	(0.0829)	(0.0370)	(0.0599)
Constant	1.343***	-3.374***	1.426***	-3.543***
	(0.351)	(0.446)	(0.259)	(0.387)
Interviewer Fixed Effects	Yes		Yes	
Chi-squared for FE coefficients	219.47		219.47	
Rho		0.1574829		0.5188295
Chi-Squared for Rho		0.01		2.13
Observations	3341	2922	3341	2922

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2.5b Heckman Selection Model – Lesotho men

	Outcome: Currently Working		Outcome: Worked in past 12 months	
	(1) Selection	(2) Outcome	(3) Selection	(4) Outcome
HIV status		0.817		1.634**
		(0.816)		(0.729)
Age * HIV status		-0.0393		-0.0807**
		(0.0491)		(0.0399)
Age Squared * HIV status		0.000458		0.000908*
		(0.000683)		(0.000534)
Rural * HIV status		-0.0652		0.0425
		(0.249)		(0.123)
Age	-0.0318***	0.143***	-0.0270***	0.152***
	(0.00854)	(0.0191)	(0.00876)	(0.0166)
Age Squared	0.000338***	-0.00189***	0.000269**	-0.00201***
	(0.000118)	(0.000264)	(0.000122)	(0.000227)
Rural	0.553***	-0.0493	0.566***	-0.0202
	(0.0457)	(0.104)	(0.0460)	(0.0781)
Schooling (ref: none)				
Primary	0.0703	0.00188	0.0752*	0.0159
	(0.0439)	(0.0798)	(0.0416)	(0.0730)
Secondary or Higher	-0.218***	-0.270***	-0.202***	-0.250***
	(0.0545)	(0.0987)	(0.0536)	(0.0914)
Wealth index	-0.128***	0.0393	-0.129***	-0.0476*
	(0.0199)	(0.0331)	(0.0181)	(0.0265)
Married	0.0155	-0.00551	0.0178	0.121
	(0.0437)	(0.0849)	(0.0445)	(0.0783)
Any child under 5 years old	0.154***	0.0513	0.159***	0.0865
	(0.0534)	(0.0787)	(0.0328)	(0.0552)
Constant	1.144***	-2.968***	1.053***	-2.795***
	(0.152)	(0.302)	(0.156)	(0.281)
Interviewer Fixed Effects	Yes		Yes	
Chi-squared for FE coefficients	23.88		24.53	
Rho		0.9955145		0.9999753
Chi-Squared for Rho		0.15		1.92
Observations	2658	2190	2658	2190

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2.6a Heckman Selection Model – Malawi women

	Outcome: Currently Working		Outcome: Worked in past 12 months	
	(1) Selection	(2) Outcome	(3) Selection	(4) Outcome
HIV status		0.822**		0.754**
		(0.376)		(0.371)
Estimated Propensity Score		0.672**		0.778***
		(0.284)		(0.281)
Age * HIV status		-0.0469*		-0.0434*
		(0.0243)		(0.0240)
Age Squared * HIV status		0.000657*		0.000603
		(0.000375)		(0.000370)
Rural * HIV status		-0.0372		-0.0188
		(0.0699)		(0.0691)
Age	-0.00273	0.000977	-0.00273	-0.000921
	(0.0200)	(0.0159)	(0.0200)	(0.0157)
Age Squared	0.000196	7.50e-05	0.000196	8.68e-05
	(0.000323)	(0.000240)	(0.000323)	(0.000237)
Rural	0.156*	0.163***	0.156*	0.157***
	(0.0812)	(0.0355)	(0.0812)	(0.0350)
Schooling (ref: none)				
Primary	0.183***	-0.000437	0.183***	-0.000121
	(0.0604)	(0.0243)	(0.0604)	(0.0240)
Secondary or Higher	0.187**	0.0121	0.187**	0.000585
	(0.0923)	(0.0361)	(0.0923)	(0.0356)
Wealth index	0.00149	-0.0186*	0.00149	-0.0205**
	(0.0258)	(0.0103)	(0.0258)	(0.0102)
Married	0.0899	0.0614**	0.0899	0.0742**
	(0.0635)	(0.0295)	(0.0635)	(0.0291)
Any child under 5 years old	0.127**	0.0916**	0.127**	0.110***
	(0.0571)	(0.0403)	(0.0571)	(0.0398)
Constant	-1.493**	0.129	-1.493**	0.198
	(0.677)	(0.172)	(0.677)	(0.170)
Interviewer Fixed Effects	Yes		Yes	
Chi-squared for FE coefficients	263.73		263.73	
Rho		0.09387		-0.03013
Observations	3726	2804	3726	2804

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table 2.6b Heckman Selection Model – Malawi men

	Outcome: Currently Working		Outcome: Worked in past 12 months	
	(1) Selection	(2) Outcome	(3) Selection	(4) Outcome
HIV status		2.645*		3.206**
		(1.433)		(1.415)
Age * HIV status		-0.117		-0.185**
		(0.0789)		(0.0776)
Age Squared * HIV status		0.00145		0.00254**
		(0.00111)		(0.00109)
Rural * HIV status		-0.497*		-0.430
		(0.279)		(0.322)
Age	0.0538***	0.136***	0.0642***	0.285***
	(0.0132)	(0.0224)	(0.0142)	(0.0309)
Age Squared	-0.000724***	-0.00175***	-0.000853***	-0.00383***
	(0.000188)	(0.000315)	(0.000200)	(0.000434)
Rural	0.438***	-0.392***	0.328***	0.126
	(0.0588)	(0.0840)	(0.0575)	(0.0961)
Schooling (ref: none)				
Primary	0.0261	-0.0212	0.0591	0.0790
	(0.0594)	(0.103)	(0.0593)	(0.149)
Secondary or Higher	0.0852	-0.180	0.0940	-0.282*
	(0.0677)	(0.110)	(0.0688)	(0.165)
Wealth index	0.00821	-0.00563	0.0287	-0.0563
	(0.0191)	(0.0307)	(0.0199)	(0.0367)
Married	-0.0230	0.307***	-0.0255	0.605***
	(0.0555)	(0.0895)	(0.0583)	(0.111)
Any child under 5 years old	0.00685	-0.191***	0.00289	-0.0824
	(0.0372)	(0.0597)	(0.0374)	(0.0748)
Constant	0.215	-1.496***	-0.184	-4.378***
	(0.213)	(0.374)	(0.256)	(0.433)
Interviewer Fixed Effects	Yes		Yes	
Chi-squared for FE coefficients	1043.89		1305.97	
Rho		-0.8924824		0.6591473
Chi-Squared for Rho		17.85		9.11
Observations	3232	2396	3232	2396

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2.7a Heckman Selection Model – Swaziland women

	Outcome: Currently Working		Outcome: Worked in past 12 months	
	(1) Selection	(2) Outcome	(3) Selection	(4) Outcome
HIV status		1.387**		1.143**
		(0.554)		(0.548)
Age * HIV status		-0.0888**		-0.0696*
		(0.0361)		(0.0359)
Age Squared * HIV status		0.00126**		0.000958*
		(0.000566)		(0.000563)
Rural * HIV status		0.203**		0.170*
		(0.0889)		(0.0891)
Age	-0.0355***	0.241***	-0.0357***	0.237***
	(0.00848)	(0.0190)	(0.00839)	(0.0186)
Age Squared	0.000462***	-0.00305***	0.000476***	-0.00304***
	(0.000137)	(0.000298)	(0.000135)	(0.000294)
Rural	0.517***	-0.358***	0.509***	-0.297***
	(0.0260)	(0.0574)	(0.0258)	(0.0573)
Schooling (ref: none)				
Primary	-0.00823	0.0669	-0.0292	0.0480
	(0.0398)	(0.0794)	(0.0395)	(0.0797)
Secondary or Higher	-0.253***	0.0450	-0.267***	0.0607
	(0.0398)	(0.0786)	(0.0394)	(0.0787)
Wealth index	-0.0509***	0.0640***	-0.0507***	0.0542***
	(0.00879)	(0.0158)	(0.00866)	(0.0155)
Married	-0.0133	-0.0898*	-0.0304	-0.0864*
	(0.0289)	(0.0484)	(0.0286)	(0.0480)
Any child under 5 years old	0.182***	-0.104**	0.191***	-0.138***
	(0.0250)	(0.0449)	(0.0245)	(0.0445)
Constant	1.830***	-4.288***	1.887***	-4.125***
	(0.166)	(0.283)	(0.164)	(0.276)
Interviewer Fixed Effects	Yes		Yes	
Chi-squared for FE coefficients	357.34		347.79	
Rho		0.9485232		0.9231157
Chi-Squared for Rho		26.56		29.27
Observations	4612	4259	4612	4259

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2.7b Heckman Selection Model – Swaziland men

	Outcome: Currently Working		Outcome: Worked in past 12 months	
	(1) Selection	(2) Outcome	(3) Selection	(4) Outcome
HIV status		2.551***		1.450
		(0.779)		(0.978)
Estimated Propensity Score				-1.854***
				(0.488)
Age * HIV status		-0.139***		-0.0573
		(0.0486)		(0.0616)
Age Squared * HIV status		0.00187**		0.000696
		(0.000730)		(0.000921)
Rural * HIV status		-0.270**		-0.548***
		(0.117)		(0.153)
Age	-0.101***	0.276***	-0.0934***	0.471***
	(0.00852)	(0.0185)	(0.00864)	(0.0315)
Age Squared	0.00147***	-0.00383***	0.00139***	-0.00660***
	(0.000138)	(0.000296)	(0.000137)	(0.000456)
Rural	0.246***	-0.243***	0.259***	-0.332***
	(0.0278)	(0.0558)	(0.0273)	(0.0555)
Schooling (ref: none)				
Primary	-0.0382	0.0495	-0.100**	0.0302
	(0.0487)	(0.0901)	(0.0469)	(0.0978)
Secondary or Higher	-0.0920*	-0.138	-0.154***	-0.278***
	(0.0488)	(0.0876)	(0.0457)	(0.0975)
Wealth index	-0.0563***	0.00324	-0.0496***	-0.00968
	(0.00948)	(0.0165)	(0.00851)	(0.0166)
Married	-0.0362	0.272***	-0.0513	0.521***
	(0.0365)	(0.0667)	(0.0340)	(0.0788)
Any child under 5 years old	0.228***	-0.0299	0.222***	-0.156***
	(0.0238)	(0.0467)	(0.0233)	(0.0453)
Constant	2.493***	-4.293***	2.479***	-6.194***
	(0.150)	(0.279)	(0.150)	(0.399)
Interviewer Fixed Effects	Yes		Yes	
Chi-squared for FE coefficients	274.98		638.48	
Rho		0.9135402		-1
Chi-Squared for Rho		32.33		0.67
Observations	4102	3573	4102	3573

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2.8a Heckman Selection Model – Zimbabwe women

	Outcome: Currently Working		Outcome: Worked in past 12 months	
	(1)	(2)	(3)	(4)
	Selection	Outcome	Selection	Outcome
HIV status		0.0565		0.154
		(0.180)		(0.183)
Age * HIV status		-0.00271		-0.00994
		(0.0117)		(0.0119)
Age Squared * HIV status		4.13e-05		0.000159
		(0.000183)		(0.000186)
Rural * HIV status		-0.0353		-0.0470*
		(0.0279)		(0.0284)
Age	-0.00623	0.0548***	-0.00623	0.0623***
	(0.0137)	(0.00545)	(0.0137)	(0.00557)
Age Squared	0.000126	-0.000749***	0.000126	-0.000887***
	(0.000222)	(8.82e-05)	(0.000222)	(9.02e-05)
Rural	0.499***	-0.0566***	0.499***	-0.0674***
	(0.0512)	(0.0209)	(0.0512)	(0.0214)
Schooling (ref: none)				
Primary	0.0192	0.0474	0.0192	0.0547
	(0.0917)	(0.0329)	(0.0917)	(0.0336)
Secondary or Higher	0.0996	0.0575*	0.0996	0.0596*
	(0.0954)	(0.0342)	(0.0954)	(0.0351)
Wealth index	-0.0194	0.0282***	-0.0194	0.0253***
	(0.0143)	(0.00541)	(0.0143)	(0.00554)
Married	-0.0388	-0.0336**	-0.0388	-0.0339**
	(0.0407)	(0.0153)	(0.0407)	(0.0156)
Any child under 5 years old	0.143***	-0.0479***	0.143***	-0.0505***
	(0.0374)	(0.0142)	(0.0374)	(0.0146)
Constant	0.810***	-0.376***	0.810***	-0.412***
	(0.264)	(0.0843)	(0.264)	(0.0863)
Interviewer Fixed Effects	Yes		Yes	
Chi-squared for FE coefficients	266.03		266.03	
Rho		-0.92944		-0.94597
Observations	8622	7260	8622	7260

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2.8b Heckman Selection Model – Zimbabwe men

