Food Aid Support to HIV/AIDS-Affected Households in Western Kenya

An Abstract

Submitted on April 1, 2010
To the Department of International Health
In Partial Fulfillment of the Requirements of
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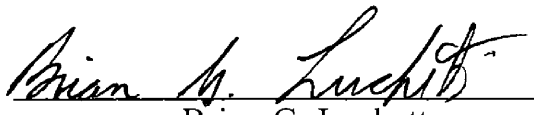
For the Degree of Doctor of Philosophy
by



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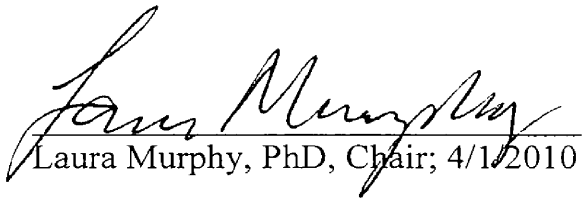

Laura Murphy, PhD, Chair; 4/1/2010

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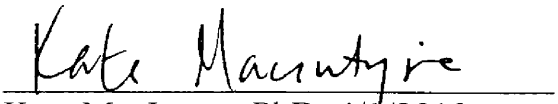

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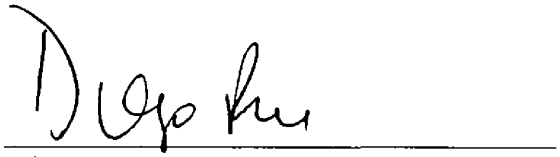

Diego Rose, PhD; 4/1/2010

Abstract

Empirical research in sub-Saharan Africa has found that the illness or death of a prime-age adult in rural, smallholder households erodes household livelihood sustainability through reduced labor productivity, stress-sales of assets, and curtailment of child education. This has prompted many policy makers to propose the use of food aid to support HIV/AIDS-affected households in their time of crisis.

The World Food Programme conducted a pilot food aid distribution in a high HIV prevalence area of western Kenya. Randomized cross-sectional surveys of 900 households in 30 clusters were taken at baseline and follow-up to guide and assess the project. Information about household demographics, labor employment, assets, food security, food aid receipt, school attendance and child health were collected in the surveys. The presence of a chronically ill prime-age adult or any recent death of a prime-age adult was used as a proxy measure of HIV/AIDS.

This study examines whether the provision of food aid to HIV/AIDS-affected households arrests the erosive effects of HIV/AIDS on smallholder livelihood security. I hypothesize that the provision of food aid increases retention of household assets, increases labor hours devoted to productive labor, decreases time spent in care-giving, decreases time spent in convalescence, increases land under cultivation, and increases school attendance by children.

I used a propensity score matching approach to address issues of selection bias in the assignment of households to participation in the pilot project. Regression analyses

estimated the association of program participation, HIV/AIDS-affectedness and their interaction on measures of livelihood security.

HIV/AIDS-affected households receiving food aid were better able to maintain their asset base and sustain their labor employment than similar households not receiving food aid. Prime-age women living in beneficiary households diversified their labor employment to include more off-farm activities. Beneficiary households with an ill prime-age adult reduced their land under cultivation. High school boys living in beneficiary households spent more time in school than those living in non-beneficiary households.

The period of prime-age illness is critical to smallholder livelihoods. The provision of food aid to HIV/AIDS-affected households is effective in maintaining productive assets and diversifying household labor to manage livelihood risks.

IRB Approval

Effective February 5, 2009, the Tulane Biomedical IRB approved Study#: 09-00308 for exempt status (45 CFR 46.101 (b), (4),(5)).

Food Aid Support to HIV/AIDS-Affected Households in Western Kenya

A Dissertation

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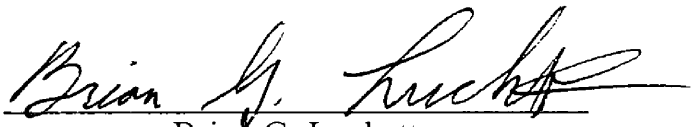

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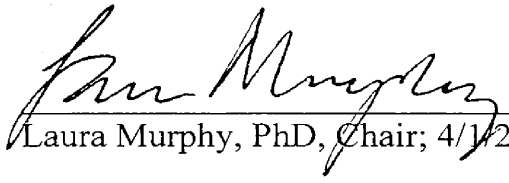

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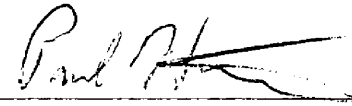

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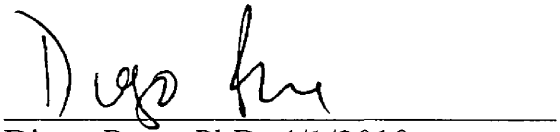

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Chapter 1: Introduction

Many international organizations have concluded that the HIV/AIDS epidemic in Eastern and Southern Africa is both a humanitarian emergency and a development challenge. The epidemic, as seen from a sustainable livelihoods approach, erodes the ability of households to exploit and maintain critical capital resources.

This loss of capital, it is argued, results in households being unable to meet their food needs. In the struggle to acquire basic sustenance, other priorities, such as school attendance and future income generation, are sacrificed. This downward spiral of capital erosion further impoverishes the household and makes it ever more vulnerable in the event of some external shock.

A number of organizations are experimenting with food aid to support HIV/AIDS-affected households. So far, food aid programs aimed at supporting HIV/AIDS-affected households have been designed around assumptions of causality based more on anecdotal evidence than hard data. A review of the literature reveals growing empirical evidence of the impact that HIV/AIDS is having on household food security, although the process remains less well understood.

Empirical evidence of the relationship between HIV/AIDS and food security will have an ever greater role in defining how food aid is used to address the epidemic. Field research can help to identify appropriate points of intervention in the HIV/AIDS-food insecurity cycle at which food aid would be effective. Identification of the affected

population is important to establishing effective targeting parameters. Quantifiable and reliable indicators are important in setting measurable objectives that facilitate rigorous monitoring and evaluation of programs.

Many funding organizations are placing greater emphasis on evidence-based programming as they seek to maximize the impact of their grants. A program design with empirical underpinnings is likely to be more amenable at the time of evaluation than one based in theory or on anecdotal evidence. The catch lies in how to accurately measure such a shifting and amorphous concept as "food security" and then be able to assign causality to other factors. Even the determination of HIV/AIDS status is difficult in populations with little access to health care and where HIV infected persons face discrimination.

1.1: Literature Review

In the past two and a half decades, the HIV/AIDS epidemic has emerged as, arguably, the world's foremost health crisis. Nowhere is the impact of the epidemic felt as strongly as in Sub-Saharan Africa where an estimated 25 million people are infected with HIV (Barnett and Whiteside, 2003). The epidemic has far reaching consequences for every aspect of life for both the infected and those around them. There is an ongoing debate about the role of the epidemic in driving food insecurity and what social safety net programs can be crafted to support households in crisis.

Food aid is one of the primary tools available to development and relief programmers to address food insecurity. But, currently there is not a consensus on how food aid can best be used to mitigate the effects of the HIV/AIDS epidemic, or even if it should be

used. Informing this debate is a substantial literature addressing the processes by which HIV/AIDS undermines individual and household food security.

1.2: The HIV/AIDS-Food Security Paradigm

Most of the early hypotheses about the interactions between HIV/AIDS and food security were informed by anecdotal evidence based on field observations. Gillespie, Jackson and Haddad (2001) presented one of the first comprehensive paradigms: presented below in a somewhat abbreviated form.

> Adult becomes sick ► reduces work ► other household members work longer on farm ► health care expenses rise ► reduced household consumption ► switch to labor-extensive crops with less nutritional value ► nutritional status decreases ► adult stops work ► increased care-giving burden ► assets sold to purchase food ► debts increase ► children removed from school to save on school fees and to work on farm ► adult dies ► funeral expenses ► reduced cultivation of land ► poor farm management practices leads to increase in crop pests and diseases ► loss of knowledge transfer to younger household members ► social reciprocity networks strained ► deceased person's partner becomes ill ► downward spiral accelerates...

Recent empirical research has borne out much of Gillespie's paradigm, but has found a much greater heterogeneity of effects than expected. However, there has emerged a general picture of the relationships between HIV/AIDS and household food security. HIV/AIDS impacts labor resources and allocation, asset levels, human capital investment and the nutritional status of infected individuals and children living in affected households. Addressing these various effects should be the aim of welfare interventions targeted to HIV/AIDS-affected households and should inform evaluation efforts.

1.3: Labor Constraints in HIV/AIDS-affected Households

A central element of the HIV/AIDS-food security paradigm is the impact that HIV/AIDS has on household labor supply. For instance, the FAO estimated that two person years of labor may be lost when a prime-age (PA) adult dies due to both the disability of the deceased person prior to death and care-giving obligations by other household members (as cited in Gillespie and Kadiyala, 2004). Onyango (2005) estimated a loss of 213 person days of labor lost per death-affected household and 162 person days of labor lost in illness-affected households in western Kenya. The FAO has estimated that HIV/AIDS in the ten hardest hit African countries will reduce the labor force by 20 percent by 2020 (as cited in Yamano and Jayne, 2002).

However, affected households do not all suffer labor constraints after the death of a PA member either because they were able to replace PA adults or had more PA adults to begin with (Mather et al, 2004). In fact, Mather, Donovan, Jayne, et al. (2004) found that the average affected household had as many, if not more, PA adults *ex post* than non-affected households. This is likely due to a result reported by Beegle (2003) that one third of adult deaths reported were among people who moved into the household within six months prior to death. This suggests that many HIV/AIDS-affected households may not experience a labor shortage as a result of losing a member.

It should also be remembered that following a death in a household, the household has one less person to feed. Thus, lower household food production or consumption may not necessarily reflect an erosion of household food security. The impact that a PA death has on household welfare is often dependant on the role the deceased played in the household's livelihood with the death of a core member having a greater impact than the

death of an incidental adult member. Estimates of the percentage of household heads/spouses comprising PA deaths range from 53 in Malawi to 16 in Zambia among five national studies cited by Mather, Donovan, Jayne, et al. (2004).

Gender and household position of the ill/deceased person is important in determining the impact on the household (Mather et al, 2004, Mather and Donovan, 2008). Households will replace adult members depending on the gender and position in the household of the deceased person. Households experiencing the death of a head/spouse were found to have fewer *ex post* members and higher dependency than non-affected households (Mather, Donovan, Janyne, et al., 2004). Mather and Donovan (2008) found that a male PA death resulted in an average reduction of 1.07 adults in the household while a PA female death reduced household size by an average of 0.30 adults as 52 percent of households experiencing a PA female death were able to attract a new PA adult member while only 27 percent of households experiencing a PA male death did.

Beegle (2003) found that in the period preceding a male death, prime age women and teenage boys spend 6 to 7 hours per week more in farm labor. Also, children and the elderly spent less time in farm labor preceding a male death suggesting that the period of incapacitating illness prior to a male death is a critical time in which some household members spend more time in care-giving and others must make up for that lost farm labor.

Prime-age morbidity and mortality affects off-farm labor as well. Yamano and Jayne (2002) found that households affected by a PA death had a mean reduction in off-farm income of 35 to 40 percent. However, if the deceased was a male head of household, the mean reduction in off-farm income was almost 80 percent. Mather and Donovan (2008)

found an 88 percent reduction in non-farm income following the death of a PA male head of household in southern Mozambique. They also found that PA male chronic illness was associated with a significant reduction in non-farm income nationally while PA female chronic illness significantly reduced non-farm income in some regions. Chapoto and Jayne (2005) did not find a significant decline in non-farm income among Zambian households experiencing PA mortality.

1.4: Asset Erosion

Households coping with a chronic illness may be forced to sell off household assets to be able to afford health care or to compensate for the lost income of the ill member. After the death of an ill member, households may sell off assets to pay funeral expenses or to further compensate for lost income. For instance, Kenyan households experiencing the death of a head/spouse had significantly lower asset levels than non-affected households by approximately one half (Yamano & Jayne, 2002). The effect was especially notable for small livestock (chickens, pigs, goats and sheep).

Using the FAO's tropical livestock units, Mather and Donovan (2008) found a 34 percent reduction in TLUs due to a PA male death. PA female deaths were not associated with any reductions in tropical livestock units nor were any reductions found in PA illness-affected households. There was a significant reduction in cattle holdings by 30 percent among households in Zambia experiencing the death of a male head of household (Chapoto and Jayne, 2005). There was also a significant reduction in small animal holdings among Zambian households experiencing a PA death with Chapoto and Jayne (2005) finding a decrease in small animal holding of 30 and 42 percent among

households experiencing the death of a PA male or female, respectively. However, Zambian households experiencing the death of a male head of household had an average reduction in small animals of 65 percent and a 37 percent decline after the death of a female head or spouse. However, the impact of PA mortality may vary by pre-death household wealth. Wealthier households in Zambia experienced an average decline in small animal holdings of 77 percent while poorer households showed a decline of 55 percent (Chapoto and Jayne, 2005).

In addition to the loss of livestock assets, HIV/AIDS can lead to declining farm productivity through the loss of landholdings and farming implements. Households in Kenya experiencing the death of a prime-age male showed an average reduction in farming implements of 29 percent (Yamano & Jayne, 2002). Mather and Donovan (2008) using a panel study approach in Mozambique found that total landholdings were reduced by 20 percent after a PA male death and 19 percent after a PA female death. The death of a male head of household resulted in a reduction in landholding of 32 percent. However, due to demographic changes in households after a PA death, Mather and Donovan found no change in landholding per adult equivalent.

1.5: Land Under Cultivation

Due to labor constraints and the loss of productive assets, many HIV/AIDS-affected households are unable to maintain the area of land previously under cultivation and must allow more land to lay fallow. For instance, Onyango (2005) estimated that households affected by death and illness in western Kenya had 22 percent and 26 percent less land under cultivation, respectively, than non-affected households. Additionally, Jayne,

Chapoto, Byron, et al. (2006) estimated that the difference in community mortality rates from the 25th to the 75th percentile resulted in a decrease in community land area under cultivation of 5.2 percent.

The impact of death on land cultivation varies by the gender of the deceased person in the household. Onyango estimated a reduction of one quarter hectare under cultivation when the deceased was a male, but only a negligible reduction when the deceased was female. In Zambia, Chapoto and Jayne (2005) found a statistically significant reduction in land under cultivation after the death of an adult male but not after the death of an adult female. However, if the deceased was a male head of household there was a 21 percent reduction in land under cultivation.

Yamano and Jayne (2002) found that among Kenyan households surveyed that fell into the bottom half of the income range, the death of a PA male head/spouse resulted in reduced area devoted to cash crops while the death of a PA female head/spouse resulted in reduced area devoted to cereal crops. Among households experiencing the loss of a head/spouse, there was a 68 percent reduction in the net value of agricultural output. This was primarily due to loss of cash crop (coffee) income.

1.6: Orphans and Vulnerable Children (OVC)

UNICEF estimates that there are 11 million orphans in Sub-Saharan Africa (as cited in Gillespie and Kadiyala, 2004). The implications of this staggering number is that there are millions of vulnerable children who may be caring for ill family members, dropping out of school, going hungry and living on the streets. This is leading to more unprotected, poorly-socialized and under-educated young people who will, in turn, may

be at greater risk of contracting HIV. Orphans face stigma and even discrimination within their adoptive households. Orphans often are denied the same access to resources such as food and education granted to the other, non-adopted, children in the household (WFP, 2002). They may be forced to work longer hours and be subjected to physical and emotional abuse.

Nyambedha, Wandibba, Aagaarrdd-Hansen, et al. (2003) conducted a study of orphans in western Kenya. Of the children included in the study, one third of the children had lost at least one parent. Of those children who had lost a parent, half had lost their father, 20 percent had lost their mother and the remaining 30 percent had lost both parents. 12 percent of orphans were under five years of age. Of 100 caregivers who completed a structured interview, 84 percent mentioned schooling as a problem and 48 percent reported a lack of food. The study also found that widowed mothers were generally unable to afford both food and school fees so that children of deceased fathers were much less likely to attend school.