	Outcome: Currently Working		Outcome: Worked in past 12 months	
	(1) Selection	(2) Outcome	(3) Selection	(4) Outcome
HIV status		1.772***		2.355***
		(0.571)		(0.639)
Estimated Propensity Score		-0.753**		-1.038***
		(0.308)		(0.342)
Age * HIV status		-0.105***		-0.150***
		(0.0346)		(0.0396)
Age Squared * HIV status		0.00139***		0.00222***
		(0.000504)		(0.000590)
Rural * HIV status		-0.172		-0.286**
		(0.111)		(0.132)
Age	-0.0173**	0.251***	-0.0182**	0.312***
	(0.00725)	(0.0171)	(0.00718)	(0.0180)
Age Squared	0.000248**	-0.00333***	0.000263**	-0.00418***
	(0.000104)	(0.000235)	(0.000103)	(0.000248)
Rural	0.417***	-0.121**	0.442***	-0.134**
	(0.0294)	(0.0483)	(0.0290)	(0.0528)
Schooling (ref: none)				
Primary	0.543***	0.127	0.535***	0.327*
	(0.0854)	(0.150)	(0.0841)	(0.167)
Secondary or Higher	0.455***	0.0969	0.455***	0.191
	(0.0855)	(0.151)	(0.0844)	(0.168)
Wealth index	-0.0390***	0.0185	-0.0369***	0.0236
	(0.00844)	(0.0145)	(0.00848)	(0.0157)
Married	-0.121***	0.278***	-0.120***	0.352***
	(0.0324)	(0.0651)	(0.0320)	(0.0730)
Any child under 5 years old	0.113***	-0.144***	0.105***	-0.0771*
	(0.0219)	(0.0395)	(0.0214)	(0.0415)
Constant	-0.291*	-3.414***	-0.329*	-4.269***
	(0.172)	(0.280)	(0.169)	(0.306)
Interviewer Fixed Effects	Yes		Yes	
Chi-squared for FE coefficients	1304.21		1337.7	
Rho		-0.9689355		-0.9568463
Chi-Squared for Rho		73.3		67.19
Observations	7116	5515	7116	5515

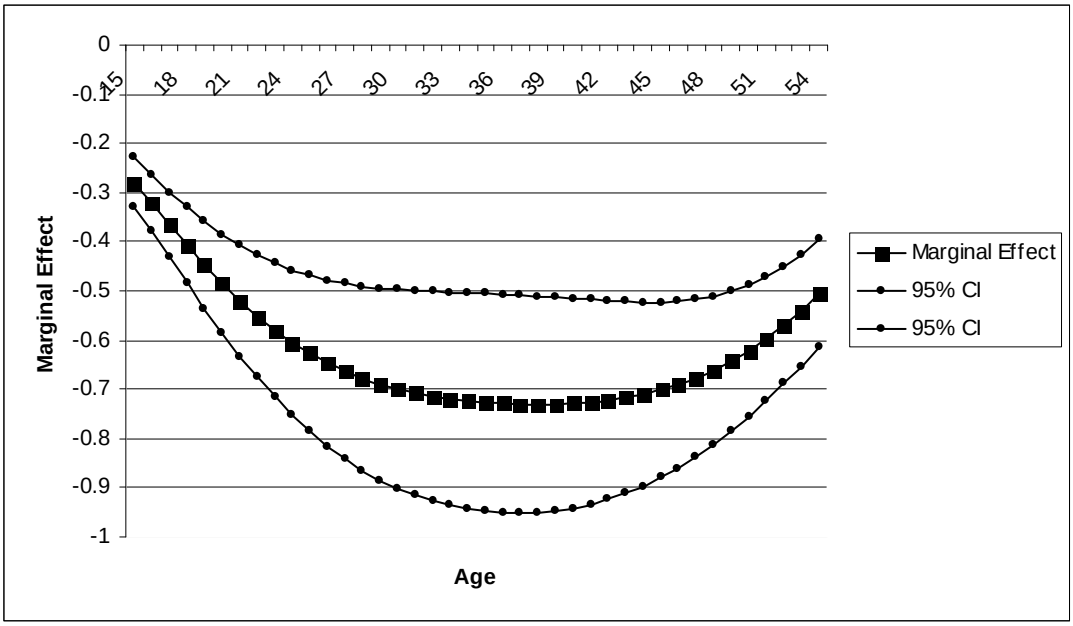
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2.9 Marginal Effects of being HIV Positive (average individual)

	Outcome: Currently Working		Outcome: Worked in past 12 months	
Lesotho				
Women	-0.387	***	-0.455	***
	(0.068)		(0.032)	
Men	-0.236		-0.411	***
	(0.164)		(0.083)	
Malawi				
Women	-0.322	**	-0.292	*
	(0.149)		(0.152)	
Men	-0.733	***	-0.907	***
	(0.080)		(0.051)	
Swaziland				
Women	-0.347	***	-0.321	***
	(0.080)		(0.121)	
Men	-0.464	***	-0.559	*
	(0.023)		(0.333)	
Zimbabwe				
Women	-0.027		-0.070	
	(0.067)		(0.070)	
Men	-0.680	***	-0.825	***
	(0.122)		(0.083)	

*** p<0.01, ** p<0.05, * p<0.1

Figure 2.1 Marginal Effect of HIV status on Outcome: Currently Working (Zimbabwean man)



References

1. Acemoglu, Daron and Simon Johnson, 2006, "Disease and Development: The effect of life expectancy on economic growth," *NBER Working Paper 12269*.

2. Becker, Sascha O. and Andrea Ichino, 2002, "Estimation of average treatment effects based on propensity scores," *The Stata Journal*, 2(4): 358-377.

3. Beegle, Kathleen, 2005. "Labor Effects of Adult Mortality in Tanzanian Households," *Economic Development and Cultural Change*, 53: 655-683.

4. Bell, Clive, Shantayanan Devarajan, and Hans Gersbach, 2006, "The long-run economic costs of AIDS: a model with an application to South Africa," *World Bank Economic Review* 20(1): 55-89.

5. Bennell, Paul, Karin Hyde, and Nicola Swainson, 2002, "The Impact of the HIV/AIDS epidemic on the education sector in sub-Saharan Africa," *Centre for International Education, University of Sussex Institute of Education*.

6. Bloom, David E. and Ajay S. Mahal, 1997, "Does the AIDS epidemic threaten economic growth?" *Journal of Econometrics*, 77: 105-124.

7. Bruhns, Ramona, 2006, "The Long-run Effects of HIV/AIDS in Kenya," *Yale University, Economic Growth Center*.

8. D'Agostino, Ralph B, 1998, "Tutorial in Biostatistics; Propensity Score Methods for Bias Reduction in the Comparison of a Treatment to a Non-Randomized Control Group," *Statistics in Medicine*, 17: 2265-2281.

9. Dorward, Andrew R, Idrissa Mwale, and Rosalba Tuseo, 2006, "Labor Market and Wage Impacts of HIV/AIDS in Rural Malawi," *Review of Agricultural Economics*, 28(3): 429-439.

10. Fortson, Jane, 2008, "The Gradient in Sub-Saharan Africa: Socioeconomic Status and HIV/AIDS," *Demography*, 45(2): 303-322.

11. Fortson, Jane, 2008, "Mortality Risk and Human Capital Investment: The Impact of HIV/AIDS in Sub-Saharan Africa," *Under Review*.

12. Habyarimana, James, Bekezela Mbakile and Christian Pop-Eleches, 2007, "HIV/AIDS, ARV Treatment and Worker Absenteeism: Evidence from a Large African Firm," *Draft*.

13. Haddad, Lawrence and Stuart Gillespie, 2001, "Effective Food and Nutrition Policy to HIV/AIDS: What we know what we need to know," *International Food Policy Research Institute, Food Consumption and Nutrition Division Discussion Paper No 112.*

14. Imbens, Guido W., 2004, "Nonparametric Estimation of Average Treatment Effects under Exogeneity: A Review," *Review of Ecnomics & Statistics*, 86(1): 4-29.

15. Lesotho Clothing & Allied Workers' Union, 2006, "Highlights of current labor market conditions in Lesotho," *Global Policy Network*.

16. Levinsohn, Jim, 2008, "HIV status and Labor Market Participation in South Africa," *Working Paper*.

17. Lisk, Franklyn, 2002, "Labor market and employment implications of HIV/AIDS,"*Working Paper, ILO Programme on HIV/AIDS and the World of Work.*

18. McKelvey, Christopher, 2007, "Circumcision and the Labor Market Consequences of HIV in Developing Countries, " *Preliminary draft.*

19. Montgomery, Catherine M., Victoria Hosegood, Joanna Buszam and Ian M. Timaeus, 2006, "Men's involvement in the South Africa family: Engendering change in the AIDS era," *Social Science and Medicine,* 62: 2411-2419.

20. Murray, Jill, Pam Sonnenberg, Gill Nelson, Stuart Shearer, Andre Bester, Arther Begley, and Judith R. Glynn, 2005, "Effect of HIV on work-related injury rates in South African gold miners," *AIDS*, 19:2019-2024.

21. Rosenbaum, Paul R. and Donald B. Rubin, 1983, "The central role of the propensity score in observational studies for causal effects," *Biometrika*, 70 (1): 41-55.

22. Schrecker, Ted and Ronald Labonte, 2004, "Taming the Brain Drain: A Challenge for Public Health Systems in Southern Africa," *International Journal of Occupational and Environmental Health*, 10: 409-415.

23. Smith, Mohga Kamal, 2002, "Gender, poverty, and intergenerational vulnerability to HIV/AIDS," *Gender & Development*, 10(3): 63-70.

24. Strauss, John and Duncan Thomas, 1998, "Health, Nutrition, and Economic Development," *Journal of Economic Literature*, 36: 766-817.

25. Terza, Joseph V., Anirban Basu, and Paul J, Rathouz, 2008, "Two-stage residual inclusion estimation: Addressing endogeneity in health econometric modeling," *Journal of Health Economics*, 27: 531-543.

26. Thirumurthy, Harsha, Joshua Graff Zivin, Markus Goldstein, 2007, "The Economic Impact of AIDS Treatment: Labor Supply in Western Kenya," *Journal of Human Resources*, 43(3): 511-552.

27. Werker, Eric, Amrita Ahuja and Brian Wendell, 2006, "Male Circumcision and AIDS: The Macroeconomic Impact of a Health Crisis," *Working paper*.

28. World Bank, 2000, "Swaziland; Reducing Poverty Through Shared Growth," *Human Development Group, Eastern and Southern Africa Report No 19658-SW.*

29. Young, Alwyn, 2005, "The Gift of the Dying: The Tragedy of AIDS and the Welfare of Future African Generations," *Quarterly Journal of Economic*, 120: 423-466.

30. Young, Alwyn, 2005, "In Sorrow to Bring Forth Children: Fertility amidst the Plague of HIV," *Working Paper, University of Chicago Graduate School of Business*.

CHAPTER III: THE EFFECTS OF ORPHAN FOSTERING ON THE EDUCATION, EMPLOYMENT, AND HEALTH OF CO-RESIDING YOUNG ADULTS IN METROPOLITAN CAPE TOWN

Introduction

For many years, the number of HIV/AIDS related deaths in developing countries has been increasing at such an alarming rate that the question is no longer whether the disease will be an epidemic, but rather how severe the epidemic will be. The human suffering and declines in health associated with HIV/AIDS have been well-documented; however, the disease also has consequences for people who are not infected. Premature parental deaths in countries with generalized AIDS epidemics have resulted in an increasing number of orphans. As the number of orphans grows, the need for foster care will rise correspondingly. An example of this phenomenon can be seen in South Africa, where 3.7 million orphans are in need of care, at least half of whom are attributable to HIV/AIDS (Children's Institute, 2009).

Much research on the effects of HIV on youth in Africa has focused on AIDS orphans, comparing their outcomes (usually schooling, with some attention to other outcomes) with those of non-orphans (see discussion below). In contrast, relatively little research has looked at the effects of HIV on young persons in households which foster orphans.

Upon parental death, African families are often disbanded with children being sent to live with relatives; these familial networks in African culture have often been suggested as a reason why the impact of HIV on orphans is less severe than expected. Voluntary fostering, when children with living parents are sent to live with relatives in order to access better schools is common practice in this setting. However, AIDS orphans most frequently represent involuntary fostering (Madhavan, 2004).

While much research has focused on the plight of orphans and orphan placement, comparatively little has been written about other vulnerable groups. In southern Africa, double orphans who have lost both parents are usually absorbed into a relative's household; single orphans losing just one parent are also often sent to live with relatives. Given limited resources, another group of individuals could be negatively affected – the existing household members.

This study uses a longitudinal data set to highlight the effects of HIV for the young adults aged 14-18 in 2002 that lived in households which fostered orphans; outcomes of interest are the school enrollment, employment, and health status of young adults in the households who are ***not*** orphans. The aim is to bridge the current information gap by providing empirical evidence of the spillover effects of fostering to help inform welfare policies. The teenage years are a crucial development phase that without proper care and guidance may result in teenagers being prone to negative outcomes. The data are from the Cape Area Panel Study (CAPS), a project covering the metropolitan Cape Town area of South Africa that followed a representative group of young adults and their families from 2002 to 2006. While the HIV prevalence rate of 5.7% is lower in metropolitan Cape Town when compared to the whole country, projections for 2010 show the HIV prevalence rate to be on the rise in Cape Town, along with an increasing number of HIV/AIDS related deaths (City of Cape Town, 2008).

Background

Relative Effects of Orphan Status on Schooling Outcomes

Case, Paxson, and Ableidinger (2004) used data from 10 sub-Saharan countries to examine the impact of orphanhood on school enrollment. While children from poorer households are less likely to be enrolled, and orphans are more likely to come from poor households, they also find that intra household discrimination exists, in that orphans are less likely than non-orphans to be in school, which can be explained by the tendency of orphans to live with distant or non-related caregivers. The authors use Hamilton's Rule to explain why the discrimination exists – i.e. the lack of close biological

ties implies that the caregivers may not feel the same affinity towards the children, perhaps since they do not expect as great a transfer in future.

Ainsworth, Beegle and Koda (2005), using data from the Kagera region of Tanzania, found that a coping mechanism of Tanzanian households when faced with adult death is to delay enrolling biological young children (ages 7-10) but continue enrolling older children (ages 11-14). Evans and Miguel (2007) used a Kenyan panel data set to find that school participation is substantially decreased following parental death, with the drop occurring before death. Using the Cape Area Panel Study, Anderson and Beutel (2009) found that double orphans are less likely to be enrolled in school when compared to non-orphans, single orphans, and fostered children.

Effects of Other Factors on Child Outcomes

Orphan status alone may not deter enrollment. Ainsworth and Filmer (2002), using 1990s data from 28 sub-Saharan countries, found that the enrollment gap between children from richer and poorer households dwarfs the orphan enrollment gap for the majority of households. The gender of the HIV inflicted parent also makes a difference. Lloyd and Blanc (1996) find that in sub-Saharan Africa, female-headed households are comparatively disadvantaged economically, but after controlling for the differences in wealth across households, children are consistently more likely to be enrolled in school and have higher grade completion in female-headed households. Case and Ardington (2006) analyzed longitudinal data from the province of KwaZulu-Natal in South Africa to find that maternal death had a significant impact on both enrollment and completion of children's schooling, whereas paternal death was a significant predictor of household socioeconomic status. In their cohort study from the Kagera region of Tanzania, Beegle, De Weerdt, and Dercon (2009) found that maternal orphans were two centimeters shorter with a one year schooling deficiency.

The gender of the orphan also makes plays an important role. For instance, Yamano and Jayne (2005) found that the negative impact of losing a parent to be greater on girls than boys. While most studies focus on effects for children under the age of 15, Yamano, Shimamura, and Sserunkuuma (2006) found lower school attendance among females aged 15-18.

Externalities of Fostering Orphans

Fostering orphans can affect households in a number of ways. Orphans are a benefit as they can provide an extra source of labor – older orphans can engage in income-producing work outside the household, while younger orphans can contribute working time within the household, such as by doing household chores or providing childcare. Similarly, depending on the gender of the orphan, the type of labor provided may differ. Assuming that individuals are altruistic, satisfaction can be derived from caring for an orphan. Using data from Burkina Faso and household and child fixed effects models to address the endogeneity of fostering, Akresh (2004) found increased enrollment for all household children after the introduction of a foster child, suggesting a positive impact (what he terms a "Pareto improvement in schooling"). Indeed, fostering may protect households from negative shocks.

However, orphans also impose a cost. At the most basic level, these costs include food, shelter, and clothing, while additional expenses include school fees, medical care, transport and so forth. Financial pressure may result in children and adolescents already present in households being forced to work, since limited resources would be spread among more people. Furthermore, intangible costs also occur, such as limited parental time, which would be split between a greater number of people if the household took in orphans. In total, fostering orphans may generate negative externalities for the young adults in the household, for which no direct reimbursement occurs. This hypothesis is particularly plausible since it is often the poorest relatives who are taking in the orphans (Foster and Williamson, 2000).

Only a few papers have attempted to quantity this spillover effect. Evans (2005) used a variety of estimation strategies on Demographic and Health Survey (DHS) data from 26 African countries (spanning the years 1991-2002) and found no evidence of negative spillover effects after an orphan joins a household on the outcomes of school enrollment, young children's likelihood of being stunted or underweight, and women's likelihood of being underweight. However, DHS data are cross-sectional in nature which is a limitation to his findings. Parikh et al (2007) used longitudinal data

from the province of Kwazulu-Natal in South Africa and found no differences in most education, health and labor outcomes between orphans and non-orphans from the same household. The lack of significant findings may be due to the study sample used. Schools were their only recruitment source, and thus may exclude the orphans who are worse-off. This study adds to the literature by providing evidence on the externalities of fostering an orphan for young adults living in households which fostered orphans.

Methods

Data

The Cape Area Panel Study (CAPS) started as a collaboration between the Population Studies Center in the Institute for Social Research at the University of Michigan and the Center for Social Science Research at the University of Cape Town, with primary funding from the National Institute of Child Health and Human Development and the Andrew W. Mellon Foundation. Starting in wave 4 (2006), Princeton University became a collaborator, with funding provided through a National Institute on Aging grant (Lam, 2008). CAPS has two panel components – young adults and households – both of which are used in this study.

The main focus of CAPS is a representative sample of young persons between the ages of 14 and 22 (at the first wave in 2002) in Cape Town who are followed as they transition to adulthood. The survey covers a range of outcomes including schooling, employment, sexual and reproductive health, and intergenerational familial support. Up to three young adults per household were included as an analysis of census data showed that few households contained more than three young adults. Four waves of data have been collected. While the core survey component was administered to young adults for waves 1, 3 and 4, each of those waves also included unique elements. Wave 3 (2005) targeted the full set of young adults originally interviewed in Wave 1 in order to update the previously collected core components of CAPS. New questions for young adults included a detailed history of residence, schooling, and sexual partners, as well as intergenerational transfers. Wave 4 (2006)

looked at the full original sample (aged 18-26) as well, with survey questions similar to those from wave 3.[4]

A household questionnaire was also administered over the same period (2002-2006) for households with and without young adults. However, CAPS is not a household panel by design. Similar to the young adult questionnaires, a core survey component was administered to each household for waves 1, 3 and 4, with each of those waves also including unique elements. Wave 1 asked respondents (with respondents being 18 years or older and very knowledgeable about household members) questions regarding the demographic composition, schooling, and employment of household members. Wave 2 focused on young adults, and thus only had a brief household roster within the young adult questionnaire looking at household composition, but it does not have any detailed information). Waves 3 and 4 use a similar household questionnaire, with additional questions looking at the health and health care use of household members. Waves 3 and 4 also had additional modules looking at household expenditures, shocks to the household and financial transfers to and from the household

The CAPS sample was identified through a stratified two-stage process. The first stage involved the selection of sample clusters using the 1996 census Enumeration Areas (EA), and then households were randomly selected within each EA in the second stage. Weights provided by the CAPS team will be used to address sample design and non-response issues such that results are representative of the young adult population of Cape Town. The adjustment for sample design is needed as a result of intentional oversampling of African and white households, intentional differential sampling of households with and without young adults, and the addition of secondary households into the sample of screener households.

[4]Wave 1 (2002) included an evaluation of the literacy and numeracy of young adults in the sample. Wave 2a (2003) re-interviewed approximately one-third of the original sample and focused on sex and AIDS, while Wave 2b (2004) re-interviewed the remaining two-thirds and focused on further topics pertaining to employment, unemployment, and school choice.

This study used waves 1 (2002), 3 (2005) and 4 (2006) of both components as wave 2 did not interview the full young adult sample. The sample has been restricted to Black/African and Colored (families of mixed race origins) families, since orphan fostering occurs predominantly among families from these two population groups. Only one White/Caucasian household was found to be fostering an orphan across the panel, and orphan fostering was not found in Indian/Asian households at all during the same time period. This concentration of fostering among certain racial groups reflects not only history, but also the varying HIV/AIDS prevalence levels, as HIV infection rates are found to be highest among Black South Africans.

Theoretical Model

In the classic household production model introduced by Becker (1965), households seek to maximize their utility subject to a variety of constraints, which determines the allocation of time among various activities such as work and leisure. This model can be applied towards orphan fostering (Ravallion and Wodon, 2000; Zimmerman, 2003). Assume a simplified household utility U = U(C, W_{YA}, O; Z) where C = household consumption of goods, W_{YA} = education/employment (or leisure)/health of young adult, O = presence of an orphan, and Z = vector of exogenous household variables. Fostering orphans can thus affect utility directly (e.g. altruistic individuals would gain satisfaction) and indirectly (e.g. if orphans worked, then their income could contribute towards household consumption). The maximization of this household utility function subject to time and budget constraints will determine young adult outcomes.

Empirical Model

The following model was used to measure the effect of fostering on non-orphan young adults:

$$y_{iht} = \alpha_i + \beta\ F_{iht} + \sum_k \lambda_k X_{ikht} + \sum_m \lambda_m Z_{imht} + \sum_n \lambda_n A_{inht} + \varepsilon_{iht}$$

y_{iht} = outcome of non-orphan young adult *i* in household *h* for time *t*

α_i = young adult person fixed effects

F_{iht} = 1 if household is fostering at least one orphan

X_{ikht} = vector of time-varying young adult characteristics

Z_{imht} = vector of time-varying household characteristics

A_{inht} = vector of orphan characteristics

ε_{iht} = error term

Dependent Variables

Three main dependent variables were asked of all young adults: (1) current enrollment in primary, secondary school, or university/technikon (yes=1/no=0). (2) employment in the last 12 months for wave 1, and between surveys for waves 3 and 4 (yes=1/no=0); and (3) self-reported health of respondent, reported as poor, fair, good very good, or excellent. The health variable has been dichotomized such that 0 = poor, fair, or good health, and 1 = very good and excellent health.

By law, children are required to be in school up to the age of 15 or ninth grade, depending on which milestone is reached first. Thus, not being in school until age 15 or ninth grade is unambiguously bad. Being employed full-time is usually a bad outcome for young children, but at some age, being employed may be perceived as a good outcome (or at least preferable to being out of school and unemployed). While it is important to look at health outcomes, given the time frame of the survey and age of the sample, the impacts on health outcomes are likely to be minimal.

Key Explanatory Variables

The key explanatory variables of interest pertain to whether a household is fostering orphans at the time of the wave. Using the household roster, households are coded as *fostering an orphan* if individuals 18 years of age or younger have lost either both or one of their parents (either to death, or unknown). A double orphan would thus be one that has lost both of his or her parents, while maternal (paternal) orphans signal the loss of the mother (father). A household is only considered to be fostering an orphan if a living parent is not a member of the same household. Orphans could be the nephew/niece, cousin, other family member or unrelated to the young adult. Not all households are fostering an orphan, and some households may foster more than one orphan.

A binary indicator for whether the household was fostering more than one orphan was included, as it is plausible that negative effects of fostering are stronger when a household fosters more than one orphan. In addition, the effect of fostering may vary by household characteristics, so interactions were considered for the orphan indicator with the wealth quintiles (described below).

Control Variables

Many characteristics are likely to influence both the decision to foster an orphan and outcomes of current household young adults and controls were included for these potential confounders wherever possible.

A household's financial position is likely to affect both the ability to foster orphans and outcomes of household members. Household wealth is represented through ownership of assets, constructed by summing across thirteen household goods (radio/stereo/cassette recorder, TV, video/VCR/DVD, telephone, cellular phone, refrigerator/freezer, gas/electric stove, microwave, washing machine, bicycle, motorcycle, car/bakki/combi, and computer/laptop)[5] such that households that own more of the 13 assets are likely to be financially better off than households that own fewer assets. Wealth quintiles were then created from the sum of the 13 assets. Various grants are available to care of children, with qualification determined through a means test. The Child Support Grant is for primary caregivers of children under the age of 15, and the Foster Child Grant is a monthly payment received by foster parents appointed in court (Cape Gateway, 2009), neither of which covers the full cost of raising an orphan. The models include an indicator of whether anyone in the household received either of the two grants.

Young person characteristics include age and gender. Inconsistencies in age for a small number of observations were identified and rectified using the individual's birth date and the date of the interview or the modal age. Various functional forms (for example, age squared versus age

[5]Summing asset ownership is accepted practice for surveys which do not include commonly used indicators for household economic status, see for example Case, Paxson, and Ableidinger (2004).

groups) were tested to ensure the most appropriate model specification. Wave indicators for waves 3 and 4 were also included.

Model Estimation

Endogeneity of having a fostered orphan in the household can bias the estimated coefficients. For instance, households which take in orphans may have an inherent preference for children, which heightens both the probability of fostering and of good outcomes for the children. The panel data with repeat observations on the same people over time helps to identify unbiased parameter estimates by making it possible to control for unobserved time-invariant characteristics. An individual fixed effects approach was therefore considered to control for unobserved time-invariant individual characteristics. Since fixed effects models are likely to be more consistent, but random effects models are more efficient, Hausman tests were used to see if a random effects model is consistent. Such tests indicated that fixed effects were appropriate for the School Enrollment and Employment models, while random effects were appropriate for the Health Status model.

An instrumental variables (IV) approach was also explored, using area orphan rate, area orphan rate squared, and asset index multiplied by the area orphan rate as instruments for whether the household is fostering an orphan. However, the instruments proved to be weak and could not be shown to be validly excluded, so the IV results are not included.