The results from Nyambedha's study reinforce the conclusions of Yamano and Jayne's 2004 study of PA mortality and primary school attendance in Kenya. They found that children living in a household with a terminally ill adult were 20 percent less likely to attend school. However, among poor households, about a third of children in households with a terminally ill adult did not attend school. After the death of a PA adult in a poor household, boys were 24 percent less likely to attend school. It should be noted though that both studies by Nyambedha, Wandibba, Aagaarrdd-Hansen, et al. and Yamano and Jayne were conducted prior to the 2003 decision by the Government of Kenya to provide free primary schooling to children less than 12 years of age.

1.7: Food Aid Interventions

The empirical evidence supports the conclusion that poor households experiencing a PA illness and/or death suffer negative impacts on their food security. Without any intervention a downward cycle of decreasing labor productivity and an eroding asset base reduces the viability of a household's livelihood.

Food aid is generally the first reaction to food insecurity problems in developing countries by development agencies. There is heated debate about whether food aid is the correct response. Levine and Chastre (2004) argue that free distribution of food is appropriate only when three conditions exist: 1) targeted households lack access to food, 2) there is a lack of availability of food and inelasticity of supply, and 3) alternative ways of helping people get access to food would either take too long or might not be practical or reliable.

Food insecurity among HIV/AIDS-affected households happens in the midst of well functioning markets. Therefore, it would appear that free food distribution to HIV/AIDS-affected households or individuals is not an appropriate response. However, donors are reluctant to provide cash transfer assistance for fear of misallocation. Also, food aid is politically popular with donor governments, and food aid, being somewhat less fungible, is more likely to be fully consumed while cash may be spent on a variety of needs. These factors make food aid programming attractive despite considerations of cost-effectiveness or what is ultimately best for beneficiaries and the communities in which they reside.

Targeting food to HIV/AIDS-affected households is problematic. "The finding that many affected households have similar household income and land/labor ratios in comparison with their non-affected neighbors suggests that it will be difficult to

effectively target food aid, and other assistance, or technologies to "affected households" (Mather, Donovan, Jayne, et al., 2004)."

The misuse of food aid may have negative consequences. It is unclear if targeting food aid to HIV/AIDS-affected households strengthens or erodes local social support systems. And most disturbingly, Yamano and Jayne (2002) pose the question of moral hazard: "to what extent would men be motivated to take greater risks in their behavior knowing that assistance would be available to their families in the event of their death?"

Despite such concerns, food aid has been shown to be effective in meeting the nutritional needs of recipient individuals and households while providing some secondary incentives and benefits. Improved nutrition can facilitate learning and increase school attendance among vulnerable children. The World Bank estimated that the most cost-effective means of supporting OVC is to provide them with schooling support and nutritional supplements (as cited in Gillespie and Kadiyala, 2004).

HIV infected individuals benefit from food assistance also. Egge and Strasser (2005) noted that almost all program participants and personnel stated seeing positive impacts of food aid on PLWHA. The most commonly cited benefits are increased weight, improved health and increased food consumption. Beneficiaries reported that after receiving food aid they noticed marked improvements in weight, strength, ability to work and overall well-being. Some informants stated that the receipt of food aid freed up money they would have otherwise spent on basic food stuffs and allowed them to diversify their diets.

Food aid may be thought of as an income support to poor households since those households tend to spend a very large proportion of their income on food. The provision of food aid allows households to use money that would otherwise have been spent on

purchasing food for other needs. In some respects, this wealth transfer is similar to an unconditional cash transfer. Cash transfers have been shown to be effective in increasing school enrollment and attendance, health care service utilization and diversifying diets (Adato and Bassett, 2008).

1.8: Targeted Food Assistance Programs

A variety of targeting schemes can be employed to reach targeted individuals/households. Self-targeting schemes such as inferior commodities or food-for-work programs are not suitable for targeting households that are both HIV/AIDS-affected and food insecure due to issues of palatability in feeding PLWHA and labor constraints in HIV/AIDS-affected households (WFP, 2003). General distributions may help to prevent refugees from engaging in transactional sex, but such distributions can hardly be described as targeted to HIV/AIDS-affected populations. Agency-managed food distributions can be appropriate, particularly in targeting individuals identified through clinics and hospitals. Community-based/managed schemes that utilize village committees to determine program eligibility are likely to be the most appropriate means to support HIV/AIDS-affected households. Mathys (2003) states that community-managed targeting is most appropriate when the program is directed at livelihood support rather than prevention of morbidity/mortality.

Mason, Bailes, Mason, et al. (2007) conclude from their testing of the new variant famine hypothesis that assistance targeted to drought-prone communities or those with a weak productive asset base may be an important part of food security and HIV/AIDS mitigation programs and policies.

1.9: Issues in Empirical Research

Surveys of HIV/AIDS impacts on household food security face several problems with identifying affected households and measuring effects. One common problem is the exclusion of households that have dissolved due to the affects of HIV/AIDS in surveys. Missing these households would bias estimates of mortality rates and mortality impacts downwards. However, panel data from multiple countries show that dissolution rates are low (Mather et al, 2004). Of the households that could not be re-interviewed (5.6 percent of the *ex ante* households) in Yamano and Jayne's Kenya study, only 11 percent had dissolved.

Another issue arises because studies are typically conducted in areas with high HIV prevalence which can limit their generalizability to national populations (Mather et al, 2004). Studies done in high population density areas may reflect land scarce and labor abundant environments and not allow extrapolation to labor constrained areas where the problem of PA deaths is likely most severe (Beegle, 2003, Mather et al, 2004). Mather et al lament that there is an "absence of nationally-representative micro-level information on the effects of HIV/AIDS on rural households and communities."

Labor resources of households may extend into other, non-affected households, making it difficult to assess the impact of chronic illness and death on a household's labor supply (Beegle, 2003). Female-headed households are particularly reliant on neighbors to help with farm work during peak agricultural seasons (Donovan et al, 2003). As Mather, Donovan, Jayne, et al. (2004) state, "In areas where the epidemic is more widespread, no household in a community remains unaffected in one way or another and all the households may have negative effects." Thus, comparing affected households to

unaffected households in an analysis may underestimate the true impact of the disease because households being considered as "unaffected" may have, in reality, suffered from some external impacts.

In rural Africa, people may not know that they are HIV positive or may be unwilling to admit that someone in their household has AIDS for fear of stigma. Thus, proxy indicators of HIV/AIDS must be employed to identify affected households. "Prime-age" is an important concept in measuring the impact of HIV/AIDS. Yamano and Jayne (2002) defined "prime age" using the ranges of 15 to 45 years for women and 15 to 54 years for men. These age ranges were based on clinical data for age at diagnosis of AIDS cases rather than an age range that necessarily coincides with highest economic productivity. PA deaths should therefore be considered a marker of AIDS rather than economic productivity, although there is significant overlap between the two.

Prime-age (PA) death has been found to be an accurate marker for AIDS. Beegle (2003) found that 95 percent of prime-age (20-50 years) deaths were attributed to illness. Yamano and Jayne compared the mortality rates for PA adults in their sample to published mortality rates among a known HIV negative sample in Tanzania and found that most PA deaths could be attributed to AIDS. Donovan, Bailey, Mpyisi, et al. (2003) used 'verbal autopsies' to further refine the reliability of AIDS indicators and found that most PA deaths could be attributed to a long-term illness.

One of the main issues in analyzing data from household surveys of HIV/AIDS is the issue of endogeneity in regression models. Endogeneity occurs when some unobserved factor predicts one of the independent variables in the model. Attention has been focused on variables of HIV/AIDS-affectedness since HIV/AIDS is not distributed randomly

amongst households, but is associated with certain household characteristics. Failure to control for these differences could lead to biased estimates of the impact of PA death and illness on households.

Beegle (2003) discusses three ways in which PA deaths may be endogenous. Since HIV infection is the result of a pattern of behaviors, the death of an adult may be a function of both household unobservables and the deceased individual's unobservables. Alternatively, any illness or disability of surviving household members may hasten the death of a terminally ill member due to reduced income/consumption or care-giving. An ill person may choose to seek end of life care in a particular household due to that household's ability to care for him/her. Chapoto and Jayne (2005) used a Hausman-Wu test for endogeneity that compares ordinary least squares regression to instrumental variable results and found that the death of a prime-age adult in a household was endogenous to the model.

Cross-sectional studies present issues of assigning causality. Barnighausen, Hosegood, Timeaus, et al. (2007) discuss limitations of cross-sectional studies in examining the relationship between HIV/AIDS and socioeconomic status. They point out that cross-sectional studies are not able to distinguish between the effect of socioeconomic status on HIV/AIDS and the effect of HIV/AIDS on socioeconomic status. Malnutrition among poor women may make them more vulnerable to HIV transmission due to reduced integrity of the vaginal epithelium making it more permeable to HIV. Poor women may be more dependant on their male partners and suffer from reduced bargaining power in asserting the use of condoms or other preventive measures. On the other hand, wealthier people may have more resources to attract multiple partners,

thus increasing their likelihood of being exposed. Conversely, HIV/AIDS may limit a person's ability to work and may lead to substantial increases in health care expenses thus leading to lower socioeconomic status. Eliciting such bi-directional causality between HIV/AIDS and socioeconomic status is not possible with cross-sectional studies. However, de Walque (2006) found no consistent pattern relating wealth to HIV infection across five countries with Demographic Health Survey seroprevalence data.

Mahal, Canning, Odumosu, et al. (2008) analyzed cross-sectional data to compare health care expenditures of HIV infected individuals with that of non-infected individuals. To control for selection bias associated with the non-random nature of both HIV infection and a convenience sample of infected individuals identified through clinics, the authors used propensity score matching. The authors admit that the control group identified through PSM is only truly valid if HIV is not correlated with unobserved confounders. They state: "In the absence of real experimental data, estimating the effect of being HIV positive adjusting for observable confounders, as we did, seems better than not adjusting at all, even if it falls short of adjusting for all possible confounding effects."

1.10: Knowledge Gaps in HIV/AIDS Interventions

On the face of it, provision of food aid to HIV/AIDS-affected households appears to be the good and humanitarian thing to do. However, in the context of limited available funding for HIV/AIDS programming, empirical evidence for the effectiveness of food aid is essential. This is especially true considering the potential downsides of food aid, such as depressing local agricultural markets, dependency on food aid to the detriment of local

initiatives, and stigma associated with participation in the program. So far, such empirical evidence is sparse at best.

The 2006 Political Declaration on HIV/AIDS which was endorsed by all UN member states resolved in Article 28 to, "integrate food and nutritional support... as part of a comprehensive response to HIV/AIDS." Thus, UNAIDS has advocated that governments ensure that food and nutrition assistance is "relevant and appropriate" to people living with HIV/AIDS (UNAIDS, 2006).

However, the UK-DFID states that it receives many applications for nutritional intervention programs aimed at people living with HIV/AIDS, but is unable to assess the relative merits of such programs due to a lack of evidence on the efficacy of such programs (de Wall and Tumushabe, 2003). Murphy (2004) quotes one nutritionist as saying, "the advocacy and mobilization got ahead of our knowledge and empirical evidence of the reality." Another nutritionist agreed, saying: "The awareness is good, but the jump to causal linkage is bad. It is not data driven, not based on data."

Clearly, programmatic reaction to the issues of HIV/AIDS and food security needs a base of empirical evidence to support the large outlays that food distributions entail. Patricia Bonnard of USAID's Food and Nutrition Technical Assistance Project wrote: "Different strategies and interventions are relevant to different scenarios of how the disease is spreading and affecting a community. Therefore, the design of an appropriate mitigation strategy should begin with an assessment." (Bonnard, 2002)

In 2005, IFPRI organized the International Conference on HIV/AIDS, Food and Nutrition Security in Durban, South Africa. The call for abstracts specifically requested presentations concerning, "What is known about the processes and impacts of food and

nutrition-relevant policies, programs or interventions." More specifically, applicants were asked to address, "how to link short term (e.g. targeted food aid to address acute food insecurity of affected households) with longer term livelihood-oriented approaches." That same year Stuart Gillespie and Suneetha Kadiyala wrote in an IFPRI Food Policy Review that: "We need to build the evidence base on action. Indicators and monitoring systems need to be put in place to track the effectiveness of policies and programs aimed at responding to the interaction of HIV/AIDS with food and nutrition insecurity." (Gillespie, 2005)

A consultancy report issued by IFPRI concerning HIV/AIDS and food and nutrition security in Kenya noted in the executive summary that: "Following the IFPRI conference of 2005, it was recognized that national governments ought to integrate and scale up food and nutrition security in HIV/AIDS using evidence-based and scientifically proven research findings as a meaningful approach to mitigating the adverse effects of the pandemic." (Wagah, 2005)

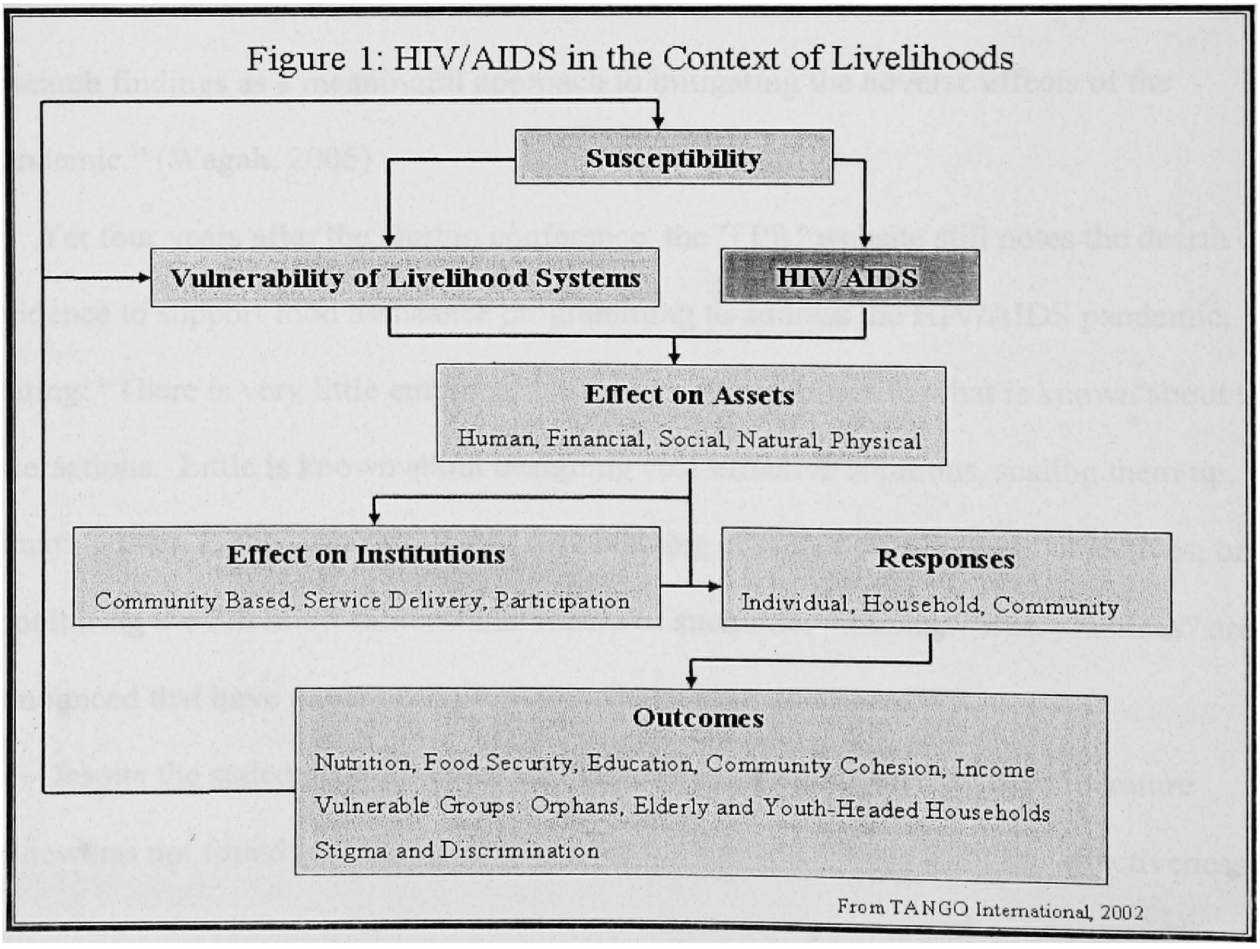
Yet four years after the Durbin conference, the IFPRI website still notes the dearth of evidence to support food assistance programming to address the HIV/AIDS pandemic, stating: "There is very little empirical basis to guide responses to what is known about the interactions. Little is known about designing cost-effective solutions, scaling them up, situating them in the larger strategies for obtaining complex development objectives, or monitoring the full multi-dimensional nature of such interventions. "Best practices" are announced that have never been properly evaluated or compared."