Given the dichotomous nature of the outcomes of interest but the need to use person fixed effects for two models, Linear Probability Models (LPM) were used. While such models can suffer from unbounded predicted probabilities and constant marginal effects, these problems are more likely when the mean of the dependent variable is close to either 0 or 1. In this study, the mean of the dummy dependent variables are close to 0.5 (means of school enrollment, employment, and health are 0.55, 0.35, and 0.59, respectively), so estimated marginal effects and inferences should be similar to those produced by logit or probit models.

Weights were incorporated to account for sample design and non-response. Standard errors were adjusted for clustering at the household level, as up to three young adults are interviewed at each

household. The final sample consisted of 1661 young adults in wave 1, 1658 young adults in wave 3 and 1666 young adults in wave 4.

Results

Descriptive Statistics

Table 3.1 provides descriptive statistics for the analysis sample, which followed roughly 1660 young persons over the three waves. Fifty-seven, 86, and 92 young adults were living in households which fostered orphans in waves 1, 3 and 4 respectively. In a fixed effects model, the estimates are identified by households having a change in orphan status. In this sample, not a lot of young adults are in a household that have a change in orphan status, which limits the power of the analysis.

In wave 1, 84.5% of the young adults were enrolled in school; that number dropped to 48.4% in wave 3 and then 34.1% in wave 4. Correspondingly, employment rose during the same period, from 12.5% to 44.6% and then 48.3% by wave 4. As expected, the health status of young adults altered very little between the waves – 60.4% of young adults reported being in excellent or very good health in wave 1. The corresponding figures for wave 3 and 4 are 58.5% and 59.6%. Health status has little variation both across and within young adults over the survey period, given that younger members of a population are usually fairly healthy. On average, young adults lived in households that gained 1 asset over the survey period. The percentage of households (with a young adult) receiving childcare grants also rose, from 13.8% in wave 1 to 30.8% in wave 4. The mean age of the young adults in wave 1 is around 16 years old, then 19 in wave 3 and 20 in wave 4. The young adults are fairly evenly divided among the sexes – approximately 45% are male and the remainder female through all three waves. T-tests showed that young adults living with a fostered orphan tended to come from poorer households – they have fewer assets ($p=0.0046$), and are also more likely to be the recipient of a child care grant ($p<0.001$). There is no significant difference between the young adults living in households fostering orphans and young adults living in households not fostering orphans when it comes to the age ($p=0.1346$) and gender ($p=0.9256$) distributions of the young adults.

Table 3.2 lists the distribution of young adults among households fostering orphans. In wave 1, most fostered orphans were in the age group of 7-12; 39 young adults lived with at least 1 orphan of such age. In waves 3 and 4, the fostered orphans are older – 54 and 55 young adults lived with at least 1 orphan aged 13-18. The limited sample size does not provide adequate power to test for heterogeneous effects of fostering orphans, particularly by the age and gender of the fostered orphan.

Tables 3.3, 3.4 and 3.6 present results for each of the three outcomes, with four different model specifications for each outcome. For School Enrollment (Table 3.3) and Employment (Table 3.4), Hausman tests indicated that fixed effects were the preferred specification. Hence, for Tables 3.3 and 3.4, column (1) shows the random effects estimates, column (2) shows the fixed effects estimates, column (3) and (4) show the fixed effects estimates with asset index interaction/orphan characteristic (binary, indicating whether the household is fostering more than one orphan). Column (5), the estimates of most interest, contains the estimates from fixed effects models with both interactions and orphan characteristic (i.e. columns (3) and (4)). For Health Status (Table 3.6), the Hausman test indicated that random effects was the preferred specification. Thus, column (1) of Table 3.6 is the fixed effects estimates, column (2) is the random effects estimates, column (3)/(4) is the random effects estimates with interactions/orphan characteristic. Column (5) combines the models presented in columns (3) and (4).

School Enrollment (Table 3.3)

As shown in column (2), the simple fixed effects specification, living in a household fostering an orphan has a statistically insignificant effect on the probability that the young adult is enrolled in school. The lack of statistically significant effects remains unchanged with the more complex models in columns (3) and (4). In column (4), it can be seen that young adults from households fostering more than one orphan is 14.5% more likely to be enrolled in school, with the effect being statistically significant.

To determine the interactive effect of fostering an orphan and the wealth status of the household, as well as fostering more than on orphan on the probability of school enrollment, linear

combinations of the relevant coefficient at different wealth quintiles were calculated with results presented in Table 3.5 (coefficients from column (5)). Fostering an orphan actually has a positive and statistically significant effect on the enrollment of young adults from households in wealth quintiles 2 (ownership of 5-6 assets), 3 (ownership of 7-8 assets) and 4 (ownership of 9-10 assets).

Being from a wealthier household increases the probability that the young adult is enrolled in school – households in wealth quintiles 2, 3 and 4 are more able to afford to send their older children to school when compared to households in wealth quintile 1. Furthermore, wealthier households are also more likely to be able to financially support more than one orphan. This result holds across the models specified in columns (2) – fixed effects only, (3) – fixed effects with asset index interaction, and (4) – fixed effects with orphan characteristic.

Young adults are less likely to be enrolled in school as the years progress. For example, in column (5), the probability of a young adult being enrolled in school is 45.4% lower in wave 3, and by wave 4, that number becomes 59.7%. This effect is true across all model specifications. Similarly, age is a significant factor in determining school enrollment across all models.

Employment (Table 3.4)

To determine the interactive effect of fostering an orphan and the wealth status of the household, as well as fostering more than on orphan on the probability of employment, linear combinations of the relevant coefficient at different levels of wealth were calculated and illustrated graphically. As table 3.5 shows, the probability of employment drops with increases in wealth, though the effect is never statistically significant.

Young adults from households receiving a child care grant are more likely to be employed, although the effect is not statistically significant. Given that child care grants are allocated based upon a means test, young adults from homes receiving such a grant are likely to be poorer, raising the need to work instead of or in addition to attending school.

Young adults are more likely to be employed as they get older, and this effect is significant across all model specifications. For example, in column (5) the positive coefficient on wave 3

indicates that the probability of working increase by 39.8% in wave 3, which rises to 42.6% by wave 4. Similarly, age is a significant factor in determining employment across all models.

Health Status (Table 3.6)

As shown in column (1), the random effects specification, young adults living in households which foster orphans are 8.6% less likely to be in very good or excellent health.

The resources available to a household matters – a young adult living in a household that has more assets increases the probability of being in better health, although the effect is only statistically significant when comparing young adults from households in wealth quintile 2 versus young adults from households in wealth quintile 1. The self-reported health status of the young adult is associated with how the household views its financial health. Male young adults are 3.2 percentage points more likely to report being in good health, which holds true across all model specifications, indicating perhaps an ingrained cultural preference for sons, and thus a diversion of resources to male offspring. Or, it is also possible that females are more likely to self-report being in average health than males. Not surprisingly, neither age nor wave effects were found, reinforcing the assumption that health status does not vary much among this portion of the population.

Discussion

The results show that young adults from households fostering orphans have a higher probability of being enrolled in school if the household is in a higher wealth quintile – a finding in line with that of Akresh (2004). Since young adults from higher wealth quintile households which foster an orphan face higher school enrollment, there may be labor substitution between young adults and fostered orphans in these households. While the result is not statistically significant, young adults living in households which foster orphans are also less likely to be working (if they come from a household in a higher wealth quintile), and less likely to be in very good or excellent health.

The South African Schools Act of 1996 makes education compulsory for individuals between the ages of seven and 15, or ninth grade, which ever comes first. Hence, age 15 is a crucial year for young adults, who must decide whether to continue their education or to engage in employment.

Hence, young adults from households in lower wealth quintiles may choose to work instead of study. While choosing to work may have current beneficial impacts for the household in terms of resources, the young adult may be limited in earning potential in the future, due to not completing high school and obtaining education beyond that. Furthermore, HIV prevention is often taught in high schools, so the young adult would be unable to gain from such sessions. Furthermore, attending school influences one's sexual networks, and may be associated with lower risk behavior (Hargreaves et al, 2007). However, given the high unemployment rate prevalent in South Africa, being employed is not necessarily a bad outcome.

South Africa has a history of migration – for example, under apartheid many African adults were forced to work in locations far removed from their homes, resulting in a need for foster care. Hence, there is likely a built-in mechanism to support foster children. Furthermore, the strong social ties may serve as an effective short-term coping mechanism, with negative impacts not being felt in the short run. However, neither reason is likely to be a plausible long-term and sustainable solution, with currently increasing HIV prevalence rates.

Some limitations may influence the results. The relatively small sample size (only a limited number of young adults are residing in households which fosters orphans) results in tests having low power, and thus may contribute to not finding more statistically significant effects.

Unfortunately, the dataset has no information about why certain households chose to foster orphans (for example, they could be the only relatives who could afford to do so). Hence, the orphan placement decision may be endogenous, and knowing why households take in orphans would improve the applicability of my results. It is possible that there is selectivity in orphan fostering, as certain orphans, such as the sick or disabled who consume more resources, may be less likely to be adopted. Households may show a preference for orphans who will be able to contribute more, whether it is through the external labor market, or within the household, and who are perceived to be a good influence on the other children in the household. I have attempted to address the issue through a variety of controls and fixed effects. However, it should be acknowledged that household effects

may not be time-invariant. Also, the cause of parental death is unknown. However, given the high HIV prevalence, it is likely to be AIDS related. Furthermore, even if such information were available, due to stigma, AIDS-related deaths may not be recorded as such.

Given the sample population for CAPS, the ability for results to be generalized to the greater South African population is limited. Also, since CAPS did not interview individuals in institutions or without homes, care should be taken when considering the external validity of the results.

Finally, the indicators used in this study may not be sensitive to changes, which are reflected through the health status measure in that not much variation in health among young adults was found. Young adults are in general a healthy segment of most populations due to their age. Also, there may be a long-run impact on health which is not captured in the four year period spanned by the survey data. For example, preventive care is often neglected in resource limited settings, and the consequences of neglecting prevention may not be realized until later in life. Also, the employment measure used in this study does not distinguish between full-time and part-time work; young adults may be going to school and working part-time. There also may be lagged effects of fostering orphans on employment outcomes.

The findings from this study point to the need for more investigations of this topic. First, anthropometric measures such as height and weight may be helpful in determining whether fostering an orphan has a negative impact on the health young adults. Second, more information is needed regarding orphan placement – for instance, did a household take in an orphan because they are the only available relative? Furthermore, are parents altruistic or selfish towards orphans? Qualitative interviews could help to better understand these issues.

Table 3.1 Descriptive Statistics - Means

	Wave 1	**Wave 3**	**Wave 4**
	(n=1661)	(n=1658)	(n=1666)
Dependent Variables			
School Enrollment	0.845	0.484	0.341
Employment	0.125	0.446	0.483
Health Status	0.604	0.585	0.596
Household Controls			
Asset Index	6.04	7.162	7.339
Childcare Grant	0.138	0.157	0.308
Young Adult Controls			
Age	16.036	20.954	21.839
Male	0.453	0.455	0.449

Table 3.2 Descriptive Statistics – Distribution of Young Adults in Households Fostering Orphans

	Wave 1	**Wave 3**	**Wave 4**
	(n=1661)	(n=1658)	(n=1666)
No. of orphans ages 0-6			
1	11	8	10
2	3	3	0
No. of orphans ages 7-12			
1	33	33	31
2	5	3	4
3	1	0	0
4	0	0	1
No. of orphans ages 13-18			
1	9	47	48
2	0	7	5
3	0	0	2
No. of male orphans			
1	33	38	48
2	3	6	2
3	0	0	1
4	0	0	0
5	0	0	1
No. of female orphans			
1	22	49	44
2	3	3	5
3	1	3	3

Table 3.3 Linear Probability Models – Outcome: School Enrollment

	(1)	(2)	(3)	(4)	(5)
	RE	FE	FE with interaction	FE with orphan characteristic	(3) + (4)
Foster Orphan	0.067**	0.044	-0.033	0.018	-0.068
	(0.030)	(0.041)	(0.070)	(0.044)	(0.072)
Wealth Quintile 2*Foster Orphan			0.112		0.124
			(0.082)		(0.082)
Wealth Quintile 3*Foster Orphan			0.094		0.107
			(0.090)		(0.091)
Wealth Quintile 4*Foster Orphan			0.119		0.112
			(0.117)		(0.117)
Wealth Quintile 5*Foster Orphan			0.070		0.047
			(0.143)		(0.144)
More than one orphan				0.145*	0.160*
				(0.086)	(0.087)
Wealth Quintile 2	0.026	0.049**	0.043**	0.049**	0.043**
	(0.017)	(0.021)	(0.021)	(0.021)	(0.021)
Wealth Quintile 3	0.014	0.063**	0.059**	0.063**	0.058**
	(0.018)	(0.025)	(0.025)	(0.025)	(0.025)
Wealth Quintile 4	0.006	0.062**	0.056*	0.061**	0.055*
	(0.020)	(0.030)	(0.030)	(0.030)	(0.030)
Wealth Quintile 5	0.030	0.016	0.013	0.015	0.012
	(0.023)	(0.038)	(0.039)	(0.038)	(0.039)
Childcare grant	0.029*	0.027	0.027	0.027	0.026
	(0.015)	(0.018)	(0.018)	(0.018)	(0.018)
Age of young adult	-0.055***	0.079***	0.079***	0.079***	0.080***
	(0.010)	(0.018)	(0.019)	(0.018)	(0.019)
(Age of young adult)^2	-0.005***	-0.007***	-0.007***	-0.007***	-0.007***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Male	-0.018	0.000	0.000	0.000	0.000
	(0.015)	(0.000)	(0.000)	(0.000)	(0.000)
Wave 3	-0.103***	-0.451***	-0.451***	-0.452***	-0.454***
	(0.020)	(0.046)	(0.046)	(0.046)	(0.046)
Wave 4	-0.149***	-0.594***	-0.595***	-0.596***	-0.597***
	(0.023)	(0.058)	(0.058)	(0.058)	(0.058)
Constant	1.002***	0.690***	0.693***	0.689***	0.692***
	(0.023)	(0.038)	(0.038)	(0.038)	(0.038)
Observations	5027	5027	5027	5027	5027
R-squared		0.381	0.381	0.381	0.382
Number of personid	1703	1703	1703	1703	1703