Despite the stated need for evidence-based programming, an extensive literature review has not found any examples of a rigorous statistical analysis of the effectiveness

and impacts of food aid to HIV/AIDS-affected households. The impact survey conducted by WFP to assess its Care and Nutrition of Households Affected by HIV/AIDS offers this opportunity. While these survey data are not ideal in all regards, it is sufficient to examine many of the main hypotheses underlying program models of food support to HIV/AIDS-affected households.

Chapter 2: Conceptual Model of HIV/AIDS and Rural Livelihoods

The effects of HIV/AIDS are felt throughout the social and economic environments of hard hit communities. Figure 1 presents a conceptual model of HIV/AIDS and its effect in a sustainable livelihoods model. The primary impact of the disease is through its effect on all forms of capital: human, financial, social, natural and physical. Erosions in the capital assets of individuals, households and communities lead to responses with poor outcomes with an increase in vulnerability and susceptibility to HIV infection that feeds back into a cycle of eroding assets bases.

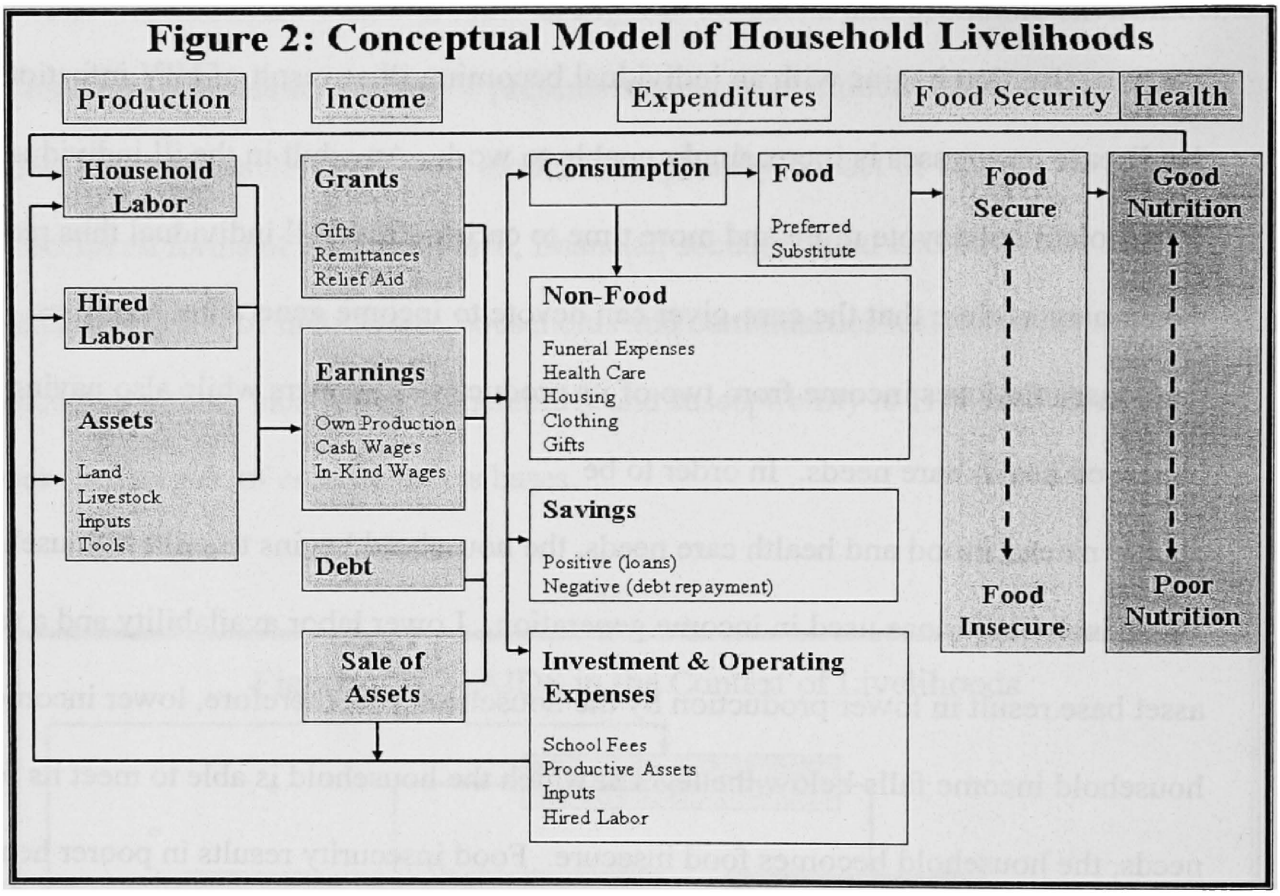


It is instructive to examine the impact of HIV/AIDS at different levels. For the purposes of this analysis, the effects of HIV/AIDS will be considered in the context of household livelihoods.

The process of HIV/AIDS leading to household food insecurity may be best described in a narrative that begins with an individual becoming ill as result of HIV infection and as the disease progresses is increasingly unable to work. An adult in the ill individual's household must devote more and more time to caring for the ill individual thus reducing the amount of time that the care-giver can devote to income generating activities. Thus, the household loses income from two of its productive members while also paying for increased health care needs. In order to be
able to meet its food and health care needs, the household begins to sell off household assets including those used in income generation. Lower labor availability and a reduced asset base result in lower production by the household and, therefore, lower income. As household income falls below the level at which the household is able to meet its food needs, the household becomes food insecure. Food insecurity results in poorer health of the household members as they are unable to meet their energy and protein needs. Poor nutrition leads to lower labor productivity, further reducing income, food expenditures, energy levels, etc.

Figure 2 presents a schematic of a simple household livelihood model. This model is intended to illustrate the situation of rural households typical of Western Kenya. Although not specific to farming households, the model emphasizes many aspects of small-holder agricultural systems such as land and livestock holdings, production of own

produce and purchase of farming inputs. The model does allow for landless households dependant on wage labor or petty trading though.



The main aspects of the model are production (employment of labor and assets) leading to income which is used to fund expenditures. Expenditures may be on food or non-food items. Adequate and consistent levels of food consumption determine household food security which is essential to the health of household members. Healthy household members are more productive and assumed to enjoy higher incomes.

HIV/AIDS has negative impacts and consequences for many aspects of a household's livelihood. It is assumed that the negative consequences of HIV/AIDS carry throughout the model and are recursive in nature leading to a cycle of worsening food insecurity.

Production: Households may employ labor, capital or both to generate income. The most productive members of any household are healthy, prime age adults, but older children and elderly adults may also be productive. Household labor may be employed in agricultural activities on the household's own land holdings (including rented land) or may be employed in formal or informal labor outside of the household. Households possessing productive assets but lacking sufficient intra-household labor may hire in labor while households with labor capacity exceeding that necessary to exploit the household's own asset base may hire out their labor for wages.

Household assets may be used to produce wealth or may be a form of consumption. Productive assets include land, livestock, tools and raw material inputs such as seed and fertilizer. Non-productive assets include such items as cooking utensils, hurricane lamps, furniture, etc. However, some assets may be a form of consumption for one household but a productive asset for another. For instance, a bicycle may be considered consumption if it is only used for personal transportation but a productive asset if it is used to transport goods to market.

Every household has a unique mix of assets and labor that will determine its productive capacity. It may be assumed that people will pursue their best economic interests and change households when it is advantageous to both the individual and the new household. Thus, prime age adults may migrate into more productive households and out of less productive ones.

HIV/AIDS impacts household productivity through labor constraints and liquidation of productive assets. When a household member becomes ill, s/he will spend less time working and more time convalescing while other household members will devote more time to care-giving for the ill member and less time to productive activities. Productive members of a household may migrate out to other households leading to a further erosion of labor assets in the first household. Health care costs associated with treating opportunistic infections may be met by the household through selling productive assets.

Income: Households receive income through own production, wage or in-kind labor, grants, borrowing and sale of household assets. Income is derived through household productivity (in case of own production) and wage and in-kind labor with these sources assumed to be at the core of small-holders' livelihood strategies. However, income may also come from remittances from migrant laborers, gifts from relatives and community members or relief aid, but these sources may be considered undependable or transitory and not a reliable part of a livelihood strategy. Income through debt may be erosive if it is used for consumption purposes since the household will be required to repay the loan at some future time with no additional income derived from its use. Sale of productive household assets may also be erosive if it is used for consumption and reduces the household's future potential earnings.

HIV/AIDS impacts household income primarily through lower productivity of its labor and erosion of assets, however, it may also reduce income through grants if the ill member returned home and is no longer able to send remittances or if relatives or community members reduce gifting due to either stigmatization associated with the disease or compassion fatigue over the course of the illness.

Expenditures: Household expenditures may be divided into consumption, savings and investment. Consumption is the purchase of products that are not used in the production of income. Although these products may be essential to life (e.g. food) they cannot be thought of as an investment since they are not directly involved in the creation of wealth. Consumption expenditures may be for food items or non-food items.

Households may save part of their income. Among low-income households, savings may take the form of loans to other households or individuals with an explicit agreement that the loan be repaid at some future time. Saving can be negative as well as positive. Negative savings are the repayment of past loans received and reduce the potential current and future consumption level of the household. A gift to another household or individual should be thought of as consumption since there is no expectation of repayment.

Investments are household expenditures made with the expectation that the expenditures will yield a greater return in the future. School fees are a common investment made by poor households in their children with the hope the children will someday earn more because of their education. Farming households invest in land (whether purchased or rented), farming tools, agricultural inputs (e.g. improved seed, fertilizer, pesticide), and hiring labor. Non-farming households may invest in inventory for resale and transportation costs to get their goods to market among other things.

HIV/AIDS primarily affects expenditures by shifting household spending to non-food consumption; especially health care costs, transportation costs in seeking health care, and funeral expenses. Poor households tend to spend the greatest proportion of their income on food. Increased health care costs and funeral expenses shift money from food

acquisition. Households may try to maintain food expenditures by decreasing expenditures on investment; most notably school fees.

Food Security: Ultimately, households are food secure or food insecure because of their ability to regularly generate income and devote that income to the acquisition of sufficient amounts of nutritious and palatable foods. Food security is dependent on a wide variety of factors involved in productivity and the allocation of resources within the household. However, food security is not a simple bivariate outcome, but ranges from famine to waste with most small-holder households lying somewhere in-between.

HIV/AIDS affects the food security level of a household through erosion of productivity and diversion of resources to non-food acquisition.

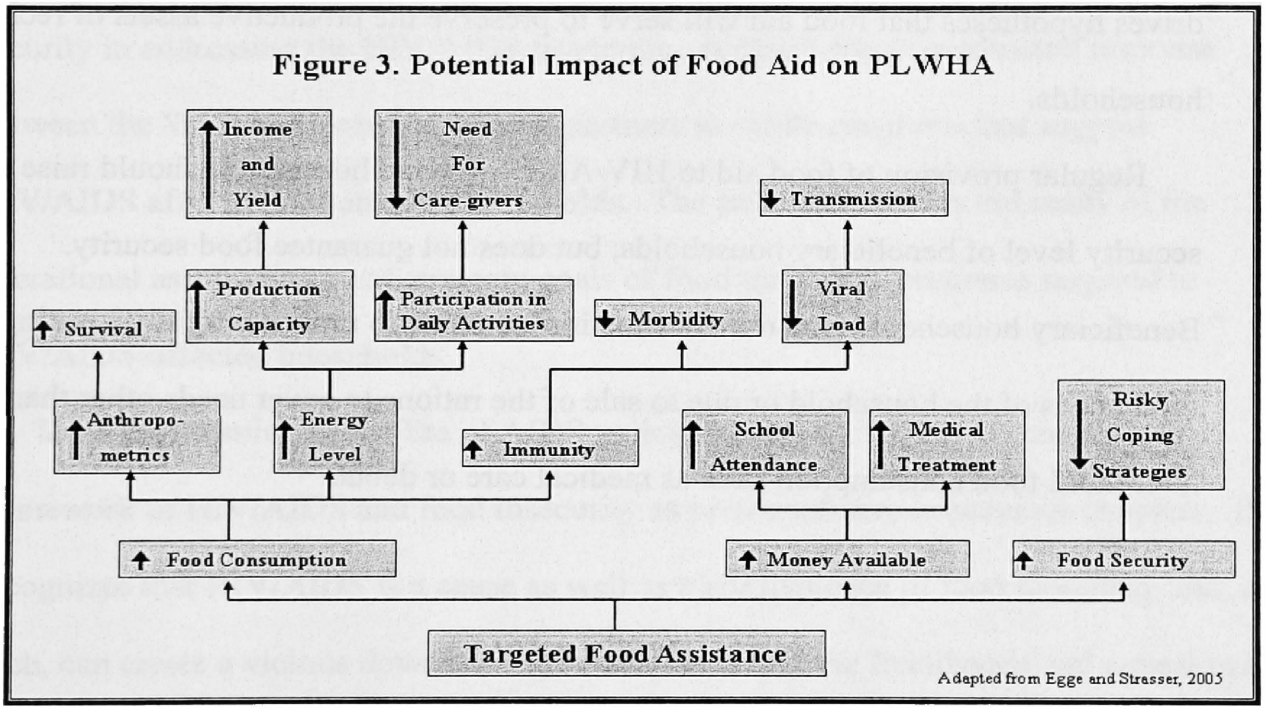
Health: Proper nutrition is essential to maintain health and food security is the foundation of proper nutrition. In the context of developing countries such as Kenya, negative health outcomes are much more likely to be due to undernourishment rather than over-nourishment as found in developed countries. Insufficient energy intake reduces an individual's ability to labor, especially the physically demanding manual labor commonly employed in agriculture. Low energy intake can also reduce cognitive acuity and impair a child's school performance. Micronutrient malnutrition can increase an individual's susceptibility to infection and decrease the amount of time or vigor that the individual is able to devote to labor.

HIV/AIDS makes infected individuals more susceptible to opportunistic infections. Proper nutrition is essential to maintaining the health of HIV infected persons so that they may remain active.

2.1: Food Aid

The provision of food aid has impacts and consequences for many aspects of household livelihoods which may counter the negative consequences of HIV/AIDS. Figure 3 provides a schematic of expected benefits of food aid to individuals living with HIV/AIDS. Although Figure 3 presents a model of individual level effects of food aid, the benefits that accrue to households may be easily extrapolated since households are composed of individuals.

Figure 3. Potential Impact of Food Aid on PLWHA



The provision of food aid to a HIV/AIDS-affected household may address the availability of labor within the household either through improving the health and stamina of members or by attracting new members seeking a more food secure household. Food aid may provide the nourishment that the HIV-infected person needs to remain productive thus reducing his/her care-giving burden and may improve the

nutrition of other household members and increase their productivity levels as well. Food aid will also compensate for the lost productivity of household members to some degree.

The fungibility of food aid means that it is essentially an income support. This is especially true in very poor landless households that expend most of their income on food, but is also true for landed households that are unable to meet their food consumption needs given their labor and asset base. Food aid allows the household to expend resources that would otherwise have been spent on food to hire labor, purchase health care, pay school fees or diversify diets. This concept of the fungibility of food aid drives hypotheses that food aid will serve to preserve the productive assets of recipient households.

Regular provision of food aid to HIV/AIDS-affected households should raise the food security level of beneficiary households, but does not guarantee food security. Beneficiary households may remain food insecure due to rations not fully meeting the food needs of the household or due to sale of the rations to cover needs other than household food consumption such as medical care or debts.

Chapter 3: Methods

3.1: The "Nutrition and Care of People Affected by HIV/AIDS" Pilot Project

In January of 2003, the WFP issued a policy paper titled, Programming in the Era of AIDS: WFP's Response to HIV/AIDS. This paper outlined a set of policy recommendations that explicitly acknowledged the central role of nutrition and food security in addressing the HIV/AIDS pandemic. It called for a coordinated response between the WFP and its implementing partners to create programs that support HIV/AIDS affected persons and households. The policy paper lays out many of the operational assumptions and strategic goals of food assistance programs targeted to HIV/AIDS-affected households

The Programming in the Era of AIDS policy paper builds upon the conceptual framework of HIV/AIDS and food insecurity as presented here in previous chapters. It recognizes that HIV/AIDS is a cause as well as a consequence of food insecurity and, as such, can create a vicious downward cycle that threatens the livelihoods and cohesion of affected households. Therefore, the paper endorses the use of food assistance to arrest the erosion of household capital and reduce the vulnerability of affected households.