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table 3.4 Linear Probability Models – Outcome: Employment

	(1)	(2)	(3)	(4)	(5)
	RE	FE	FE with interaction	FE with orphan characteristic	(3) + (4)
Foster Orphan	-0.085***	0.009	0.144*	0.028	0.168**
	(0.030)	(0.044)	(0.075)	(0.047)	(0.078)
Wealth Quintile 2*Foster Orphan			-0.181**		-0.190**
			(0.088)		(0.088)
Wealth Quintile 3*Foster Orphan			-0.160		-0.169*
			(0.098)		(0.098)
Wealth Quintile 4*Foster Orphan			-0.156		-0.151
			(0.126)		(0.126)
Wealth Quintile 5*Foster Orphan			-0.293*		-0.278*
			(0.154)		(0.155)
More than one orphan				-0.102	-0.110
				(0.092)	(0.094)
Wealth Quintile 2	0.014	-0.012	-0.002	-0.012	-0.001
	(0.018)	(0.022)	(0.023)	(0.022)	(0.023)
Wealth Quintile 3	0.059***	-0.041	-0.034	-0.042	-0.033
	(0.019)	(0.027)	(0.027)	(0.027)	(0.027)
Wealth Quintile 4	0.127***	-0.023	-0.015	-0.022	-0.014
	(0.020)	(0.032)	(0.032)	(0.032)	(0.032)
Wealth Quintile 5	0.181***	0.026	0.041	0.027	0.041
	(0.023)	(0.041)	(0.042)	(0.041)	(0.042)
Childcare grant	-0.038**	0.006	0.007	0.006	0.007
	(0.015)	(0.020)	(0.020)	(0.020)	(0.020)
Age of young adult	0.012	-0.096***	-0.095***	-0.096***	-0.096***
	(0.011)	(0.020)	(0.020)	(0.020)	(0.020)
(Age of young adult)^2	0.007***	0.010***	0.010***	0.010***	0.010***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Male	0.087***	0.000	0.000	0.000	0.000
	(0.015)	(0.000)	(0.000)	(0.000)	(0.000)
Wave 3	0.124***	0.398***	0.396***	0.399***	0.398***
	(0.020)	(0.049)	(0.049)	(0.049)	(0.049)
Wave 4	0.077***	0.425***	0.424***	0.426***	0.426***
	(0.023)	(0.062)	(0.062)	(0.062)	(0.062)
Constant	0.156***	0.271***	0.263***	0.271***	0.263***
	(0.027)	(0.041)	(0.041)	(0.041)	(0.041)
Observations	5030	5030	5030	5030	5030
R-squared		0.240	0.242	0.241	0.242
Number of personid	1703	1703	1703	1703	1703

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table 3.5 Linear Combinations of Coefficients

	Outcome: School Enrollment	**Outcome: Employment**
Wealth Quintile 2	0.217**	-0.132
	(0.097)	(0.105)
Wealth Quintile 3	0.200*	-0.111
	(0.099)	(0.107)
Wealth Quintile 4	0.204*	-0.094
	(0.116)	(0.125)
Wealth Quintile 5	0.140	-0.220
	(0.138)	(0.149)

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table 3.6 Linear Probability Models – Outcome: Self-reported Health Status

	(1)	(2)	(3)	(4)	(5)
	RE	FE	RE with interaction	RE with orphan characteristic	(3) + (4)
Foster Orphan	-0.086**	-0.102*	-0.077	-0.080**	-0.067
	(0.034)	(0.057)	(0.063)	(0.039)	(0.067)
Wealth Quintile 2*Foster Orphan			-0.100		-0.102
			(0.089)		(0.090)
Wealth Quintile 3*Foster Orphan			0.044		0.041
			(0.092)		(0.092)
Wealth Quintile 4*Foster Orphan			-0.021		-0.023
			(0.109)		(0.109)
Wealth Quintile 5*Foster Orphan			0.130		0.134
			(0.138)		(0.138)
More than one orphan				-0.027	-0.037
				(0.078)	(0.079)
Wealth Quintile 2	-0.037*	-0.042	-0.031	-0.037*	-0.031
	(0.021)	(0.029)	(0.021)	(0.021)	(0.021)
Wealth Quintile 3	0.002	0.003	-0.000	0.002	-0.000
	(0.022)	(0.034)	(0.022)	(0.022)	(0.022)
Wealth Quintile 4	0.017	0.027	0.018	0.017	0.018
	(0.022)	(0.041)	(0.023)	(0.022)	(0.023)
Wealth Quintile 5	0.022	0.003	0.019	0.022	0.019
	(0.026)	(0.053)	(0.026)	(0.026)	(0.026)
Childcare grant	-0.005	-0.006	-0.005	-0.005	-0.005
	(0.017)	(0.025)	(0.017)	(0.017)	(0.017)
Age of young adult	-0.020	-0.041	-0.020	-0.020	-0.020
	(0.013)	(0.026)	(0.013)	(0.013)	(0.013)
(Age of young adult)^2	0.002	0.001	0.002	0.002	0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Male	0.032**	0.000	0.032**	0.032**	0.032**
	(0.015)	(0.000)	(0.015)	(0.015)	(0.015)
Wave 3	-0.000	0.069	-0.001	-0.000	-0.001
	(0.023)	(0.063)	(0.023)	(0.023)	(0.023)
Wave 4	0.010	0.101	0.009	0.010	0.009
	(0.026)	(0.080)	(0.026)	(0.026)	(0.026)
Constant	0.629***	0.690***	0.627***	0.629***	0.627***
	(0.026)	(0.052)	(0.026)	(0.026)	(0.026)
Observations	5030	5030	5030	5030	5030
R-squared		0.004			
Number of personid	1703	1703	1703	1703	1703

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

References

1. Anderson, Kermyt G. and Ann M. Beutel, 2009, "Are orphans and fostered children less likely to be in school: Evidence from South Africa," *Population Association of America*.

2. Ainsworth, Martha and Deon Filmer, 2002, "Poverty, AIDS, and Children's Schooling. A Targeting Dilemma," *World Bank Policy Research Working Paper 2885*.

3. Ainsworth, Martha, Kathleen Beegle and Godlike Koda, 2005, "The impact of adult mortality on primary school enrollment in Northwestern Tanzania," *Journal of Development Studies*, 41: 412-439.

4. Akresh, Richard, 2004, "Adjusting Household Structure: School Enrollment Impacts of Child Fostering in Burkina Faso," *Yale University Economic Growth Center Discussion Paper No. 897*.

5. Becker, Gary S., 1965, "A Theory of the Allocation of Time," *The Economic Journal*, 75(299): 493-517.

6. Beegle, Kathleen, Joachim De Weerdt, and Stefan Dercon, 2009, "The intergenerational impact of the African orphans crisis: a cohort study from an HIV affected area," *International Journal of Epidemiology*, 38(2):561-568.

7. Beegle, Kathleen, Deon Filmer, Andrew Stokes and Lucia Tiererova, 2009, "Orphanhood and the Living Arrangements of Children in Sub-Saharan Africa," *World Bank Policy Research Working Paper 2889*.

8. Cape Gateway http://www.capegateway.gov.za/ (last accessed November 21, 2009).

9. Case, Anne and Cally Ardington, 2006, "The Impact of Parental Death on School Enrollment and Achievement: Longitudinal Evidence from South Africa," *Demography*, 43(3): 401-420.

10. Case, Anne, Christina Paxson and Joseph Ableidinger, 2004, "Orphans in Africa: Parental Death, Poverty and School Enrollment," *Demography*, 41(3): 483-508.

11. Central Intelligence Agency – The World Factbook https://www.cia.gov/library/publications/the-world-factbook/ (last accessed August 11, 2008).

12. City of Cape Town http://www.capetown.gov.za (last accessed January 9, 2009).

13. Evans, David, 2005, "The Spillover Impacts of Africa's Orphan Crisis," *Working Paper*.

14. Evans, David K. and Edward Miguel, 2007, "Orphans and Schooling in Africa: A Longitudinal Analysis," *Demography*, 44(1): 35-57.

15. Foster, Geoff and John Williamson, 2000, "A review of current literature of the impact of HIV/AIDS on children in sub-Saharan Africa," *AIDS*, 14 (suppl 3): S275-S284.

16. Hargreaves, JR, LA Morrison, JC Kim, CP Bonell, JDH Porter, C Watts, J Busza, G Phetla, and PM Pronyk, 2007, "The association between school attendance, HIV infection and sexual

behavior among young people in rural South Africa," *Journal of Epidemiology and Community Health*, 62: 113-119.

17. Hosegood, Victoria, Sian Floyd, Milly Marston, Caterina Hill, Nuala McGrath, Raphael Isingo, Amelia Crampin, and Basa Zaba, 2007,"The effects of high HIV prevalence on orphanhood and living arrangements of children in Malawi, Tanzania, and South Africa," *Population Studies*, 61(3): 327-336.

18. Lam, David, Cally Ardington, Nicola Branson, Anne Case, Murray Leibbrandt, Alicia Menendez, Jeremy Seekings and Meredith Sparks. *The Cape Area Panel Study: A Very Short Introduction to the Integrated Waves 1-2-3-4 Data.* The University of Cape Town, October 2008.

19. Lloyd, Cynthia B. and Ann K. Blanc,1996, "Children's Schooling in sub-Saharan Africa: The Role of Fathers, Mothers and Others," *Population and Development Review*, 22(2): 265-298.

20. Madhavan, Sangeetha, 2004, "Fosterage patterns in the age of AIDS: continuity and change," *Social Science and Medicine*, 58:1443-1454.

21. Parikh, Anokhi, Mary Bachman DeSilva, Mandisa Cakwe, Tim Quinlan, Jonathan L. Simon, Anne Skalicky and Tom Zhuwau, 2007, "Exploring the Cinderella myth: intrahousehold differences in child wellbeing between orphans and non-orphans in Amajuba District, South Africa," *AIDS*, 21 (suppl 7): S95-S103.

22. Ravallion, Martin and Quentin Wodon, 2000, "Does Child Labor Displace Schooling? Evidence on Behavioral Responses to an Enrollment Subsidy," *The Economic Journal*, 110(462): C158-175.

23. United Nations Development Program http://hdr.undp.org/en/statistics/indices/ (last accessed August 11, 2008).

24. Yamano, Takashi, Yasuharo Shimamura, and Dick Sserunkuuma, 2006, "Living Arrangements and Schooling of Orphaned Children and Adolescents in Uganda," *Economic Development and Cultural Change*, 54(4):833-856.

25. Yamano, Takashi and T.S. Jayne, 2005, "Working-Age Adult Mortality and Primary School Attendance in Rural Kenya," Economic Development and Cultural Change, 53:619-653.

26. Zimmerman, Frederick J., 2003, "Cinderella Goes to School: The Effects of Child Fostering on School Enrollment in South Africa," *Journal of Human Resources*, 38(3): 557-590.

CHAPTER IV: THE EFFECTS OF PARENTAL INVESTMENT ON SEXUAL CONCURRENCY AMONG YOUNG ADULTS IN METROPOLITAN CAPE TOWN, SOUTH AFRICA

Introduction

Heterosexual intercourse among the general population is currently the most common method of HIV transmission in southern Africa (Avert, 2010). Having more sexual partners obviously results in a higher risk for HIV infection. However, research has shown that it is not the total number of lifetime partners that drives the epidemic, but rather the timing of partners. Specifically, the widespread practice of concurrency, or overlapping partners in sexual networks (where someone has more than one partner during the same time period), has been suggested as a possible explanation for the higher HIV prevalence seen in southern Africa, when compared to countries where serial or once-off casual or commercial sexual encounters are more common (Conly, 2008). In a seminal paper, Morris and Kretzschmar (1997) used a stochastic simulation of ten scenarios from sequential monogamy through increasing levels of concurrency and found that concurrent partnerships exponentially increase the spread of HIV. They suggest the number of connected people at any point in time to be the underlying reason for this phenomenon because just one infected person in a sexual network puts everyone at risk.