The paper advocates the following principles in WFP programming in the context of HIV/AIDS:

- WFP involvement will focus on nutrition and food security targeting households based on their food security status and not their HIV status.

- Whenever possible and/or appropriate, WFP will take HIV/AIDS into consideration when creating programs or setting policy.
- WFP's HIV/AIDS response will be coordinated with and function within the host government's national HIV/AIDS strategy.
- WFP will work with local NGOs and CBOs to complement and scale-up existing prevention, mitigation and care activities.
- Particular emphasis will be placed on addressing the needs of the most vulnerable members of society including women children and, in particular, orphans.

WFP's Executive Board approved the recommendations of the Programming in the Era of AIDS policy paper in May of 2003 and called for their immediate implementation. In response, WFP/Kenya proposed a pilot project to test the feasibility and effectiveness of food aid distributions to HIV/AIDS-affected households. Kenya is an ideal location for such a pilot project due to a number of factors. The regional headquarters of the United Nations is located in the capital, Nairobi, in which the WFP/Kenya offices are housed. From Kenya, a large scale food relief program had been underway to provide emergency relief to populations in southern Sudan. Large shipments of food aid commodities are transported through the Kenyan port of Mombasa and loaded on trucks to warehouses in the interior. The preexistence of logistical support made the pilot project more economical, reliable and sustainable at a large scale.

The World Food Programme's stated goal of the Nutrition and Care of People Affected by HIV/AIDS pilot food assistance project is to "improve food security among vulnerable households, especially those headed by children and old grandparents." To this end, the project distributed take-home rations monthly to over 36,000 persons in up

to 8000 very poor households. Beneficiary households are therefore, firstly food insecure and secondly HIV/AIDS-affected.

WFP supports the project with funding and in-kind donations by the United States under the USAID's Food for Peace Program and by the European Commission's EuropeAid Cooperation Office. The project is implemented by the Government of Kenya's Department of Social Services within the Ministry of Gender, Sports, Culture and Social Services. Local implementing partners include: Christian Children's Fund in Funyula, Kenya Orphans and Rural Development Program in Matayos, Rural Education and Economic Enhancement Programme in Butula, World Vision in Budalangi, and Christian Support Fund in Nambale.

The local implementing partners are responsible for the distribution of rations to beneficiary households. These implementing partners train, monitor and work with village-level Community Management Committees to identify households to be included in the beneficiary rolls.

3.2: Project Area

Busia District is located in the Western Province of Kenya; bordering Uganda to the immediate north of Lake Victoria. The predominant ethnic group is Luhya. The district is divided into six divisions: Budalangi, Busia Town, Butula, Funyula, Matayos, and Nambale. The study area covered all divisions except the urban area of Busia Town. Appendix 2 provides a map of the project area.

The district lies within the Lake Victoria Basin providing relatively fertile farm land. Most of the area receives from 780 to 1015 mm of rainfall per year during two rainy

seasons: long rains from March to May and short rains from August to October and is drained by two rivers: the Nzoia and the Suo. Crops grown in Busia Distric include maize, millet, beans and cassava.

However, the area's agricultural potential is mitigated by its dense population. The 1999 census put the population of Busia District at 369,209 living in a dry land area of 1,125 km^2 for a population density of approximately 328 people per km^2 or 1.33 people per acre.

3.3: HIV in Busia District

Busia District has one of the highest HIV infection rates in Kenya (WFP, 2003). The Kenyan Ministry of Health reported that the sero-prevalence from Busia's antenatal clinics was 15.5 percent in 2002 compared to a national average of 8.7 percent in rural antenatal clinics and 12.4 percent in urban antenatal clinics. In 2001, the Kenya Ministry of Health reported the HIV prevalence in rural Busia at 20 percent and 28.5 percent in urban Busia Town.

However, more recent evidence found that the Western Province, of which Busia is one district, has lower HIV prevalence than the national average. The 2007 Kenya AIDS Indicator Survey (Republic of Kenya, 2009) found that the Western Province has a prevalence of 5.3 percent among adults 15 to 64 years of age in the rural areas and 6.0 percent in urban areas. Busia District though, is in the south of the Western Province adjacent to Nyanza Province which has the highest HIV prevalence in the nation. Therefore, the prevalence of HIV in Busia District may be closer to that of Nyanza Province. Nyanza Province has a prevalence of 14.9 percent in rural areas and 13.9

percent in urban areas. The 2007 Kenya AIDS Indicator Survey used randomly selected households providing biologic specimens to determine HIV prevalence and may be considered to be more accurate than previous pre-natal clinic estimates.

Whatever the true prevalence of HIV may be in Busia District, the pandemic is most likely due to the mobility of its population which facilitates rapid spread of sexually transmitted diseases. Busia Town is the last stop in Kenaya on the Mombasa-Kampala highway and receives heavy cross border traffic with Uganda. In the south of Busia District, fishermen working in Lake Victoria are also highly mobile and wealthy enough to attract multiple partners.

3.4: Community Based Targeting

Beginning with the drought of 1999, food assistance programs in Kenya employed a community-based food targeting and distribution system which was fully implemented nationwide by 2002. This involved two major changes to the food assistance distribution scheme: 1) pooling of all commodities regardless of origin and distribution through the same channels to avoid duplication of efforts, and 2) elected community management committees responsible for selection of beneficiaries instead of government officials or agency staff.

Community-based targeting allows the community to decide who is neediest; employing local knowledge and values in assessing food insecurity. The strength of community-based targeting is its transparency and the ability of local residents to appeal decisions directly to decision makers. The community management committees may also suspend or initiate allowances to beneficiaries as circumstances dictate. Given the

traditional role of women in managing food allocations within communities (lending/borrowing/gifting), the participation of women in the managing committees is essential to success and stressed by the local implementing CBOs.

Prior to implementation, the implementing CBO conducts an awareness program in the target communities to be sure that the community residents are aware of how much food is being distributed and the criteria for receiving it. Residents are made aware of the election process for choosing management committee members. Once the management committee is chosen, public meetings, called *barazza*(s), are convened in which beneficiaries are publicly proposed and comment is allowed as to their appropriateness. While not wholly immune to corruption, the *barazza* process makes public who requested food aid and who received it, and allows community members to seek redress with the implementing partners. Mathys (2003) compared the experiences of Save the Children (UK) in three countries and concludes that community-based targeting is best practice when the goal of the program is livelihood support rather than emergency response.

The implementing CBOs stress to the management committees that the program is targeted to food insecure households affected by HIV/AIDS. However, the management committee is responsible for establishing the specific targeting criteria for their community. This allows for variation in household livelihood strategies by village. Ideally, the criteria used by the management committee are presented for discussion at the first *barazza* before the beneficiary rolls are determined.

3.5: Commodities and Rations

The WFP guidelines provided for every person in all registered household to receive a daily ration of maize, pulses, oil and sugar. The rations include a balance of staple foods appropriate to the diet in Busia district. The maize provided is not milled and the pulses are dried. The rations are designed to provide 58 percent of an adult's daily nutritional needs.

In addition, households with children under five years of age, pregnant or lactating women, or bedridden adults received a ration of corn/soya blend meal (CSB) for each of those individuals. CSB is a blend of milled maize and soy with the addition of oil and fortified with vitamins and minerals (vitamins A, B complex, C, and calcium and phosphorus). It is commonly prepared with water and sugar. 100 grams of CSB contains 380 calories, 18 grams of protein and 6 percent fat.

The commodity rations are given below in Table 1 along with the percent of calories provided per day per adult equivalent (based on FAO and WHO nutrition guidelines that sets an adult equivalent at 2895 kcals per day). The value of one monthly ration is given in Kenya shillings.

Table 1. Food aid commodity types and rations provided in the Nutrition and Care of People with HIV/AIDS pilot project by weight, value and calories.

Commodity	Daily Ration (gm/person)	Monthly Ration (kg/person)	%Kcals/Adult Equivalent/day	Value/Month (Ksh)
Maize	200	6	25.22	240.00
Pulses	60	1.8	10.36	144.00
Cooking Oil	15	0.45	4.15	22.50
Sugar	10	1.5	1.34	75.00
CSB	50	0.3	6.56	12.00

Ration allocations can be less if there is under-delivery to the distribution point due to losses, lack of resources or delays in transport. Households may also receive less than their intended rations due to incorrect distribution at the distribution points. Also, to receive rations, a registered beneficiary must present in person to collect them. If the registered beneficiary is unable to attend the monthly distribution due to transportation problems or other commitments, he/she will have to wait another month before being able to collect the rations.

Household members may receive less than their daily ration due to intra-household allocations of the food. Rations may be sold, bartered or used to repay a previous loan of food to the household. Some members may not receive rations due to inequitable distribution of rations within the household where some members are favored over others.

However, the most common reason for inadequate rations is if the Community Management Committees decide to include more households in the program than the number of individual rations allows. Thus, not all household members may be registered in beneficiary households (as per WFP guidelines) so those rations can be reallocated to other households. This practice, called ration dilution, reduces the impact that the program is able to demonstrate on participating households.

3.6: The Baseline and Impact Surveys

Two separate surveys were conducted in support of the Nutrition and Care of People Affected by HIV/AIDS pilot program: a baseline survey and an impact survey (see Appendix 3). Each survey included a household level component and a community level

component (see Appendix 4). The household level data are the focus of this analysis, however, the community level data are important in understanding the targeting schemes employed in each community and the nature of food insecurity in each community.

The baseline survey's main objective was to provide guidance in planning the project. The survey sought to determine the proportion of households that were HIV/AIDS-affected through use of proxy measures such as presence of orphans, recent death(s) and illness among prime age adults, dependency ratios and time spent in care-giving. These proxy measures were used in lieu of serological testing or direct questioning about HIV/AIDS to determine household affectedness. The baseline survey also collected information about the food security situation of households. The combination of these factors was used to determine which proxy indicators of HIV/AIDS affectedness were most associated with food insecurity and therefore the most useful as targeting criteria.

The impact survey included all of the information collected in the baseline survey with the addition of questions about food aid receipt and use for beneficiaries of the program. This phase of the survey was intended to evaluate the impact of the pilot distribution on the food security and nutrition of recipient households. It was also intended to measure the targeting efficiency of the program and the performance of the implementing partners and Community Management Committees who drew up the recipient rolls.

3.7: Sampling Frame

The Nutrition and Care of People Affected by HIV/AIDS program evaluation survey used a 30 by 30 cluster sample study design with approximately 30 households surveyed

in 31 villages in May/June of 2003 and 33 villages in May/June of 2004. For the purposes of this survey, a household was defined as "all people who regularly eat food prepared from the same pot."

The baseline survey conducted before implementation of the program included five divisions of Busia District in which implementing partner NGOs and CBOs operate. There are six divisions in Busia District, but the urban area of Busia Town was not included. Villages sampled were randomly selected from a complete enumeration of all villages in each of the five divisions using a proportional distribution scheme based on the population of the division. Therefore, more villages were sampled from more populous divisions, but all divisions were sampled.

The follow-up survey conducted after implementation of the program used the same sampling frame as the baseline survey sampling villages from the same five divisions. However, none of the villages sampled in the baseline survey were re-sampled in the follow-up survey. Therefore, this is not a panel design, but should rather be considered two cross-sectional surveys covering the same geographic area at different times.

In selected villages, each interviewer started in the approximate geographic center of the village and spun a pencil on a clipboard. The interviewer then began walking in the direction that the pencil pointed and interviewed households as encountered in that direction. Each interviewer would attempt to continue interviewing households in the direction of the pencil spin in order to avoid crossing paths with other interviewers.

In addition to the household surveys, one community survey was conducted in each village (cluster) for both the baseline and follow-up survey. Participants in the

community survey were adults who volunteered to answer the survey questions by consensus.

3.8: Data Collection

Survey interviewers were divided into three teams of six persons each. One of the six interviewers was designated as a supervisor and was responsible for checking all of the surveys for completeness and accuracy at the end of the day. Any mistakes or omissions found by the supervisor were corrected by the responsible interviewer upon return visit to the household interviewed. Interviewers were expected to complete five households per day resulting in 30 interviews per day in each selected village. However, given road conditions, bad weather and initial inexperience, the three teams took three weeks to ultimately complete 900 interviews.

Interviewers were instructed to politely approach households and introduce themselves as workers for the World Food Programme. However, they were specifically instructed to stress the importance of the data in informing the District Social Development Office and the WFP to address the needs of the district and that potential household entitlements to food distributions were in no way tied to survey responses.

Once the interviewer had introduced him or herself to an adult in the household, he/she asked to speak to the person in the household who is most responsible for distribution of food within the household. In most cases this was an adult female, since they typically are most aware of food and nutrition issues within the household. Verbal consent was obtained before questioning using a written script. The households were not identified by name, address or geographic coordinates.

The community interviews were typically completed at the end of the work day by assembling a group of adult village residents of both genders. The group of residents was then asked to reach a consensus on answers to the survey questions.

3.9: Data Description

The survey instrument included detailed household demographic information with time utilization on every current member of the household. Less detailed information was collected on former members of the household. Sections concerning household expenditures and consumption of own produce covered most common foods. Current holdings of land, household goods and livestock were ascertained as well as holdings a year prior to interview. Food aid beneficiaries were asked about their receipt and utilization food aid and perceptions of the program.

Sections of the survey employed in this analysis are discussed in more detail below.

Household Demographics: Age, gender, marital status, educational attainment and relationship to the household head were collected for every member of the household. The categories for marital status included widowed as well as married, never married, separated and divorced. Categorical responses to relationship to household head include fostered children with living parents, one living parent or no living parent. Unfortunately, the survey did not specify the exact relationship of fostered children to the household head so it is not possible to determine if the fostered children are the head's grandchildren or some other relationship.

Labor: For every household member the number of hours dedicated to a particular activity per day is recorded. These activities include farm labor, off-farm labor, fishing,

domestic labor, convalescence, care-giving, school attendance, idleness or entertaining, or other activities. This information provides a quantitative measure of hours spent in productive labor and school attendance. It also indicates which household member(s) are productive and which suffer from illness.

Household Immigration and Emigration: The total household size two years prior to the survey was recorded with the number of people immigrating into the household and leaving the household, the number of births and the number of deaths. Deaths in the household are recorded separately for individuals less than 18 years of age, between 18 and 49 years of age, and for members older than 49 years of age. Thus, prime age mortality is captured in the survey, but the exact time of the death, gender of the deceased or the relationship of the deceased to the household head is not.

Household Expenditures: Expenditures for food, school fees, clothing, travel, alcohol, medicine and gifts by household members in the week prior to interview were recorded. Quantities, unit prices and total outlays were recorded for each item. Food expenditures were broken down into food types, including: maize, other cereals, pulses, vegetables, fruits, tubers, meat, milk, eggs, sugar, salt, spices and cooking oil. Maize milling costs and purchases of livestock were also included. With the addition of other miscellaneous items, the total household expenditure for the week prior to the survey was determined

Consumption of Own Produce and Gifts: For the week prior to interview, the consumption of the household's own produce and gifted foods were recorded. Own produce and gifts were recorded separately with the amounts consumed. Foods included in the survey are: maize, other cereals, roots and tubers, pulses, vegetables, fruits, meat,

milk, eggs, sugar cane, salt and spices, cooking oil, wild fruits and other wild foods. With the addition of household expenditures, this information provides a measure of total household expenditure on food in the week prior to the interview.

Household Assets: Current household assets and asset levels one year prior to interview were included in the survey. Livestock assets were recorded separately for cattle, sheep, goats, pigs, chickens and donkeys. Domestic assets included cooking pots, braziers, lanterns, beds, radios and bicycles. Unfortunately, housing construction characteristics were not recorded.

Land Holdings and Utilization: Household land holdings were recorded for the current agricultural season and for the previous agricultural season. This included land owned and land rented in and land rented out. Acres of land under cultivation and fallowed were recorded for each season. This information is important in calculating household assets and the ability of the household to keep land under cultivation.

Food Aid Receipt: If a household received food aid from the World Food Programme, a series of questions were asked about how much food aid they received, what types of commodities they received, perceptions about the fairness of food aid distribution, access to food aid distributions, who in the household benefits from the food aid and if the food aid has improved the health of sick persons in the household.

Each survey respondent was asked who in their community they believe receives the food aid: poor households, food insecure households, child or grandparent headed households, households with sick or disabled members or households with orphans. This information is useful in modeling the targeting scheme in each community.

The Community Survey Format records other information useful in modeling the targeting scheme. Each Community Management Committee is responsible for drawing up its own set of targeting criteria within the confines of the project guidelines and then implementing those criteria in the distribution of rations. Therefore, targeting criteria may vary by community. Questions included in the Community Survey Format address local definitions of poverty and perceived targeting criteria within that community.

3.10: Statistical Methods

Estimating the treatment effects of the food aid intervention in Busia District presents many challenges. Since the households surveyed at baseline are not the same as those selected for the impact survey, these data are best regarded as two cross-sectional studies of the same population. A further complication is the fact that households were not randomly allocated to treatment and control groups.

The issue of selection bias is particularly vexing in this context due to the influence of household wealth. Household wealth may influence both the likelihood of a household being HIV/AIDS-affected and how the household responds to HIV/AIDS-affectedness.

When an individual becomes ill with AIDS, he/she will exercise whatever options are available to reside in a household that can best support him/her during the terminal stages of illness (Beegle, 2003). If possible, an ill person will choose a household that has sufficient resources to provide medical services, comfort and sustenance. Additionally, poorer households that do not have the resources to care for a terminally ill person may attempt to discourage that person from residing with them. Therefore, wealthier households may be more likely to host AIDS patients than poorer ones and thereby be

HIV/AIDS-affected. For instance, the Tanzania HIV/AIDS and Malaria Indicator Survey of 2007-08 (Tanzania Commission for AIDS, 2008) found that HIV prevalence increased with increasing wealth and that the top wealth quintile had the highest HIV prevalence for both men and women. However, in the Tanzania study prevalence by wealth quintile was not broken down by rural/urban residence so it is unknown to what extent the wealth effect is driven by urban environmental factors.

But it is unclear if household wealth does predict a household's likelihood that it will be HIV/AIDS-affected in this sample. Results from the 2003 and the 2007 Kenya Aids Indicator Survey (Republic of Kenya, 2009) suggest that wealth is not a likely predictor of HIV/AIDS-affectedness in Kenyan rural households.

Two rounds of the Kenya AIDS Indicator Survey (KAIS) were conducted in 2003 and in 2007. These surveys collected individual and household level data relevant to the HIV epidemic and included biologic specimens to determine HIV infection status. Nationally, the 2007 KAIS found no association between household wealth and HIV prevalence among either men or women. When disaggregated by rural/urban residence, HIV prevalence by wealth quintile showed some variation in urban populations, but very little variation among rural populations. The 2003 KAIS found that individuals from the lowest household wealth quintile had the lowest prevalence of HIV, but by 2007 this difference had disappeared. Similarly, individuals with no primary schooling had lower HIV prevalence than other educational attainment groups in 2003, but not in 2007. The report concludes that HIV prevalence has increased in rural areas since 2003, especially among men, and that HIV prevalence has increased among the very poor and uneducated since 2003.

The impact survey of the Nutrition and Care of People Affected by HIV/AIDS pilot project was conducted in 2004 (i.e. between the two rounds of the KAIS) and it is not possible to place it within the national trends described by the KAIS as the indicators for wealth and HIV infection were measured differently in the two rounds. However, the leveling of HIV prevalence across wealth quintiles in rural areas that was found in the 2007 KAIS suggests that household wealth is not a significant predictor of the presence of an HIV infected person in a household.

What is clear from the literature is that wealthier households have more resources to maintain or quickly rebuild their asset base and hire or attract replacement labor during the illness and after the death of a prime-age member than poorer households do (Yamano and Jayne, 2002). It is poor households that are especially vulnerable to the negative consequences of prime-age illness/death. It is also poor households that were targeted for participation in the food aid distribution in Busia District. Therefore, analyses of these data must carefully consider issues of heterogeneity in response to HIV/AIDS-affectedness by household wealth.

An additional, but relatively minor issue in the analysis of these data is the cluster sampling scheme used in selecting surveyed households. Cluster sampling imposes a particular type of variance-covariance matrix on the data and must be accounted for in the analysis. Also, when analyzing data from multiple individuals residing in the same household, the intra-class correlation of those individuals needs to be considered in estimation of standard errors. Appendix 3 gives background characteristics for each village (cluster) sampled in the impact survey.

3.10.1: Analytical Approach

The nature of the data favors a comparison of beneficiary households and non-beneficiary households surveyed after program implementation. The first issue in such an analysis is how to account for selection bias in program participation since households were not randomly assigned to the program.

Conventional multivariate analyses that include a treatment dummy variable along with control variables to account for differences between groups may not be suitable for analysis of observational studies due to large disparities in the covariate means between the two treatment groups. These differences in the observed covariates may lead to biased estimates of the treatment effect because multivariable techniques may not adequately balance the two groups. It is tempting to increase the number of covariates in an attempt to better account for group differences, but this may produce instability in the model, misleading results and decreased precision (Newgard et al., 2004). The results of such an analysis are presented in Appendix 4 for the purposes of comparison.

To address issues of selection bias in assignment to treatment, beneficiary households were matched to non-beneficiary households using propensity scores before regression analyses were performed to test the study hypotheses. Table 2 gives frequencies and means of household characteristics for all beneficiary and non-beneficiary households and for matched households.

Table 2: Characteristics of households sampled in the 2004 impact survey by beneficiary status and propensity score matching.

	All Households				Matched Households			
	Beneficiaries		Non-Beneficiaries		Beneficiaries		Non-Beneficiaries	
	N	%	N	%	N	%	N	%
Head of Household								
Marital Status								
Married	92	33	504	81	91	36	61	45
Divorced	14	5	7	1	11	4	2	1
Never Married	8	3	7	1	8	3	2	1
Widowed	163	59	103	17	140	56	70	52
Age								
<20	4	1	6	1	4	2	0	0
20-29	23	8	115	19	23	9	14	10
30-39	43	16	162	26	39	16	25	19
40-49	53	19	113	18	51	20	26	19
50-59	44	16	107	17	42	17	29	21
60+	110	40	118	19	91	36	41	30
Gender								
Male	91	33	441	71	89	36	53	39
Female	186	67	180	29	161	64	82	61
Education								
No Education	141	51	132	21	119	48	57	42
Primary Only	108	39	351	57	104	42	57	42
Secondary	28	10	138	22	27	11	21	16
Household Composition								
Household Size								
1 to 3	64	23	116	19	55	22	29	21
4 to 6	122	44	288	46	112	45	58	43
7 to 9	72	26	163	26	67	27	38	28
10+	19	7	54	9	16	6	10	7
Prime-age Members								
0	79	29	51	8	65	26	23	17
1	96	35	126	20	86	34	38	28
2	53	19	307	49	52	21	54	40
3	35	13	88	14	34	14	14	10
4+	14	5	49	8	13	5	6	4
Children Under 5 Years								
0	160	58	242	39	142	57	73	54
1 or 2	103	37	357	57	95	38	59	44
3+	14	5	22	4	13	5	3	2
Orphans								
0	156	56	495	80	149	60	84	62
1	39	14	64	10	36	14	20	15
2	29	10	35	6	25	10	17	13
3	26	9	17	3	19	8	9	7
4+	27	10	10	2	21	8	5	4
Mean Dependency Ratio	0.6260		0.5240		0.6038		0.5892	

Table 2: Continued.

	All Households				Matched Households			
	Beneficiaries		Non-Beneficiaries		Beneficiaries		Non-Beneficiaries	
	N	%	N	%	N	%	N	%
HIV/AIDS Indicator								
Any Prime-Age Illness	81	29	159	26	74	30	44	33
Any Prime-Age Death	34	12	33	5	32	13	17	13
Income								
Below Absolute Poverty Line	213	77	406	65	189	76	98	73
Below Food-Poor Povery Line	173	62	302	49	152	61	79	59
Mean Total Expenditures/Day	143 Ksh		202 Ksh		148 Ksh		145 Ksh	
Total	277	31	621	69	250	65	135	35

3.10.2: Propensity Scores

In 1983, Rosenbaum and Rubin proposed the use of propensity scores to create counterfactual comparisons. While the probability of treatment in a randomized trial with two evenly allocated treatment groups is 0.5, the probability for treatment in a non-randomized trial

is unknown. Thus, the propensity score is the conditional probability (from 0 to 1) that a subject will be treated based on an observed set of covariates. This allows the investigator to balance the two groups by including in the analysis only untreated subjects with propensity scores similar to treated subjects, thus minimizing differences in covariates and improving the comparability of the two groups.

Propensity score matching applied to this dataset identified non-beneficiary households that are similar to beneficiary households and use those as the control group. Households that were not matched were dropped from the analysis (9% of beneficiary households and 78% of non-beneficiary households).

Since beneficiary households were targeted based on their relative deprivation, the households matched to them using propensity scores may also be expected to be poorer relative to the unmatched non-beneficiary households. Therefore, propensity score matching serves two purposes: to identify a similar control group and eliminate some of the heterogeneity of response to prime-age illness/death among households in the dataset due to differences in wealth.

Propensity score matching does not directly address the issue of endogeneity that may arise from HIV/AIDS infection being correlated with unobserved individual and household characteristics that affect the outcome. However, by restricting the dataset to observations on a similar set of households, bias arising from the use of endogenous predictors may be reduced, especially if the unobserved factors correlated with HIV/AIDS-affectedness are issues of household wealth, composition and education.

Propensity scores were calculated by first identifying a set of variables that best predicted program participation. The SCORE option was employed in PROC LOGISTIC (SAS Institute Inc., 2002) to identify a set of variables for use in calculating the propensity score. The aim of the propensity score model is not to test any hypotheses about treatment selection, but rather to calculate a set of propensity scores that identifies a set of non-treated subjects most similar to the treated subjects (Rosenbaum and Rubin, 1983).

The 28 variables identified (as above) for inclusion in the propensity score calculation are shown in Table 3 with coefficients and p-values with the form of the model presented below (for the sake of clarity, random effects for sample clusters is not specified in the model).

The form of the logit model for deriving propensity scores:

$$\text{Logit}(p(FA_j=1|X_j)) = \beta_0 + \beta_1 HHH\_AGE_j + \beta_2 FHHH_j + \beta_3 HHH\_NO\_EDU_j + \beta_4 HHH\_MARRIED_j + \beta_5 DEPRATIO\_AGE\_AE_j + \beta_6 CCF_j + \beta_7 KORDP_j + \beta_8 REEP_j + \beta_9 ICS_j + \beta_{10} BEDS\_OPEN_j + \beta_{11} BICYCLES\_OPEN_j + \beta_{12} CATTLE\_OPEN_j + \beta_{13} GOATS\_OPEN_j + \beta_{14} LAMPS\_OPEN_j + \beta_{15} PIGS\_OPEN_j + \beta_{16} POTS\_OPEN_j + \beta_{17} POULTRY\_OPEN_j + \beta_{18} RADIOS\_OPEN_j + \beta_{19} SHEEP\_OPEN_j + \beta_{20} STOVES\_OPEN_j + \beta_{21} TOTEXP\_DAY\_AE_j + \beta_{22} TYPE1_j + \beta_{23} TYPE2_j + \beta_{24} UNDER5_j + \beta_{25} OWN\_OPEN_j + \beta_{26} ANY\_PA\_DEATH_j + \beta_{27} ANY\_PA\_ILL_j + \beta_{28} PRP\_FOOD_j + \varepsilon$$

Where:

HHH_AGE = Age of head of household in household j

FHHH = Dummy for female household head in household j

HHH_NO_EDU = Dummy for no education of household head in household j

HHH_MARRIED = Dummy for marital status of household head in household j (=1 if married)

DEPRATIO_AGE_AE = Dependency ratio of household j (calculated as ratio of prime age adults to others expressed in adult equivalences)

CCF=Dummy for household j in the operating area of implementing partner CCF

KORDP=Dummy for household j in the operating area of implementing partner KORDP

REEP=Dummy for household j in the operating area of implementing partner REEP

ICS=Dummy for household j in the operating area of implementing partner ISC

BEDS_OPEN=Number of beds owned by household j in 2003

BICYCLES_OPEN=Number of bicycles owned by household j in 2003

CATTLE_OPEN=Number of cattle owned by household j in 2003

GOATS_OPEN=Number of goats owned by household j in 2003

LAMPS_OPEN=Number of lamps owned by household j in 2003

PIGS_OPEN=Number of pigs owned by household j in 2003

POTS_OPEN=Number of pots owned by household j in 2003

POULTRY_OPEN=Number of poultry owned by household j in 2003

RADIOS_OPEN=Number of radios owned by household j in 2003

SHEEP_OPEN=Number of sheep owned by household j in 2003

STOVES_OPEN=Number of stoves owned by household j in 2003

TOTEXP_DAY_AE=Daily expenditure for non-food and food items (including own produce) in Kenya Shillings by household j divided by household adult equivalents

TYPE1=Number of type 1 orphans in household j

TYPE2=Number of type 2 orphans in household j

UNDER5 = Number of children under five in household j

OWN_OPEN=Acres of land owned by household j in 2003

ANY_PA_DEATH=Dummy for any prime-age mortality in prior two years in household j

ANY_PA_ILL=Dummy for any chronic prime-age morbidity in household j

PRP_FOOD=Proportion of total household expenditures for food (including own produce)

Table 3: Variables included in the propensity score model with their estimates and p-values.

Variable	Variable Description	Coefficient	P-Value
Intercept	Intercept	0.5907	0.3959
hhh_no_edu	Household head: no education	0.2027	0.4008
hhh_married	Household head: married	-1.8428	<0.0001
fhhh	Houusehold head: female	0.0962	0.7248
hhh_age	Household head: age	0.0076	0.2741
ccf	Implementing partner: CCF	-0.5017	0.1662
kordp	Implementing partner: KORDP	0.2842	0.5941
reep	Implementing partner: REEP	-0.6077	0.2154
ics	Implementing partner: ICS	-0.8161	0.1466
own_open	Land owned year prior to survey	0.0012	0.9816
beds_open	Beds owned year prior to survey	0.0488	0.6610
bicycles_open	Bicycles owned year prior to survey	-0.1331	0.4549
cattle_open	Cattle owned year prior to survey	-0.1231	0.0285
goats_open	Goats owned year prior to survey	0.0072	0.8940
lamps_open	Lamps owned year prior to survey	0.1800	0.1308
pigs_open	Pigs owned year prior to survey	-0.0896	0.4096
pots_open	Pots owned year prior to survey	-0.0065	0.8919
poultry_open	Poultry owned year prior to survey	0.0009	0.9104
radios_open	Radios owned year prior to survey	-0.0131	0.9375
sheep_open	Sheep owned year prior to survey	0.0018	0.9857
stoves_open	Stoves Owned year prior to survey	-0.0848	0.4746
totexp_day_ae	Total expenditures per day per adult equivalent	-0.0087	0.0010
type1	Number of type 1 orphans	0.1064	0.3810
type2	Number of type 2 orphans	0.4817	<0.0001
under5	Number of children under 5 years of age	-0.2020	0.0906
any_pa_death	Any prime-age death	0.2177	0.4928
any_pa_ill	Any prime-age illness	0.6885	0.0012
depratio_age_ae	Dependency ratio based on age per adult equivalent	1.0165	0.0218
prp_food	Proportion of total budget comprising food	-1.0646	0.0239

Numbers of each type of asset was employed rather than aggregated values of the assets to allow for closer matching given variations in livelihood strategy.

Beneficiary status (yes or no) was then regressed on the set of identified variables and the predicted probability (the propensity score) was output as a new variable in the dataset. PROC GLIMMIX was employed for calculation of the propensity score because of the ease of accounting for sample clustering in the procedure.

Data from two households was not included in the analyses due to missing values for variables necessary for the calculation of the propensity score. Therefore, only 898 of the 900 households surveyed were used.

3.10.3: Propensity Score Matching

Using the propensity score, beneficiary households were matched to non-beneficiary households using a greedy match method as developed by Coca-Perraillion (2007). The greedy match method finds non-treated subjects with the closest propensity score to treated subjects.