The first few weeks following initial HIV infection, also known as Acute HIV Infection, can further accelerate the spread of HIV through networks given the high HIV viral loads during this time period (Pilcher et al, 2004). Hollingsworth et al (2008) found that primary infection is 26 times more infectious than asymptomatic infection over a period of approximately three months after

seroconversion. With concurrent relationships, less time occurs between ending one relationship and beginning the next, so that the protective effect of sequence is lost. Thus transmission through Acute HIV Infection is amplified through concurrent relationships. In addition, concurrent partnerships are associated with a higher number of sexual acts, often combined with lower condom use (Mah, 2008).

The role of concurrency in HIV transmission can be seen through Uganda, a country often cited as a successful example in limiting the spread of HIV in the 90's. Asides from strong government support, educational campaigns focused heavily on "zero grazing", or being faithful to your partners and therefore minimizing concurrent relationships. The focus on monogamy can be contrasted from the prevention programs of other sub-Saharan African countries which focused more on abstinence and condom use, but saw higher HIV prevalences (Halperin and Epstein, 2007).

Given the high prevalence of HIV in the general southern African population, it is important to better understand the sexual behavior of young South African adults and the risk factors that may heighten the probability of becoming infected. Thus, this study will add to the growing body of literature on the predictors of sexual concurrency, specifically focusing on parental investment, which is appropriate given that parental influence may have a large impact on young adults. While this study will focus on young adults and the prevalence of sexual concurrency may peak at later ages, the study is nevertheless important as young adults account for a substantial portion of new infections, and at increasingly younger ages. Furthermore, it is beneficial to instill safe sexual behavior as early as possible.

Definition and Measurement of Sexual Concurrency

Until recently, there was no universally accepted definition for concurrency, although *overlap of one or more sexual partners for one month or longer* has frequently been used, with 30 days being the length of time individuals are most infectious during the initial post-infection period. At a recent meeting on concurrent sexual partnerships, a definition for concurrent sexual partnerships was suggested: *overlapping sexual partnerships in which sexual intercourse with one partner occurs between two acts of intercourse with another partner* (UNAIDS Reference Group on Estimates,

Modelling, and Projections, 2009). Similarly, concurrency has multiple methods of measurement. The two most common methods are (1) asking respondent directly if he/she has had other sexual partners during a specific partnership, and (2) asking detailed information, such as duration of relationship and frequency of intercourse, about previous partners to form a sexual partnership calendar (Mah and Halperin, 2008)[6].

Sexual Concurrency and HIV

Empirical research linking sexual concurrency and HIV prevalence is growing, as more data becomes available. While the majority of the existing studies were either conducted in the United States with a concentration on sexually transmitted infections (STI) (for example, Drumright et al, 2004), or conducted via mathematical modeling, there is growing literature from sub-Saharan Africa and other developing nations and using HIV infection data. In rural Malawi, HIV prevalence was found to be higher in polygamous marriages, where concurrent sexual partners can be expected (Reniers and Tfaily, 2008). In addition, a recent study conducted in Botswana with 310 HIV positive individuals found that 20% of its respondents had two or more sexual partners in the previous three months (Kalichman et al, 2007). In a study conducted among people living with HIV/AIDS in Vietnam, Thanh et al (2008) found that one-fifth of the sample reported sex with multiple partners. Mishra and Bignami-Van Assche (2008) found that reporting concurrent partnerships is strongly associated with being HIV positive in Demographic and Health Surveys (DHS). Since DHS is cross-sectional in nature, the direction of causality is unclear so coefficients could be biased up or down.

However, evidence to the contrary also exists- data from five cities in sub-Saharan Africa did not show concurrency to be a major determinant of the rate of HIV spread (Lagarde et al, 2001). Two recent studies take opposing viewpoints on the empirical link between concurrent relationships and the HIV epidemics. Lurie and Rosenthal (2009 and 2010) argue that although concurrency *could* be a

[6]Method (1) was used in this study. Unfortunately a significant portion (20%) of the respondents answered "Don't Know" when probed for the details of past relationships, such as the month, (or refused to answer the question). Thus, a sexual calendar approach to calculating concurrency was not used.

major factor in HIV transmission in sexual networks (as demonstrated by mathematical simulations), they believe that this causality hypothesis has thus far not been supported by strong empirical studies. A number of authors hold the opposite viewpoint and feel that the link between HIV and concurrent sexual partnerships has been adequately demonstrated through quantitative and qualitative analysis of various populations (Mah and Halperin, 2009; Epstein, 2010; Morris, 2010).

Predictors of Sexual Concurrency

While substantial research assesses predictors of risky sexual behavior, research looking specifically at the predictors of sexual concurrency is comparatively limited. In the United States, being male, unmarried, early age at sexual debut (first intercourse), and incarceration of a sex partner have been shown to be significantly associated with sexual concurrency among African-Americans in the rural South (Adimora et al, 2004). Manhart et al (2002) found that partnership characteristics such as number of lifetime partners, race discordance between partners, married/living together, night in jail, partnership duration > 6 months, and STD diagnosis during relationship were significantly associated with sexual concurrency among Seattle residents. The lack of research on predictors of concurrency is most apparent for African populations – Sandøy et al (2008) used the Zambian Sexual Behavior Surveys and found that early sexual debut, being married, early marriage, and absence from home to be important predictors. In Khayelitsha, South Africa, Mah (2008) found that having concurrent relationships were associated with being less religious, and knowledge that your primary sexual partner had concurrent partners. The characteristics of initial partnership, such as living apart from the first partner, also play a role in determining whether Kenyan individuals enter into a second (concurrent) relationship (Xu et al, 2009).

Parental Role in Children's Sexual Behavior- Conceptual Framework and Literature

Parents play an important role in the sexual behavior of their offspring and thus might impact the occurrence of concurrency in adolescent populations – a group at high risk of HIV infection in sub-Saharan Africa. Aside from the emotional distress suffered from losing a parent at a young age,

such individuals may also lack behavioral guidance as they grow up, as well as financial support. These factors may place young adults at greater risk of being infected with HIV.

Primary Socialization Theory (Oetting and Donnermeyer, 1998) states that during adolescence, behaviors are mainly learned through interactions with three primary sources (family, peer clusters, and school). In addition, Primary Socialization Theory postulates that strong family/child bonds and thus healthy family relationships are likely to result in adolescents exhibiting positive behaviors - weak family/child bonds may result in deviant behaviors, such as unsafe sex. The strength of family/child bonds is in turn determined by the interactions between parent and child. Social Cognitive Theory (Bandura, 1998) posits that individuals learn by observation, such as through interpersonal interactions. Self-efficacy, which affects outcome expectations and impediments, also plays a role in determining whether a certain behavior is practiced.

Thus, based upon Primary Socialization Theory, one might hypothesize that young adults are less likely to have concurrent sexual partners when their parents (or parental figures) invest more in their upbringing. Then, from Social Cognitive Theory, it can be hypothesized that young adults are more likely to have concurrent sexual partners if they perceive their parents to be engaging in such behavior.

Parental investment may take many forms. By being present in their children's lives, parents serve as a role model for their children, who may choose to practice similar behavior. Parents who play an active role in their offspring's everyday lives also monitor and provide support to their children, helping to bolster their confidence and self-esteem. Such emotional investment is abstract in nature and harder to quantify, but nevertheless plays an important part in guiding young adults through sexual health decisions. Thus, a lack of investment may result in negative outcomes – for example, using a 2003 nationally representative household survey of 15-24 year old South Africans, Operario et al (2007) found that death of a parent was significantly associated with risky sexual behavior of both young female and male South Africans.

Parental investment can also be of a financial nature, where parents support their children through school, or the giving of pocket money and gifts. The lack of such parental investment may result in children engaging in undesirable sexual behaviors. For instance, Parker et al (2007) show that young South African adults often engage in concurrent sexual partnerships to gain material benefits. Hence, concurrent sexual partnerships are often intergenerational, usually between young girls and older, wealthier men (Jana et al, 2008). An analysis using the 2003 nationally representative household survey of South Africans aged 15-24 years old found that women in concurrent relationships were more likely to engage in transactional sex (Steffenson et al, 2008), but that men were more likely than women to report having concurrent partners (24.7% versus 4.7%)[7]. Based on the same South African survey, young women were found to be significantly more likely to be HIV positive than their male counterparts (15.5% versus 4.8%), with HIV prevalence rising with age among females (Pettifor et al, 2005).

This study builds upon three cross-sectional studies that have examined the sexual behavior of young people in Cape Town. Camlin and Snow (2008) used wave 1 of Cape Area Panel Study (CAPS) and found that condom use at the first and the most recent sexual intercourse are functions of participation in community groups and maternal material support. In a working paper using wave 3 of CAPS, Mah (2008) found that 13% of sexually active young adults (ages 16-26) in CAPS reported concurrency during their last sexual relationship (higher among Black men and women), and that sexual concurrency was associated with a higher number of lifetime sex partners and earlier age of sexual debut. Also using CAPS, Kenyon and Badri (2009) found a statistically significant relationship between STI symptoms and a past partner who had been in concurrent sexual relationships. No studies thus far have been conducted to investigate the link between parental investment and sexual concurrency.

Methods

[7]For comparison, an United States study done using the National Longitudinal Study of Adolescent Health found that 44% of sexually active teens reported more than one partner, of which 54% reported concurrent partners.

Data

The Cape Area Panel Study (CAPS) began as a collaboration between the Population Studies Center in the Institute for Social Research at the University of Michigan and the Center for Social Science Research at the University of Cape Town, with primary funding from the National Institute of Child Health and Human Development and the Andrew W. Mellon Foundation. Starting in wave 4, Princeton University became a collaborator, with funding provided through a National Institute on Aging grant (Lam, 2008). CAPS has two panel components – young adults, and households.

The main focus of CAPS is a representative sample of young adults between the ages of 14 and 22 (at the first wave in 2002) in Cape Town who are followed as they transition to adulthood. The survey covers a range of outcomes including schooling, employment, sexual and reproductive health, and intergenerational familial support. Up to three young adults per household were included as an analysis of census data showed that few households contained more than three young adults. Four waves of data have been collected. While the core survey component was administered to young adults for waves 1, 3 and 4, each of those waves also included unique elements[8]. Wave 3 (2005) targeted the full set of young adults originally interviewed in Wave 1 in order to update the previously collected core components of CAPS. New questions for young adults included a detailed history of residence, schooling, and sexual partners, as well as intergenerational transfers. Wave 4 (2006) looked at the full original sample (aged 18-26) as well, with survey questions similar to those from wave 3.

The data were collected through a stratified two-stage process. The first stage involved the selection of sample clusters using the 1996 census Enumeration Areas (EA), and then households were randomly selected within each EA in the second stage. Weights provided by the CAPS team were to address sample design and non-response issues such that regression results are representative

[8]Wave 1 (2002) included an evaluation of the literacy and numeracy of young adults in the sample. Wave 2a (2003) re-interviewed approximately one-third of the original sample and focused on sex and AIDS, while Wave 2b (2004) re-interviewed the remaining two-thirds and focused on further topics pertaining to employment, unemployment, and school choice.

of the young adult population of Cape Town. The adjustment for sample design is needed as a result of intentional oversampling of African and white households, intentional differential sampling of households with and without young adults, and the addition of secondary households into the sample of screener households.

Sample

This study used data from the young adult component, with the wealth measure from the household component. Parental investment questions were asked in waves 1 and 3, while a detailed sexual history was obtained in wave 3. Hence, only waves 1 and 3 were utilized in this study.

Dependent Variable

The wave 3 young adult questionnaire contained a section on *Relationships Involving Sex* in which respondents were asked questions about their ten most recent sexual partners (no time frame restriction was given), including both repeated and once-off encounters, which sought to better understand the kinds of relationships young adults were having sex in. The responses to the question "Did you have any other sexual partners during the time that you and [partner #] were having a sexual relationship?" were used to determine whether a young adult was involved in sexually concurrent relationships. Even though questions regarding sexual partner history were only asked in wave 3, the questions asked for the year of past sexual relationships and hence allowed for an examination of up to ten prior sexual relationships (i.e. relationships that occurred during the wave 1 time period). Individuals were coded as falling into one of three categories: (1) not sexually active, (2) sexually active but not in concurrent sexual relationships, and (3) sexually active and reported being in sexually concurrent relationships[9].

Key Explanatory Variables

[9]Approximately 5% of individuals refused to answer the question, did not know the answer, or were unsure whether they had concurrent sexual partners; such individuals were excluded from the analysis. Coding those who responded Not Sure with those who answered Definitely Yes (Definitely No) would have resulted in an overestimate (underestimate) of concurrency.

All of the parental investment questions were asked of respondents for the prior 12 months. The majority of wave 1 interviews were conducted between August and December of 2002 (with a few interviews taking place January through April 2003), so the parental investment questions would refer to the years 2001 and 2002.