While Coca-Perraillion's macro allows for various specifications in the matching method, a nearest neighbor match within a caliper of 0.01 allowing for replacement was employed. This method randomly sorts the beneficiary households and then, starting at the top, looks for the non-beneficiary household with the closest propensity score. The match is accepted if the non-beneficiary household's propensity score is +/- 0.01 of the beneficiary household's propensity score. Replacement allows a non-beneficiary household to be matched to more than one beneficiary household. This method identified a set of non-treated households similar to treated households while retaining as many of

the original records as possible. Figures 4 and 5 show the distributions of propensity score both before and after matching.

Figure 4 shows that the propensity scores of most non-beneficiary households fall below 0.3 while the propensity scores of beneficiary households are more evenly distributed. Figure 5 shows that after matching that most of non-beneficiary households with propensity scores below 0.3 have been dropped from the analysis. Some of the beneficiary households with high propensity scores were also dropped from the analysis because there were no non-beneficiary households with propensity scores within the +/- 0.01 caliper to match to them. While the distribution of propensity scores in the matched dataset is not identical for both treatment groups, there is overlap across the range of propensity scores and the wide disparity in the distributions as seen in Figure 4 has been eliminated. Variables included in the propensity score model retain variability in the matched dataset and may be used as control variables in the final analyses. Variability in covariates is important in controlling for factors and testing for effects. Therefore, identical distributions of the propensity scores are not necessary. What is important is the elimination of great disparities in the covariate means.

A subset of matched households was created to be used in the final analysis. For the analyses of individual labor employment and school attendance, all individuals of the appropriate age range from the matched households were included instead of calculating propensity scores for individuals and then matching individuals. This approach was employed because households are targets of the program, not individuals. Also, using only individuals from matched households assures that the household level dynamics (which are largely the focus of this study) are comparable.

3.10.4: Clustering

Sample clustering was accounted for in the regression analyses on households by including a random effect for village. Villages were the clusters from which households were randomly selected. Intra-class correlation was examined for other possible levels as well: including district, implementing partner and community management committees. However, none of these levels showed significant intra-class correlation when included in models with village level clustering and were not included as random effects in the models. The regression analyses on individual labor employment and school attendance included only a random effect for household clustering because the village level intra-class correlation was no longer significant once household clustering was accounted for.

Figure 4: Distribution of propensity scores by beneficiary status before matching.

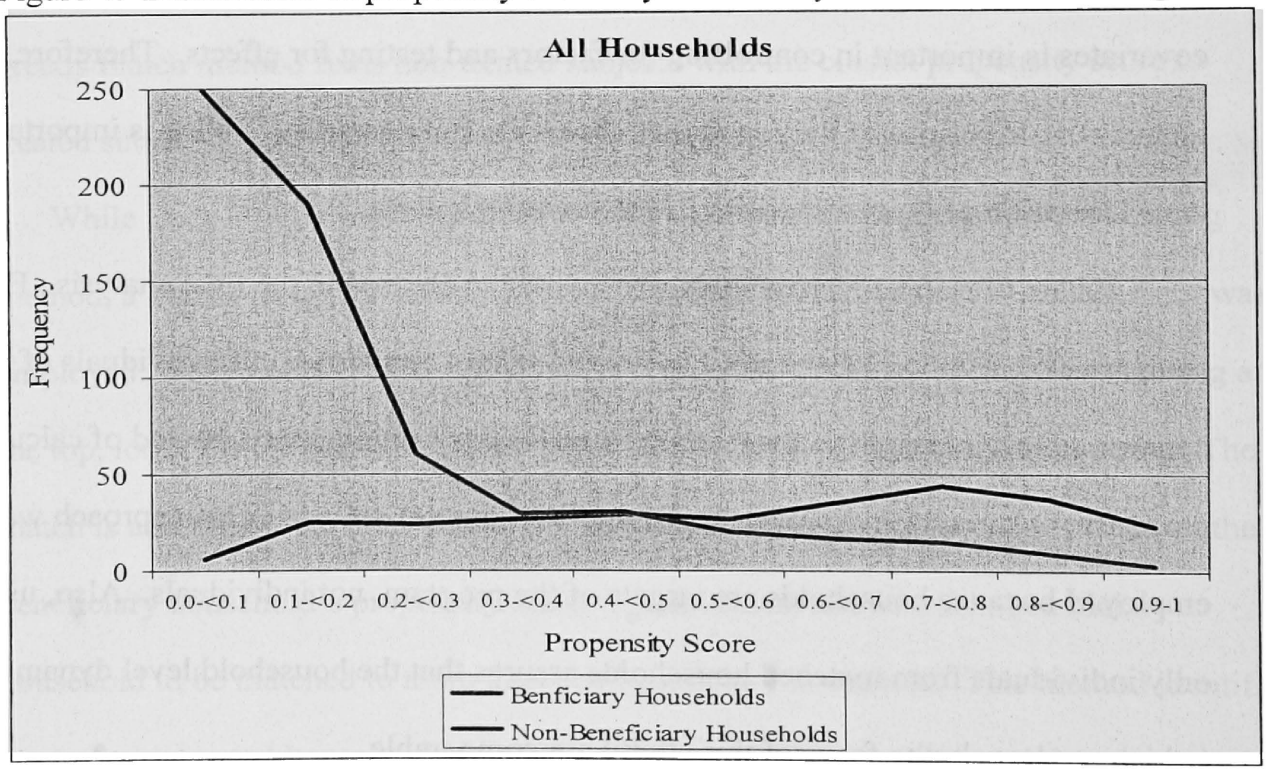
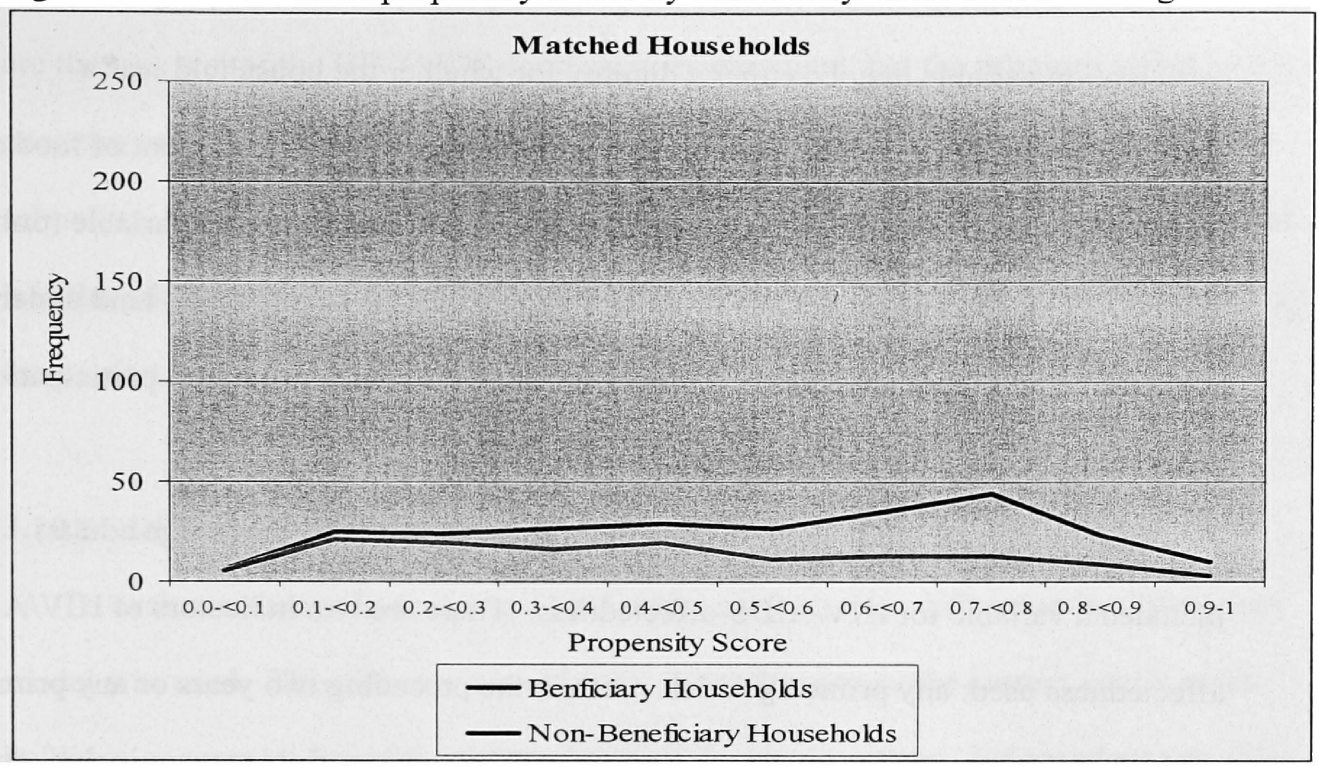


Figure 5: Distribution of propensity scores by beneficiary status after matching.



3.10.5: Key Explanatory Variables

Community Management Committees were instructed to target households that were firstly, food insecure and secondly, HIV/AIDS-affected. Many beneficiary households were food-poor (total household expenditures were insufficient to meet their food consumption needs) but did not report any HIV/AIDS indicators, while many non-beneficiary households were food-poor and reported HIV/AIDS indicators. Thus, it would appear that the primary concern of the management committees was to assist the neediest households rather than to specifically address those that were HIV/AIDS-affected. This distribution of both beneficiary households and non-beneficiary households, that are either HIV/AIDS-affected or not, allows sufficient variability to test hypotheses about the nexus of food insecurity, HIV/AIDS and poverty.

The models all include a variable for program participation. The program participation variable may be either a dummy for whether the household was a beneficiary or not or may be a continuous variable measured as the amount of food aid received by the household. It is expected that the coefficient for either variable (only one will be included in any model at a time) will be positive for assets, labor, land under cultivation and school attendance. However, the coefficient for program participation is expected to be negative for time spent in care-giving.

Additionally, all of the models (except those restricted to ill prime-age adults) included a variable for HIV/AIDS-affectedness. There are two indicators of HIV/AIDS-affectedness used: any prime-age adult death in the preceding two years or any prime-age adult reporting regular hours of convalescence. These two variables were included in the regressions separately. Negative coefficients for the HIV/AIDS-affectedness variables indicate that HIV/AIDS is associated with a reduction in time spent in productive labor or schooling, or reductions in assets or land under cultivation. A positive coefficient for the prime-age adult illness variable is expected in the model of care-giving while the coefficient for prime-age death is expected to be null.

For the purposes of this study, "prime age" was defined as ages 18 to 49 because of the way that the question about adult deaths was asked in the survey. This age range coincides with ages that are most vulnerable to HIV and are most economically productive.

Interaction terms between program participation and HIV/AIDS indicators were also included. If the model of HIV/AIDS-affectedness and food security is accurate, then the coefficients for the interaction terms should be the opposite of the coefficients for the

HIV/AIDS-affectedness terms suggesting an ameliorative effect. These interaction terms are the true test of the HIV/AIDS-food security paradigm, not the program effect. The program may show some improvement in asset retention, land cultivated, employment or schooling, but that is true of both HIV/AIDS-affected households and those that are not. It is the relationship between the HIV/AIDS indicators and the HIV/AIDS-program interaction terms that test the model presented in Chapter 3.

3.10.6: Difference-in-differences

To evaluate change in assets and land under cultivation, a difference-in-differences model was used. The outcome variable was the difference of the current year's asset holdings or acres under cultivation and that of the previous year. Independent variables included the previous year's asset level or acreage under cultivation, a dummy for program participation, dummies for prime-age illness and death, interaction terms for program participation by prime-age illness and death, and any other relevant covariates that were found to significantly affect program estimates. Covariates that were significant in the model but did not appreciably alter program estimates were not included because those variables are not specific to the hypothesis and to conserve degrees of freedom.

PROC MIXED was used to estimate the regression coefficients with random effects for village clustering. Beneficiary status was included in the LSMEANS statement with the DIFF option specified.

Asset levels were measured by their monetary value using prices specified by WFP/Kenya. This approach was employed so that items of widely varying values could

be aggregated into groups. Adjustments to item values were not made for inflation in order to be able to directly compare pre and post-program asset levels. Table 4 gives the value of various household goods and livestock in Kenya shillings as reported by WFP/Kenya.

Table 4: Values assigned to household assets by WFP/Kenya in Kenya Shillings.

Asset	Value in Kenya Shillings
Livestock	
Cow	8,500
Goat	1,500
Sheep	1,500
Pig	1,000
Poultry	300
Household Goods	
Bed	2,100
Bicycle	20,000
Lamp	1,200
Radio	500
Stove	1,000
Pot	500

3.10.7: Regression Models

PROC MIXED was used in the regression analyses of prime-age labor employment and care-giving and for child school attendance. All models (except the analysis restricted to prime-age adults reporting any convalescence) included a dummy for program participation, dummies for any household prime-age illness and death, and interaction terms for program participation by prime-age illness and death. A variety of variables that described aspects of the conceptual model described in Chapter 3 were

tested for inclusion in the models, however only those variables that were essential to the model specification were included in the results presented here. Models of prime-age adult labor included covariates for gender in the pooled models. Models of prime-age adult care-giving included dummy variables for the presence of an ill child or elder in the individual's household. School attendance models all included a continuous variable for age in years. Pooled models included a dummy variable for gender and models considering attendance of primary and secondary school age children combined included a dummy variable indicating primary school age as a proxy for free schooling. None of the other covariates tested altered the estimates of the key variables by more than ten percent and were not included to conserve degrees of freedom.

Household random effects were specified to account for clustering at the household level. Village level clustering was no longer a significant source of intraclass correlation after accounting for household level clustering and was not included.

3.10.9: Analysis of Ration Levels

Not every household received the same amount of aid. Community management committees had discretion to register all or only some of the members of a household and thereby adjust the total amount of food aid received by the household. Separate analyses were conducted using the total value of the food aid received by the household to examine if higher ration levels were associated with improved outcomes. Ration levels were measured as the total value in Kenya shillings of rations reported to have been received by the household in the month of interview. The monetary value of the rations was used in order to keep it in the same units as asset values and to be able to aggregate

ration constituents into a single value. Table 1 gives values of the ration constituent food items in Kenya shillings as reported by WFP/Kenya.

Chapter 4: Results

4.1: Study Question

Prior research has indicated that HIV/AIDS impacts many aspects of affected households' livelihoods. The provision of food aid has been suggested as a means of supporting households during the illness and immediate post-death periods of households to arrest the detrimental effects of the disease on household productivity. This study test specific hypotheses concerning retention of household productive assets, household labor employment, and child school attendance.

Study Question: Does the provision of food aid to HIV/AIDS-affected households arrest the erosive effects of HIV/AIDS on household livelihood security?

4.2: Asset Retention

There is empirical evidence that households experiencing the illness or death of a prime-age member may be forced to sell off possessions to afford health care, compensate for lost income of the ill member or to pay for a funeral. Yamano and Jayne (2002) in a study of Kenyan households found that households affected by HIV/AIDS had significantly reduced asset levels compared to households that did not experience the illness or death of a prime-age member.

The provision of food aid to HIV/AIDS-affected households is expected to help maintain household consumption during the period of acute crisis of a prime-age member's illness or death and prevent distress sales of assets.

However, since households have livelihood strategies based on their particular set of capital assets, there is likely to be a heterogeneous response in asset sales with households retaining those assets most central to their livelihood. This heterogeneity of response requires a measure of total household assets. WPF/Kenya determined the average value in Kenya Shillings for each of the household goods and livestock included in the survey. Those values were totaled to determine the households' asset base both before program implementation and after. Land holdings were considered separately from other assets since land is more difficult to sell and there are no estimates of the value of land available. Therefore, land holdings were measured in acres.

4.2.1: Hypotheses

Two hypotheses were formulated based on the assumptions of the HIV/AIDS-food security paradigm:

Hypothesis: Beneficiary households will retain more of their asset base than similar non-beneficiary households.

To test this hypothesis, assets will be considered individually and by group: total household goods, total livestock and total assets (household goods plus livestock).

Hypothesis: Beneficiary households will retain more of their land holdings than similar non-beneficiary households.

4.2.2: Modeling

The general form of the difference-in-differences models used to evaluate changes in the value of household assets is given below (for the sake of clarity, random effects for sample clustering are not incorporated into the model).

$$\Delta ASSETxj = \alpha + \beta_1 ASSET03x_j + \beta_2 FA_j + \beta_3 ANY\_PA\_DEATH_j + \beta_4 FA_j * ANY\_PA\_DEATH_j + \beta_5 ANY\_PA\_ILL_j + \beta_6 FA_j * ANY\_PA\_ILL_j + \beta_7 FHHH_j + \beta_8 OWN\_NOW_j + \beta_9 CULT\_NOW_j + \beta_{10} TOTEXP\_DAY\_AE_j + \varepsilon$$

Where:

$\Delta ASSETxj$ = Change in value in Kenya Shillings of asset x from 2003 to 2004 for household j

$ASSET03x_j$ = Value of asset x in shillings in 2003 for household j

FA_j = Dummy for food aid receipt by household j (=1 if beneficiary)

$ANY\_PA\_DEATH_j$=Dummy for any prime-age mortality in prior two years in household j

$FA_j * ANY\_PA\_DEATH_j$=Interaction term for program participation and any prime-age death in household j

$ANY\_PA\_ILL_j$=Dummy for any chronic prime-age morbidity in household j

$FA_j * ANY\_PA\_ILL_j$= Interaction term for program participation and any prime-age chronic morbidity in household j

$FHHH_j$= Dummy for female household head in household j (-)

OWN_NOW_j=Acres of land owned by household j in 2004

$CULT\_NOW_j$= Acres of land under cultivation by household j in 2004

$TOTEXP\_DAY\_AE_j$=Daily expenditure for non-food and food items (including own produce) in Kenya Shillings by household j divided by household adult equivalents

A difference-in-differences model was used to examine changes in asset holdings with covariates for opening values, program participation, prime-age illness and death and interaction terms for program participation and prime-age illness and death. Additional covariates (including interaction terms) that reflect aspects of the conceptual model presented in Chapter 3 were examined for their impact on estimates of the program participation coefficients. These additional covariates were included if they singly or in

unison changed the program participation coefficients by more than ten percent. However, no joint tests of significance were performed.

Regressions on household goods included these additional covariates:

- Female headed household: this is a dummy variable that equals one if the household head is female and zero otherwise. Household headed by women may pursue different livelihood options than members of male headed households and may spend their income in different ways. Female headship may also reflect the relative social standing of the household and impact the household's ability to receive credit or access to land.
- Land owned at time of interview: measured in acres. Land ownership is an indicator of wealth and agricultural productivity since the marginal product of labor increases with larger land holdings.
- Land under cultivation at time of interview: measured in acres. Land under cultivation is an indicator of the relative dependence of the household on agriculture.

Regressions on livestock holdings included a variable for the amount of land owned at the time of interview as described above. The regression model for total household goods and livestock included a variable for female headed households and total land under cultivation at the time of interview as described above. The model for total household goods and livestock also included:

- Daily cash expenditure divided by total household adult equivalents: measured in Kenya Shillings. This is a proxy indicator for income excluding

own agricultural produce. It is divided by total household adult equivalents to adjust for variation in household sex and age structures.

Models of change in land rented and leased by households included a covariate for land owned at the time of interview as described above. The model for change in land ownership only included the five variables for program participation, prime-age illness and death and their interactions.

The models testing bivariate levels of program participation (yes/no) used data from the subset of propensity score matched households. The models that employed a continuous variable for the value of the food aid received by the household, used data from beneficiary households only. Table 5 gives asset levels at the time of the impact survey for matched households by beneficiary status and for all beneficiary households.

4.2.3: Asset Results

Table 6 gives coefficients and p-values for program participation, prime-age illness and death and their interactions for assets individually and by aggregate. Full model results for changes in household goods, livestock and total goods and livestock are presented in Appendix 6, Table A6.1. Table 7 gives the results from regression models employing the continuous variable for ration value in Kenya Shillings.

Table 5: Mean household asset values by asset type at the time of the 2004 impact survey for propensity score matched beneficiary and non-beneficiary households and for all beneficiary households.

Asset	Matched Households		All Beneficiary Households
	Beneficiaries	Non-Beneficiaries	
Livestock			
Cattle	4,896	4,722	4,480
Goats	828	922	785
Pigs	228	237	206
Poultry	1,272	1,260	1,222
Sheep	324	356	298
Total Livestock	7,548	7,497	6,991
Household Goods			
Beds	2,694	2,753	2,714
Bicycles	8,400	8,444	8,014
Lamps	778	738	793
Pots	2,238	2,244	2236
Radios	252	263	247
Stoves	564	622	563
Total Household Goods	14,928	15,065	14,568
Total Household Assets	22,476	22,562	21,559

Table 6. Estimates and significance levels for each of the five key explanatory variables predicting change in household asset levels as valued in Kenya Shillings in propensity score matched households.

Asset	Program Participation		Prime-Age Illness		PA Illness* Program Participation		Prime-Age Death		PA Death* Program Participation	
	Estimate	P-Value	Estimate	P-Value	Estimate	P-Value	Estimate	P-Value	Estimate	P-Value
Household Goods[1]										
Beds	87	0.1692	-78	0.3791	100	0.3627	-77	0.5357	93	0.5456
Bicycles	909	0.2921	-1978	0.1006	2423	0.1044	-16	0.9924	-1661	0.4203
Lamps	44	0.3169	-105	0.0881	135	0.0763	102	0.2355	-211	0.0490
Pots	30	0.6613	-53	0.5740	85	0.4702	-141	0.2906	185	0.2613
Stoves	18	0.5715	-101	0.0274	115	0.0423	15	0.8188	-83	0.2900
Total Goods	1087	0.2209	-2416	0.0515	2876	0.0616	-51	0.9762	-1812	0.3935
Livestock[2]										
Cattle	-786	0.2313	-52	0.9541	-256	0.8194	1474	0.2450	-1938	0.2171
Goats	-72	0.6003	-168	0.3780	-183	0.4398	20	0.9420	-337	0.3132
Pigs	-30	0.6830	4.3	0.9659	-135	0.2874	71	0.6225	73	0.6828
Poultry	119	0.5226	-97	0.7061	387	0.2260	-199	0.5824	12	0.9780
Sheep	-66	0.4343	12	0.9203	-77	0.5928	-41	0.8005	82	0.6851
Total Livestock	-617	0.4231	-650	0.5354	218	0.8690	1423	0.3427	-2556	0.1700
Livestock and Goods[3]	609	0.6088	-3283	0.0494	3307	0.1079	1315	0.5707	-4240	0.1401
Land										
Land Owned[4]	-0.0107	0.6858	0.0053	0.8842	-0.0801	0.0782	-0.0047	0.9266	0.0368	0.5634
Land Leased Out[5]	-0.01	0.5384	-0.001	0.9623	-0.0289	0.2836	0.0004	0.9908	0.0224	0.5501
Land Rented In[5]	-0.0075	0.6693	0.0682	0.0046	-0.0363	0.2236	0.0736	0.0298	-0.0741	0.0771

1. All models of change in household goods and total household goods also included the asset value in the prior year, female headship, acreage owned and acreage under cultivation (n=385).
2. All models of change in household goods and total household goods also included the asset value in the prior year, acreage owned (n=385).
3. The model of total household assets also included total assets value in the prior year, female headship, acreage owned and total household expenditure per adult equivalent (n=385).
4. The model of land owned also included acreage owned in the prior year (n=385).
5. The models of land leased out and rented in also included acreage leased out or rented in the prior year and acreage owned (n=385).

Table 7. Asset change predicted by ration levels, prime-age morbidity and mortality and their interactions among beneficiary households only.

Assets	Rations in Ksh		Prime-Age Illness		PA Illness*Rations		Prime-Age Death		PA Death*Rations	
	Estimate	P-Value	Estimate	P-Value	Estimate	P-Value	Estimate	P-Value	Estimate	P-Value
Total Livestock[1]	-0.0059	0.9921	-3797.0500	0.0342	1.7561	0.0817	-1126.9600	0.7079	0.1123	0.9471
Total Household Goods[1]	-0.2880	0.4313	-791.0300	0.4809	0.5077	0.4169	-820.0500	0.6583	-0.5709	0.5841
Livestock and Goods[1]	-0.2605	0.7246	-4779.3500	0.0340	2.4161	0.0553	-1693.2300	0.6499	-0.5345	0.7985
Land Owned[2]	0.0000	0.4897	-0.0966	0.1475	0.0000	0.6648	0.0354	0.7528	0.0000	0.9059
Land Rented In[2]	0.0000	0.1327	0.0352	0.3107	0.0000	0.8181	0.0149	0.7984	0.0000	0.7738
Land Leased Out[2]	0.0000	0.2202	-0.1246	0.0545	0.0001	0.1555	-0.0263	0.8093	0.0000	0.7199

1. Models of total livestock, total household goods and total livestock and household goods predicted those values measured in Kenya shillings and also included the value of the asset(s) the year prior (n=277).
2. Models of land owned, rented in and leased out predicted those values measured in acres and also included acreage the year prior (n=277).

4.2.4: Household Goods

Estimates reported in Table 6 are in the units of Kenya Shillings for household goods and livestock. Coefficients for program participation alone for each household good is positive but none are significant, nor is the coefficient for total household goods. The program does not appear to significantly impact retention and acquisition of household goods in beneficiary households after controlling for prime-age illness.

Consistent with the HIV/AIDS-food security paradigm is the finding that prime-age illness is associated with a reduction in total household goods by a value of 2,416 Kenya Shillings (Table 6, row 6, columns 3 and 4); although it is only marginally significant (p-value=0.0515). Coefficients for each of the constituent items are negative, but only that for stoves is statistically significant. As predicted, all of the coefficients for program participation by prime-age illness are positive, suggesting an ameliorative impact of the program, but only that for stoves is statistically significant. The p-value for program participation by prime-age illness for total household goods is 0.0616 which, considering the relatively small sample size, may be indicative of an ameliorative effect (Table 6, row 6, columns 5 and 6).

Prime-age death does not appear to have any impact on household goods retention or acquisition in this sample. The coefficients for the constituent items do not all share the same sign and none are statistically significant. Likewise, total household goods do not appear to be affected by prime-age death or the interaction of prime-age death and program participation.

The analysis of ration amounts does not support the bivariate program participation model of total household goods. None of the relevant coefficients are statistically significant.

4.2.5: Livestock

There is no indication of program success in maintaining or rebuilding livestock holding in this study when analyzed as a bivariate variable. Nor is there evidence for an erosive effect of prime-age illness or death on livestock holdings. Not surprisingly then, the program does not show an interactive effect with prime-age illness and death.

However, when the program is analyzed using ration amounts and limited to beneficiary households, prime-age illness is statistically significantly associated with a reduction in total value of livestock holdings by 3,797 Kenya Shillings (Table 7, row 1, columns 3 and 4). Program participation interacted with prime-age illness has a positive coefficient but is significant only at the 0.1 level (p-value=0.0817) (Table 7, row 1, columns 5 and 6). This finding that prime-age illness is a significant factor in reducing livestock holdings among beneficiary households may be due to an effect of prime-age illness on poorer beneficiary households that were dropped from the matched analysis. The finding that higher ration amounts may be associated with greater livestock holdings retention or acquisition is evidence that food insecurity may play a role in loss of livestock holdings.

That prime-age death is not associated with loss of livestock holdings does not support the HIV/AIDS-food security paradigm that households expend a large proportion of their resources on funerals. But, the lack of evidence for a program effect on prime-

age death suggests that food security is not the driving factor in whether a household chooses to invest in new livestock.

4.2.6: Total Goods and Livestock

The coefficient of the program effect for total household goods and livestock is small with a large p-value (Table 6, row 13, columns 1 and 2). Thus, food aid alone does not appear to have any impact on household asset retention and acquisition.

The difference-in-differences analysis demonstrates clearly that prime-age illness has a negative impact on total goods and livestock in this sample with a reduction in value of of 3,283 Kenya Shillings (Table 6, row 13, columns 3 and 4). The estimate is larger than either total household goods or total livestock holdings indicating that both contributed to the decline in total goods and livestock due to prime-age illness. There is a positive coefficient for program participation interacted with prime-age illness, but it fails to achieve significance even at the 0.1 level (p-value=0.1079) (Table 6, row 13, columns 5 and 6).

Prime-age death does not significantly affect change in the quantity of total goods and livestock in this sample (Table 6, row 13, columns 7 and 8). The interaction term for program participation and prime-age death has a negative coefficient that is smaller than the coefficients for either total household goods or total livestock holdings but does not achieve statistical significance.

The analysis of ration amounts supports the findings from the bivariate analysis of program participation that prime-age illness is a significant factor in reducing total household goods and livestock (Table 7, row 3, columns 3 and 4). The interaction of

prime-age illness and ration amount has a positive coefficient and is marginally significant with a p-value of 0.0553 (Table 7, row 3, columns 5 and 6). The model estimates that the presence of an ill prime-age adult in the household reduces the value household assets by 4,779 Kenya Shillings while one shilling's worth of food aid increases values of household goods and livestock by 2.4 Kenya Shillings in households with an ill prime-age member. Thus, there is evidence that the more food aid a beneficiary household receives the more assets it is able to retain or acquire. The coefficients for ration amount, prime-age death and prime-age death by ration amount are all negative but have high p-values indicating that food aid rations had no effect on assets outside of the context of prime-age illness (Table 7, row 3, columns 7-10).

4.2.7: Land Availability

Using either the bivariate measure of program participation or ration amounts, there is little evidence for any change in land ownership in this sample. The interaction of any prime-age illness and program participation was significant at the 0.1 level with a p-value of 0.0782 and a negative coefficient (Table 6, row 14, columns 5 and 6). Thus, households with an ill prime-age member that receive food aid appear to reduce their land holding by approximately 0.08 acres.

Prime-age illness and death is significantly associated with an increase in the acreage of land rented in by a household (presumably for agricultural purposes) in the bivariate program participation model (Table 6, row 14, columns 3-4, 7-8). The interaction terms for program participation and prime-age illness and death are both negative for land rented in, but only the interaction term for prime-age death approaches significance with

a p-value of 0.0771 (Table 6, row 14, columns 9 and 10). The ration amount model supports the conclusion that households affected by prime-age illness seek to retain land available to them with a marginally significant (0.0545) negative effect on the amount of land leased out (Table 7, row 6, columns 3 and 4).

4.2.8: Discussion

There is clear evidence in this sample that prime-age illness leads to a reduction in total household goods and livestock. The analysis of bivariate program participation presented in Table 6 shows a marginally statistically significant decrease in the value of household goods among households with an ill prime-age adult while the ration amount analysis shows a significant decrease in value of livestock holdings among households with an ill prime-age adult. Both types of analyses demonstrate a statistically significant decrease in the value of total goods and livestock associated with prime-age illness. This evidence supports the HIV/AIDS-food security paradigm as discussed in Chapter 3 wherein prime-age illness leads to lower productivity and higher expenses resulting in stress sales of household assets.

There is limited evidence that program participation ameliorates the negative impact of prime-age illness on household asset retention and acquisition. While the coefficients for program participation and for ration amount are positive for interaction with prime-age illness when predicting household goods, livestock and total goods and livestock, none achieve statistical significance at the 0.05 level. The limited evidence that provision of food aid does improve asset levels suggests that food insecurity does play an important role in driving HIV/AIDS-affected households deeper into poverty.

There is no evidence for a prime-age death impact on household holdings of goods and livestock in this sample and there is no evidence that provision of food aid to households experiencing prime-age death affects their asset levels. This does not support the aspect of the HIV/AIDS-food security paradigm that prime-age death leads to further asset erosion or that improved household food security in the post-death period will improve the productive capacity of the household.

Land ownership was not affected by program participation or prime-age illness or death in this sample. This is may be due to a lack of formal land tenure in the region that makes the quick sale of land difficult. However, the positive coefficients for land rented in and negative coefficients for land leased out by households affected by prime-age illness and death suggests that HIV/AIDS-affected households in this sample pursue a food security strategy based on agriculture. The opposite signs for the interaction terms of program participation and ration amount with prime-age illness and death suggest that improved food security does not lead a household to expand agricultural production. This finding is not consistent with the HIV/AIDS-food security paradigm presented in Chapter 3 that HIV/AIDS-affected households are less agriculturally productive.

4.3: Labor Employment

A central concept of the HIV/AIDS-affected household productivity model is that labor is diverted from income generating activities to time spent in convalescence and care-giving. For instance, Onyango (2005) estimated a loss of 213 person days of labor lost per death-affected household and 162 person days of labor lost in illness-affected households in western Kenya.