The following parental investment questions were asked:

1. How often has your (mother/father) spent the night under the same roof as you?
2. How often has (mother/father) spent time with you, just the two of you?
3. How often has (mother/father) had conversations with you about personal matters?
4. Has (mother/father) spent any money on your school fees or tuition, books, supplies or uniform?
5. Has (mother/father) spent any money on you for clothing or shoes (apart from school uniforms) or for presents, gifts, or toys?
6. Has (mother/father) given you any pocket money?

Question 1 represented co-residence with parent, questions 2 and 3 were classified together as time together with parent, while questions 4, 5 and 6 combined to form parental financial support. Available response options for the first three questions were never, once or twice a year, every few months, once a month, several times a month, about once a week, daily or almost daily, and don't know. For simplification, the following combinations were made: "once or twice a year" and "every few months" = rarely; "once a month" and "several times a month" = sometimes, "about once a week" and "daily or almost daily" = often. For the last three questions, young adults could have chosen yes, no or don't know[10]. Given the distribution of the responses, binary options were created - individuals were coded as 0 if they fell in the categories never, or rarely; otherwise, they were coded as 1. Other classification options were tested (for example, having three categories: never, rarely/sometimes, often) but the pattern of the results remained unchanged. Hence, a simpler binary approach was adopted.

[10]Very few respondents answered don't know, and those who did were dropped from the analysis.

Control Variables

The following variables were included since they are likely to affect both sexual concurrency and be associated with the key independent variables: age (younger than 18, 18-20, 21 and above), gender (1=male, 0=female), race (black, colored, other – which includes Asians and whites), education (1=currently enrolled, 0=not currently enrolled), and per capita income.

Analysis

Analyses were conducted at the individual (i.e. young adult) level, and followed a cross-sectional approach. To address concerns about correlation between current behavior of young adults and current values of explanatory variables, lagged values of parental investment and control variables were included. Thus issues of reverse causality (for example, parents increasing their level of investment in their children after discovering the practice of risky sexual behavior among their offspring) were avoided as parental investment and control variables were from 2002 (wave 1), while only sexual relationships in the year 2003 and beyond were included in the construction of the dependent variable. For the empirical model, multinomial logistic regressions were run with three outcomes: (1) not sexually active, (2) sexually active but not in concurrent sexual relationships, and (3) sexually active and reported being in sexually concurrent relationships.

Robust standard errors were clustered at the household level since up to three young adults were interviewed per household. Finally, as discussed in the Data section, weights were incorporated into the regressions to account for sample design and young adult non-response.

Results

Descriptive Statistics

Summary statistics are presented in Table 4.1. Approximately one third of the sample had never had sex. Of the two-thirds who have had sex, the proportion of females who have been in sexually concurrent relationships since 2003 was much lower than that of males (2.9% versus 11%).

Parental investment was similar across female and male young adults. However, parental investment differed by the gender of the parent. Maternal investment was more common than paternal

investment across all dimensions of parental investment. Greater maternal investment is not surprising, as many fathers may be employed in jobs requiring them to live away from their families. For example, 71.9% of females and 75.3% of males reported residing with their mothers, whereas only 44% and 47.7% resided with their fathers.

The sample was had more females (n = 1709) than males (n=1467), with the average age being around 18 years. Black respondents made up 43.7% of the female sample and 42.1% of the male sample, followed by coloreds (47.3% for females and 48.5% for males) and Others (9.1% for females and 9.3% for males)[11]. A majority of respondents reported being enrolled in primary or secondary school (over 60% for both genders). Mean per capita income was slightly higher for male respondents (R1061.58 versus R989.93).

Multinomial Logistic Regression Model

Since coefficients varied by gender and race, models were stratified by both variables. Results for racial group "Other" and Colored females were not included as a result of small sample sizes.

Table 4.2 presents relative risk ratios (RRR) comparing the outcomes “had sex, sexually concurrent” and “had sex, not sexually concurrent.” A RRR less than 1 (greater than 1) implies that an increase in parental investment results in the young adults being less likely (more likely) to be in sexually concurrent relationships. As expected, financial support from fathers significantly decreased the probability of sexual concurrency among Black and Colored males. Surprisingly, time spent with mother for Black females and time spent with fathers for Black males significantly increased the probability of being in sexually concurrent relationships. Furthermore, across all three groups, co-residence with mothers decreased the probability of sexual concurrency while co-residence with fathers increased the probability of sexual concurrency, although the effect is only significant for Colored males residing with their fathers. In terms of the control variables, Black females in the 18-

[11]Note that this is representative of Western Cape, but not South Africa. For the country as a whole, the percentage of Black respondents would be much higher than the percentage of Colored respondents.

20 age group were significantly more likely than those aged 21 and above to engage in sexual concurrency.

Table 4.3 presents RRR comparing the outcomes “never had sex” and “had sex, not sexually concurrent.” As expected, Black females who resided with their mothers were significantly more likely to never have had sex. Similarly, for Black males and females as well as for Colored Males, individuals in the youngest age group (less than 18 years) and individuals who were enrolled in school were also less likely to have ever had sex.

Discussion

This study found that among young Black and Colored males, those who received financial support from their fathers were less likely to report being in concurrent relationships. However, among young Black females (males), those who spent time with mothers (fathers) were more likely to have engaged in sexual concurrency. In terms of sexual initiation, Black females who resided with their mothers were less likely to have had sex.

Co-residence with a parent can be interpreted as a form of parental monitoring, or a reality of limited living options. Thus we originally hypothesized that such factors would have a protective effect with regard to engaging in sexual concurrency among young adults. While the effect is not significant, spending nights with mothers followed this hypothesis. However, the opposite is true for young adults who slept in the same house as their father, with the effect being significant for Colored males. Qualitative research is needed to better understand the reasons behind the latter results. Men are more likely to engage in multiple and concurrent sexual partnerships. It is possible that young men who spent nights with their father are observing such behavior, and then attempting to emulate this behavior through using their fathers as role models. For young women, they may observe their fathers engaging in concurrent partnerships, and therefore feel that such behavior is acceptable (Hunter, 2004). Since time spent with fathers also increased the probability of sexual concurrency for young Black men, it is possible that young men may be taught to think that the commonality of having multiple overlapping sexual partners makes it acceptable and perhaps even encouraged as

manifestation of a man's sexual prowess and dominance over women. In a related vein, there may be a pressure to conform to avoid being perceived as not masculine.

Surprisingly, spending time with mothers was found to have a negative effect for young women. Better understanding of this peculiar finding is warranted, such as through determining the content of conversations between mothers and daughters. For example, if mothers misunderstand HIV transmission mechanism then they may not realize the risk factors and pass on misinformation to their daughters. Alternatively, a more morbid interpretation could be that mothers realize and accept the inevitability of sexual concurrency in young men, and are transmitting that viewpoint to their daughters. While not directly encouraging promiscuous sexual behaviors, this may lead young women to themselves have multiple sexual partners as Mah (2008) has found a strong relationship between reporting sexual concurrency and knowing that your sexual partner has other partners. Furthermore, mothers may be engaging in sexual concurrency themselves out of financial desperation or have more than one sexual partner to meet different desires, and thus portray it as acceptable behavior to their daughters (Leclerc-Madlala, 2003). An alternate explanation for this odd result is that of omitted variable bias, some of which may be caused by unobserved heterogeneity.

Some limitations to this study should be mentioned. As with all survey data addressing sexual behavior, there is a concern regarding the accuracy of responses – respondents may phrase their answers to be socially desirable rather than correct. For example, males tend to overestimate their number of sexual partners whereas females tend to provide an underestimate. However, this social desirability bias may be minimal since respondents were given the choice to fill out surveys themselves instead of answering questions, and also the option of refusing to answer questions from the sexual relationships module. Given the sensitivity of the questions involved, there is likely an underreporting of sexual concurrency, which would bias the results. The majority of respondents chose to answer the module with the involvement of the interviewer, perhaps indicating their comfort level with divulging their sexual history. There may also be recall bias as respondents are asked for

information about their ten most recent sexual partners, which may have spanned years, but individuals were given the option of saying that they don't know.

In terms of the data, only non-institutionalized individuals were surveyed. Furthermore, homeless individuals were excluded from the survey. Thus, the results may not be applicable to those groups. Also, the fact that the questions regarding sexual partners were only asked of young adults limits my ability to generalize the results to older individuals. For instance, migration for work purposes as respondents get older may affect sexual concurrency; such workers may choose to have both a regular sexual partner at home, and another at their work location. Similarly, sexual concurrency may increase as respondents' earning power increases (usually as a result of experience), when they are able to afford more transactional sex (not prostitution per se, but perhaps the exchange of gifts). Nevertheless, the depth and detail of the questions outweigh the age limitation. Furthermore, by focusing on young adults, it may still be possible, or may be easier, to influence their sexual behavior through policy.

Future research will look at the impact of being an orphan on sexual concurrency, to compliment this analysis as well as add to the field investigating the association between orphanhood and risk behaviors. Questions to be asked include whether age when mother/father died affects sexual concurrency as it is possible that parental death has varying effects, depending on how long they have been an orphan. For instance, parental death may have less of an impact on individuals if it occurs at a later rather than an earlier age, as parents would have had more of an opportunity to invest in their children in the former scenario.

This study found that certain dimensions of parental investment can have a protective effect in lowering the probability of concurrent sexual partnerships, which in turn would lower HIV transmission. There are also a number of potential implications. First, a better understanding is needed to pinpoint the factors resulting in maternal co-residence being protective. However, the negative effect of maternal time with daughters needs to be better understood such as through interviews with mother-daughter pairs. Second, given the often transactional nature of sexual

concurrency for young adults, it is surprising that parental financial support did not have a protective effect for young women. However, since financial support from fathers significantly decreased the probability of sexual concurrency among young men, it would be interesting to determine why the effect does not extend to daughters. For example, are sons getting spending money more frequently, or of larger amounts? Third, the relatively high number of young men reporting sexual concurrency points to a need for health education programs focusing on the risks of concurrent sexual partners. The widespread tolerance of concurrent sexual partners is increasingly being shown as a driving factor behind South Africa's high HIV prevalence rates. The adverse consequences (for example, HIV infection) associated with sexual concurrency should be highlighted more in HIV prevention campaigns by emphasizing the "Be Faithful" component of the ABC's of HIV prevention - Abstinence, Be Faithful, Condom use and also incorporated into HIV education materials at school levels.

Table 4.1 Descriptive Statistics

	Females (n=1709)	**Males (n=1467)**
Never had sex	32.6%	32.2%
Had sex & Not sex concurr	64.5%	56.9%
Had sex & Sex concurr	2.9%	11.0%
Maternal Investment		
Co-residence	71.9%	75.3%
Time together	32.4%	28.7%
Financial Support	78.6%	79.8%
Paternal Investment		
Co-residence	44.0%	47.7%
Time together	12.9%	16.3%
Financial Support	51.8%	56.5%
Age	17.7 years old	17.6 years old
In School	66.50%	66.30%
Per Capita Income (SA Rand)	R989.93	R 1061.58
Black	43.7%	42.1%
Colored	47.3%	48.5%
Other	9.1%	9.3%

Table 4.2 Multinomial Logistic Regression:
(Had sex, sex concurr) VS (Had sex, not sex concurr)

	Black Males (n=618)		Black Females (n=746)		Colored Males (n=712)	
	RRR	**p-value**	**RRR**	**p-value**	**RRR**	**p-value**
Maternal Investment						
Co-residence	0.637	0.258	0.494	0.128	0.742	0.589
Time together	0.724	0.337	2.174	0.086	1.212	0.677
Financial Support	1.463	0.317	0.989	0.979	1.591	0.405
Paternal Investment						
Co-residence	1.272	0.581	1.344	0.512	2.480	0.028
Time together	2.561	0.033	0.764	0.688	0.745	0.634
Financial Support	0.410	0.023	0.717	0.401	0.444	0.031
Age Group 1 (<18)	1.109	0.760	2.260	0.140	1.442	0.577
Age Group 2 (18-20)	0.682	0.214	2.617	0.062	1.225	0.717
In School	1.056	0.849	0.678	0.278	0.778	0.577
Per Capita Income	1.000	0.080	0.999	0.265	0.999	0.097

Table 4.3 Multinomial Logistic Regression:
(Never had sex) VS (Had sex, not sex concurr)

	Black Males (n=618)		Black Females (n=746)		Colored Males (n=712)	
	RRR	**p-value**	**RRR**	**p-value**	**RRR**	**p-value**
Maternal Investment						
Co-residence	0.912	0.813	2.326	0.010	1.031	0.918
Time together	0.932	0.824	0.715	0.299	1.008	0.972
Financial Support	1.092	0.816	0.889	0.728	1.435	0.242
Paternal Investment						
Co-residence	1.005	0.988	0.955	0.909	1.062	0.795
Time together	1.430	0.388	1.109	0.815	1.388	0.320
Financial Support	0.802	0.500	1.325	0.461	0.892	0.614
Age Group 1 (<18)	5.765	0.001	9.262	0.000	2.582	0.006
Age Group 2 (18-20)	1.951	0.221	2.101	0.275	0.819	0.567
In School	2.859	0.017	4.373	0.003	3.514	0.000
Per Capita Income	1.000	0.315	1.000	0.303	1.000	0.115

REFERENCES

1. Adimora, Adaora A., Victor J. Schoenbach, Francis Martinson, Kathryn H. Donaldson, Tonya R. Stancil and Robert E. Fullilove, 2004, "Concurrent Sexual Partnerships among African Americans in the Rural South," *Annals of Epidemiology*, 14: 155-160.

2. Avert, "AIDS and HIV around the world" http://www.avert.org/aroundworld.htm and "HIV and AIDS in Africa questions" http://www.avert.org/aids-africa-questions.htm (both last accessed May 7, 2010)

3. Bandura, Albert, 1998, "Health Promotion from the Perspective of Social Cognitive Theory," *Psychology and Health*, 13: 623-649.

4. Camlin, Carol S. and Rachel C. Snow, 2008, "Parental Investment, Club Membership, and Youth Sexual Risk Behavior in Cape Town," *Health Education & Behavior*, 35(4): 522-540.

5. Conly, Shanti, 2008, "Responding to the Epidemic: Addressing Multiple and Concurrent Partners," *HIV Implementers' Meeting, USAID Office of HIV/AIDS*.

6. Drumright, Lydia N., Pamina M. Gorbach, King K. Holmes, 2004, "Do People Really Know Their Sex Partners? Concurrency, Knowledge of Partner Behavior and Sexually Transmitted Infections Within Partnerships," *Sexually Transmitted Diseases*, 31(7): 437-442.

7. Epstein, 2010, "The Mathematics of Concurrent Partnerships and HIV: A Commentary on Lurie and Rosenthal, 2009," *AIDS and Behavior*, DOI 10.1007/s10461-009-9627-x.

8. Halperin, Daniel T and Helen Epstein, 2007, "Why is HIV prevalence so severe in southern Africa? The role of multiple concurrent partnerships and lack of male circumcision: Implications for AIDS prevention," *Southern African Journal of HIV Medicine*, 9: 19-25.

9. Hollingsworth, T. Deirdre, Roy M. Anderson and Christophe Fraser, 2008, "HIV-1 Transmission, by Stage of Infection," *Journal of Infectious Diseases*, 198: 687-693.

10. Human Sciences Research Council, 2008, "South African National HIV Prevalence, HIV Incidence, Behavior and Communication Survey."

11. Hunter, Mark, 2004, "Masculinities, multiple-sexual-partners, and AIDS: the making and unmaking of *Isoka* in Kwazulu-Natal," *Transformation* 54: 123-153.

12. Jana, Michael, Mzwethu Nkambule, Dorothy Tumno, Sue Goldstein, and Renay Weiner, 2008, "Multiple and Concurrent Sexual Partnerships in Southern Africa: A Ten Country Research Report," *The Soul City Institute Regional Programme*.

13. Kalichman, Seth C., Dolly Ntseane, Keitseope Nthomang, Mosarwa Segwabe, Odireleng Phorano, and Leickness C. Simbayi, 2007, "Recent multiple sexual partners and HIV transmission risks among people living with HIV/AIDS in Botswana," *Sexually Transmitted Infections*, 83: 371-375.

14. Kenyon, Chris and Motasim Badri, 2009, "The Role of Concurrent Sexual Relationships in the Spread of Sexually Transmitted Infections in young South Africans," *The Southern African Journal of HIV Medicine*, Summer.

15. Lagarde, Emmanuel, Bertran Auvert, Michel Caraël, Martin Laourou, Benoît Ferry, Evina Akam, Tom Sukwa, Linda Morison, Bertrand Maury, Jane Chege, Ibrahima N'Doye, Ann Buvé and the Study Group on Heterogeneity of HIV Epidemics in African Cities, 2001, "Concurrent sexual partnerships and HIV prevalence in five urban communities of sub-Saharan Africa," *AIDS*, 15: 877-884.

16. Lam, David, Cally Ardington, Nicola Branson, Anne Case, Murray Leibbrandt, Alicia Menendez, Jeremy Seekings and Meredith Sparks. *The Cape Area Panel Study: A Very Short Introduction to the Integrated Waves 1-2-3-4 Data*. The University of Cape Town, October 2008.

17. Leclerc-Madlala, Suzanne, 2003, "Transactional Sex and the Pursuit of Modernity," *Social Dynamics*, 29(2): 213-223.

18. Lurie, Mark N. and Samantha Rosenthal, 2009, "Concurrent Partnerships as a Driver of the HIV Epidemic in Sub-Saharan Africa? The Evidence is Limited," *AIDS and Behavior*, DOI:10.1007/s10461-009-9583-5.

19. Lurie, Mark N. and Samantha Rosenthal, 2010, "The Concurrency Hypothesis in Sub-Saharan Africa: Convincing Empirical Evidence is Still Lacking. Response to Mah and Halperin, Epstein, and Morris," *AIDS and Behavior*, DOI 10.1007/s10461-009-9640-0.

20. Mah, Timothy L., 2008, "Concurrent sexual partnerships and HIV/AIDS among youths in the Cape Metropolitan Area," *AIDS and Society Research Unit, Center for Social Science Research Working Paper No 226*.

21. Mah, Timothy L., 2008, "Concurrent sexual partnerships and HIV transmission in Khayelitsha, South Africa," *AIDS and Society Research Unit, Center for Social Science Research Working Paper No. 225*.

22. Mah, Timothy L., and Daniel T. Halperin, 2008, "Concurrent Sexual Partnerships and the HIV Epidemics in Africa: Evidence to Move Forward," *AIDS and Behavior*, DOI:10.1007/s10461-008-9433-x.

23. Mah, Timothy L., and Daniel T. Halperin, 2009, "The Evidence for the Role of Concurrent Partnerships in Africa's HIV Epidemics: A Response to Lurie and Rosenthal," *AIDS and Behavior*, DOI:10.1007/s10461-009-9617-z.

24. Manhart, Lisa E., Sevgi O. Aral, King K. Holmes, and Betsy Foxman, 2002, "Sex Partner Concurrency. Measurement, Prevalence, and Correlates Among Urban 18-39 year olds," *Sexually Transmitted Diseases*, 29(3): 133-143.

25. Mishra, Vinod and Simona Bignami-Van Assche, 2008, "Concurrent Sexual Partnerships and HIV Infection: Evidence from Population-Based Surveys with HIV Testing," *International AIDS Conference, Mexico City*.

26. Morris, Martina and Mirjam Kretzschmar, 1997, "Concurrent partnerships and the spread of HIV," *AIDS*, 11:641-648.

27. Morris, Martina, 2010, "Barking up the Wrong Evidence Tree. Comment on Lurie & Rosenthal," *AIDS and Behavior*, DOI 10.1007/s10461-009-9639-6.

28. Nshindano, Chama and Pranitha Maharaj, 2008, "Reasons for multiple sexual partnerships: perspectives of young people in Zambia," *African Journal of AIDS Research*, 7(1): 37-44.

29. Oetting, Eugene R. and Joseph F. Donnermeyer, 1998, "Primary Socialization Theory: The Etiology of Drug Use and Deviance. I," *Substance Use & Misuse*, 33(4): 995-1026.

30. Operario, Don, Audrey Pettifor, Lucie Cluver, Catherine MacPhail, and Helen Rees, 2007, "Prevalence of Parental Death Among Young People in South Africa and Risk for HIV Infection," *Journal of Acquired Immune Deficiency Syndrome* 44(1): 93-98.

31. Parker, Warren, Benjamin Makhubele, Pumla Ntlabati and Cathy Connolly, 2007, "Concurrent Sexual Partnerships Among Young Adults in South Africa: Challenges for HIV prevention communication," *CADRE*.

32. Pettifor, Audrey E., Helen V. Rees, Immo Kleinschmidt, Annie E. Steffenson, Catherine MacPhail, Lindiwe Hlongwa-Madikizela, Kerry Vermaak, and Nancy S. Padian, "Young people's sexual health in South Africa: HIV prevalence and sexual behaviors from a nationally representative household survey," *AIDS*, 19: 1525-1534.

33. Pilcher, Christopher D., Hsiao Chuan Tien, Joseph J. Eron Jr, Pietro L. Vernazza, Szu-Yun Leu, Paul W. Stewart, Li-Ean Goh, and Myron S. Cohen, 2004, "Brief but Efficient: Acute HIV Infection and the Sexual Transmission of HIV," *Journal of Infectious Disease*, 189: 1785-1792.

34. Pongou, Roland, 2010, "Anonymity and Infidelity: Ethnic Identity, Strategic Cross-Ethnic Sexual Network Formation, and HIV/AIDS in Africa," *Working Paper*.

35. Reniers, Georges, and Rania Tfaily, 2008, "Polygyny and HIV in Malawi," *Working Paper*.

36. Sandøy, Ingvild F., Kumbutso Dzekedzeke and Knut Fylkesnes, 2008, "Prevalence and Correlates of Concurrent Sexual Partnerships in Zambia," *AIDS and Behavior*, DOI 10.1007/s10461-008-9472-3.

37. Steffenson, A.E., George R. Seage III, Audrey E. Pettifor, Helen V. Rees, and Paul D. Cleary, 2008, "Concurrent Sexual Partnerships and HIV Risk among South African Youth," *Working paper*.

38. Thanh Duong Cong, Nguyen Tran Hien, Nguyen Anh Tuan, Bui Duc Thang, Nguyen Thanh Long, and Knut Fylkesnes, 2008, HIV Risk Behaviors and Determinants Among People Living with HIV/AIDS in Vietnam," *AIDS and Behavior*, 13:1151-1159.

39. UNAIDS Reference Group on Estimates, Modelling and Projections: Consultation on concurrent sexual partnerships: recommendations from a meeting held in Nairobi, Kenya, April 20-21, 2009. http://www.epidem.org/publications.htm (last accessed December 23, 2009).

40. UNAIDS Reference Group on Estimates, Modelling, and Projections: Working Group on Measuring Concurrent Sexual Partnerships, 2009, “HIV: consensus indicators are needed for concurrency,” *The Lancet*, DOI:10.1016/S0140-6736(09)62040-7.

41. Xu Hongwei, Nancy Luke, and Eliya Zulu, 2009, “Concurrent Sexual Partnerships among Youth in Urban Kenya: Prevalence and Partnership Effects,” *Working Paper*

CHAPTER V: CONCLUSION

Since its discovery in 1981, HIV/AIDS has affected an increasing number of individuals. The expanding effects are particularly true in southern Africa, where the disease has already reached epidemic proportions. Thus, this dissertation focused on three aspects of the disease in the region.

In Chapter II, the associations between HIV and labor market participation were tested in order to inform economic policies. Findings indicate a significant negative association between being HIV positive and currently working, as well as having worked in the past 12 months for men and women. However, the direction of causality is unclear. Nevertheless, this finding has a number of implications. First, given the significant negative association between being HIV positive and currently working, the plausibility of providing anti-retroviral treatment for workers who need it should be investigated. Such a service may ultimately benefit both workers and their employers. For example, companies may face lower absences if their workers received treatment; for workers, there would be more employment support. Second, given the negative association between HIV positive status and working, the loss in financial income to a household already inflicted with additional medical bills needs to be addressed, such as through temporary governmental assistance. This is particularly relevant given that the negative marginal effect of being HIV positive is largest for adults in their prime working years. Third, further research is needed to ascertain what stage in the disease progression renders individuals unable to work. Efforts to alleviate poverty could then be targeted towards those households.

In Chapter III, the effects of fostering orphans on young adults in the recipient household were documented to help inform welfare policies. Surprisingly, among households in higher wealth quintiles, it was found that young adults from households fostering orphans have a higher probability of being enrolled in school. Orphan fostering has already been suggested as the reason the orphan

crisis has not exploded out of control in southern Africa, and given the resulting positive externalities for young adults in households from higher wealth quintiles, subsidies for families taking in orphans should be investigated further. For instance, the fostering grant could be increased in amount, restrictions could be eased, and the application procedure further simplified to make it easer to access. Future research will be targeted towards a better understanding of the positive externalities to determine how much selectivity there is when households are deciding whether to foster an orphan. For example, are households only choosing to foster orphans which provide a work substitute for their own children, thereby freeing up their own children's time and thus allowing co-resident and non-orphaned children to attend school?

In Chapter IV, the effects of parental investment on sexual concurrency among sexually active young adults were investigated in order to inform HIV prevention policies. While some findings were in line with expectations, others were surprising. In terms of the latter, an unexpected result was that time spent with mothers for Black females and time spent with fathers for Black males significantly increased the probability of being in sexually concurrent relationships. Research is needed to understand this unexpected outcome. For instance, qualitative research would help in understanding the reasoning behind such effects and help design HIV/AIDS prevention policies that are more gender and racially appropriate. Furthermore, given that 11% of young men reported having been in sexually concurrent relationships, health education programs on the risks of sexual concurrency among young adults may be beneficial.

APPENDIX

Table A1. Orphan Characteristics

	Wave 1 (n=112)	Wave 3 (n=137)	Wave 4 (n=187)
Double	36	45	52
Maternal	37	51	80
Paternal	38	41	55
Ages 0-6	38	18	20
Ages 7-12	58	49	66
Ages 13-18	15	70	101
Male	60	58	90
Female	51	79	97