The provision of food aid to households in which a chronically ill prime-age adult is resident is expected to improve the nutrition and health of the ill person(s) thus increasing the amount of time that he/she is able to devote to productive activities and/or decreasing the amount of time that other household members devote to care-giving for the ill person(s).

Hypothesis 1: Time devoted to productive labor will increase among household members in beneficiary households.

For the purposes of this study, productive labor is defined as income generating activities including farm labor, off-farm labor (including fishing) and total productive labor (farm labor and off-farm labor combined).

This hypothesis may be considered in two ways. First, do prime-age adults living in beneficiary households increase the amount of time spent in productive labor given a prime-age adult household member is either ill or has died? That is, is there a household level effect of program participation and prime-age illness and death on prime-age members of a household? But the issue may also be framed as whether an ill prime-age adult who lives in a beneficiary household spends more time in productive labor. In other words, does food aid improve the health of prime-age individuals so that they may spend more time in labor?

The general form of the model in predicting labor hours by prime-age adults is given below (for the sake of clarity, random effects for sample clustering are not incorporated into the model).

$L_{xij} = \alpha + \beta_1 MALE_{ij} + \beta_2 AGE_{ij} + \beta_3 FA_j + \beta_4 ANY\_PA\_DEATH_j + \beta_5 FA_j * ANY\_PA\_DEATH_j + \beta_6 ANY\_PA\_ILL_j + \beta_7 FA_j * ANY\_PA\_ILL_j + \varepsilon$

Where:

L_{xij} = Daily hours of labor x performed by individual i in household j

AGE_{ij}= Age in years of individual i in household j

$MALE_{ij}$ = Dummy for gender of individual i in household j (=1 if male)

FA_j = Dummy for food aid receipt by household j (=1 if beneficiary)

$ANY\_PA\_DEATH_j$=Dummy for any prime-age mortality in prior two years in household j

$FA_j * ANY\_PA\_DEATH_j$=Interaction term for program participation and any prime-age death in household j

$ANY\_PA\_ILL_j$=Dummy for any chronic prime-age morbidity in household j

$FA_j * ANY\_PA\_ILL_j$= Interaction term for program participation and any prime-age chronic morbidity in household j

Hypothesis 2: Time devoted to care-giving will decrease among household members in beneficiary households.

The general form of the model in predicting hours of care-giving by prime-age adults is given below (for the sake of clarity, random effects for sample clustering are not incorporated into the model). Full model results for off-farm labor and all income generating labor are given in Appendix 6, Table A6.2.

$CG_{ij} = \alpha + \beta_1 MALE_{ij} + \beta_2 AGE_{ij} + \beta_3 FA_j + \beta_4 ANY\_PA\_DEATH_j + \beta_5 FA_j * ANY\_PA\_DEATH_j + \beta_6 ANY\_PA\_ILL_j + \beta_7 FA_j * ANY\_PA\_ILL_j + \beta_8 ANY\_ELDER\_ILL_j + \beta_9 ANY\_CHILD\_ILL_j + \varepsilon$

Where:

CG = Daily hours of care-giving by individual i in household j

AGE_{ij}= Age in years of individual i in household j

$MALE_{ij}$ = Dummy for gender of individual i in household j (=1 if male)

FA_j = Dummy for food aid receipt by household j (=1 if beneficiary)

$ANY\_PA\_DEATH_j$=Dummy for any prime-age mortality in prior two years in household j

$FA_j * ANY\_PA\_DEATH_j$=Interaction term for program participation and any prime-age death in household j

$ANY\_PA\_ILL_j$=Dummy for any chronic prime-age morbidity in household j

$FA_j * ANY\_PA\_ILL_j$= Interaction term for program participation and any prime-age chronic morbidity in household j

$ANY\_ELDER\_ILL_j$= Dummy for any chronic elder morbidity in household j

$ANY\_CHILD\_ILL_j$= Dummy for any chronic child morbidity in household j

Hypothesis 3: Time devoted to convalescence will decrease among prime-age adults in beneficiary households.

The general form of the model in predicting hours of convalescence by prime-age adults is given below (for the sake of clarity, random effects for sample clustering are not incorporated into the model).

$CONV_{ij} = \alpha + \beta_1 AGE_{ij} + \beta_2 MALE_{ij} + \beta_3 FA_j + \varepsilon$

Where:

$CONV_{ij}$ = Daily hours of convalescence by individual i in household j

AGE_{ij} = Age in years of individual i

$MALE_{ij}$ = Dummy for gender of individual i (=1 if male)

FA_j = Dummy for food aid receipt by household j (=1 if beneficiary)

Hypothesis 4: Beneficiary households will increase the proportion of land under cultivation compared to non-beneficiary households.

The general form of the difference-in-differences models used to evaluate changes in acreage under cultivation is given below (please note that random effects for sample clustering are not included in the model). Full model results for change in acreage under cultivation are given in Appendix 6, Table A6.2.

$\Delta CULT_j = \alpha + \beta_1 CULT\_OPEN_j + \beta_2 FA_j + \beta_3 ANY\_PA\_DEATH_j + \beta_4 FA_j * ANY\_PA\_DEATH_j + \beta_5 ANY\_PA\_ILL_j + \beta_6 FA_j * ANY\_PA\_ILL_j + \beta_7 OWN\_NOW_j + \varepsilon$

Where:

$\Delta CULT_j$ = Change in acres of land under cultivation by household j from 2003 to 2004

$CULT\_OPEN_j$ = Acres of land under cultivation by household j in 2004

FA_j = Dummy for food aid receipt by household j (=1 if beneficiary)

$ANY\_PA\_DEATH_j$=Dummy for any prime-age mortality in prior two years in household j

$FA_j * ANY\_PA\_DEATH_j$=Interaction term for program participation and any prime-age death in household j

$ANY\_PA\_ILL_j$=Dummy for any chronic prime-age morbidity in household j

$FA_j * ANY\_PA\_ILL_j$= Interaction term for program participation and any prime-age chronic morbidity in household j

OWN_NOW_j=Acres of land owned by household j in 2004

Hypotheses 1-3 were analyzed at the individual level to examine the effect of the food aid distribution. Total hours devoted to each activity were regressed on household level variables for program participation, prime-age illness and death, and their interaction terms. Additional covariates were examined for their impact on estimates of program, however, none except age were found to significantly impact the estimates of interest more than ten percent. Models using pooled data of both genders included a variable for gender. The models of care-giving included two additional variables: a dummy for the presence of any ill child and a dummy for the presence of any ill elder in the household.

Labor models typically include a wage rate variable. Unfortunately, no such data exist for this dataset and the categories of labor employment (farm, off-farm and fishing) are insufficiently detailed to be able to assign relative wage rates to them. Wage rates vary by task, skill, season, location, market demand, etc. and rigorous econometric modeling of labor is beyond the scope of these analyses. However, there is no reason to believe that wage rates differ significantly between the treatment groups. Beneficiary and non-beneficiary households were drawn from all villages sampled and matched on many of the characteristics that determine wage rates; such as education, assets and land holdings. Poor households typically engage in unskilled labor and the major determinants of wages for unskilled labor are age and gender, both of which were controlled for in the models.

Labor supply in poor households is less responsive to income than wealthier households (Abdulai, Barrett and Hoddinott, 2004). Since the matched analysis is largely confined to poorer households, it may be assumed that their labor supply is relatively

fixed. The hypotheses being tested here focus on the ability of prime-age adults to increase work hours due to an improvement in health from higher energy levels.

Ration analyses were not performed on labor, care-giving and convalescence outcomes because there is no data on how the food aid was distributed to individual household members.

Hypothesis 4 was analyzed with a difference-in-differences approach. The outcome of interest was the change in the acreage of land under cultivation by the household prior to the implementation of the food aid distribution to the amount under cultivation after the implementation of the food aid distribution. Covariates in the model included the amount of land under cultivation in the year prior to interview, total acres of land owned by the household, program participation, the presence of any prime-age illness or death, and interaction terms of program participation and prime-age illness and death. Land owned was included because as the amount of land available to the household directly impacts the household's cultivation decisions. Additional covariates were examined for their impact on estimates of program participation and prime-age illness and death, but none were found to impact the estimates of interest by more than ten percent.

PROC MIXED was used for regression modeling due to the ease of including random effects for village and household level clustering. After testing for random effects for village level and household level clustering in the labor, care-giving and convalescence models, it was found that village level clustering was not significant in models that included household level clustering. Therefore, the regression models for labor, care-giving and convalescence only included a random effect for households. The model of

land under cultivation does not include any individual level variables and only includes a random effect for village level clustering.

4.3.1: Productive Labor

Table 8 gives the results of regressions examining the impact of program participation, prime-age illness and death and interactions of program participation and prime-age illness and death for prime-age men, women and both in propensity score matched households.

Program participation and prime-age illness and death and their interaction terms show no statistically significant effect on men's farm labor (Table 8 row 1). It is interesting though that the coefficients for program participation and program participation interactions are all negative while the coefficients for prime-age illness and death are both positive, the opposite of what one would expect under the HIV/AIDS-food security paradigm. Likewise, there is no evidence of a program effect or of an effect of prime-age illness or death for women's farm labor.

The results for off-farm labor tell a different story from that for farm labor. While there are no statistically significant results for men's off-farm employment, the coefficients do conform to the expected pattern with a positive program effect (both alone and in interaction) and negative effects of prime-age illness and death (Table 8, row 4, columns 1-6). Prime age women do show statistically significant increases in off-farm labor for program participation and program participation by prime-age illness (by 0.99 and 1.19 hours per day respectively), and a statistically significant decrease of 1.3 hours per day in off-farm labor when there is an ill prime-age adult in the household (Table 8,

row 5, columns 1-6). For both sexes, only those same factors that were significant for women are significant for both sexes combined with the coefficients smaller than that for women alone, indicating that the change in women's labor is primarily driving the results (Table 8, row 6, columns 1-6).

Table 8. Estimates and significance levels for each of the five key explanatory variables predicting hours of labor by type of labor and gender of prime-age adults in propensity score matched households.

		Beneficiary Household		Any PA Illness		Beneficiary by Any PA Illness		Any PA Death		Beneficiary by Any PA Death	
Labor	Gender	Estimate	P-Value	Estimate	P-Value	Estimate	P-Value	Estimate	P-Value	Estimate	P-Value
Farm Labor[1]											
	PA Men	-0.2263	0.5418	0.4494	0.3076	-0.9108	0.1061	0.4921	0.5030	-0.9033	0.3744
	PA Women	-0.1001	0.6945	-0.0838	0.7798	-0.0611	0.8723	0.4092	0.3842	0.0974	0.8672
	All PA Adults	-0.1301	0.5751	0.1114	0.6874	-0.3384	0.3364	0.3556	0.4220	0.0349	0.9503
Off Farm Labor[1]											
	PA Men	0.5668	0.2664	-0.6405	0.2957	0.5811	0.4504	-1.0919	0.3084	1.4683	0.2894
	PA Women	0.9908	0.0042	-1.2972	0.0016	1.1914	0.0215	0.2348	0.7131	-0.8405	0.2885
	All PA Adults	0.8526	0.0056	-1.1586	0.0015	1.0539	0.0225	-0.2360	0.6873	-0.2289	0.7564
Income Generating Labor[1]											
	PA Men	0.1336	0.8589	-0.2914	0.7441	-0.1248	0.9127	-0.8599	0.5651	1.2824	0.5329
	PA Women	0.8030	0.0800	-1.4996	0.0059	1.2116	0.0780	0.8045	0.3433	-0.5659	0.5903
	All PA Adults	0.6134	0.1584	-1.2085	0.0200	0.8906	0.1757	0.1862	0.8222	0.0220	0.9832
Care-Giving[2]											
	PA Men	-0.2063	0.1118	0.0441	0.7894	0.0529	0.7897	-0.2708	0.2897	0.0478	0.8933
	PA Women	-0.1006	0.6070	0.1148	0.6402	0.1102	0.7096	-0.3764	0.2952	0.2876	0.5209
	All PA Adults	-0.1485	0.2531	0.1150	0.4837	0.0550	0.7803	-0.2897	0.2450	0.1944	0.5366

1. All models also included a variable for age of the household member. Models for men and women combined also included a variable for gender (n=236 men, 337 women, 573 combined).

2. All models of care-giving also included variables for age of the household member, presence of any ill elderly household member and presence of any ill child member. Models for men and women combined also included a variable for gender (n=236 men, 337 women, 573 combined).

The results for total productive labor show a statistically significant decease of 1.5 hours per day for women living in a household in which there is a chronically ill prime-age adult (Table 8, row 8, columns 3 and 4). This effect is larger than that for off-farm labor alone indicating that the non-significant decrease in farm labor is contributing to the effect. However, when considering all productive labor combined for women, the impacts of program participation and its interaction with prime-age illness are less clear. These coefficients are similar to those for off-farm labor, but statistically significant at the 0.1 level only (Table 8, row 8, columns 1-2 and 5-6). This suggests that it is off-farm labor that is driving the change in women's labor employment due to program participation. Men do not show any change in total productive labor due to program participation or prime-age illness or death (Table 8, row 7).

4.3.2: Care-Giving

There were no statistically significant results for daily hours of care-giving in this sample (Table 8, rows 10-12). While positive coefficients for the presence of any prime-age ill person in the household is expected, the positive coefficients for program participation by prime-age illness as seen for men women and both is contrary to what would be expected under the HIV/AIDS-food security paradigm. One would expect that if the provision of food aid improved the health of ill prime-age adults (as discussed in the next section), their need for care-giving would be reduced and that that would be reflected in the data. However, this is not the case.

4.3.3: Individual Illness and Productive Labor

Table 9 gives coefficients and p-values for program participation on daily hours of productive labor and convalescence among prime-age individuals from propensity score matched households who reported any usual daily hours of convalescence.

Table 9. Labor hours and hours of convalescence by ill prime-age adults in propensity score matched households predicted by program participation.

		Beneficiary Households	
Time Use	**Gender**	Estimate	P-Value
Farm Labor			
	PA Men	0.5516	0.3128
	PA Women	-0.0226	0.9462
	All PA Adults	0.1745	0.5615
Off Farm Labor			
	PA Men	0.5212	0.4079
	PA Women	0.01045	0.9727
	All PA Adults	0.1132	0.6738
Income Generating Labor			
	PA Men	0.79	0.4131
	PA Women	-0.0973	0.8476
	All PA Adults	0.1521	0.7428
Convalescence			
	PA Men	-2.0462	0.0701
	PA Women	-1.2036	0.0862
	All PA Adults	-1.4185	0.0103

All models also included a variable for age. Models of both men and women combined also included a variable for gender (n=49 men, 114 women, 163 combined).

While there was no effect found for program participation on productive labor, the provision of food aid does appear to reduce convalescence among chronically ill prime-

age adults by 1.4 hours per day (Table 9, rows 10-12). While the estimates of program participation on hours of convalescence fail to achieve statistical significance for men or women separately, when combined program participation reduces hours of convalescence by nearly 90 minutes per day. Given this finding, it is surprising that there was not a care-giving effect found in the previous analysis.

4.3.4: Land Under Cultivation

Table 10 gives the results of a difference-in-differences model examining the impact of program participation and prime-age illness and death on change in acreage under cultivation. Full model results for change in land under cultivation are presented in Appendix 6, Table A6.1. Program participation alone does not impact changes in acreage under cultivation nor does prime-age death or the interaction of prime-age death and program participation. Prime-age illness is a significant predictor of an increase in acreage under cultivation by 0.18 acres (Table 10, row 2). Contrary to the expectations of the HIV/AIDS-food security paradigm, the presence of an ill prime-age adult in the household increases acreage under cultivation. Furthermore, the coefficient for prime-age illness interacted with program participation is negative and significant: the opposite effect as hypothesized (Table 10, row 3). Beneficiary households hosting an ill prime-age member reduced cultivated area by approximately one quarter of an acre.

Table 10. Estimates and significance levels for each of the five key explanatory variables predicting change in acreage under cultivation in propensity score matched households.

Variable	Estimate	P-Value
Program Participation	0.0057	0.9275
Any Prime-Age Illness	0.1833	0.0349
Program Participation by Prime-Age Illness	-0.2370	0.0279
Prime-Age Death	-0.0903	0.4565
Program Participation by Prime-Age Death	-0.0137	0.9275

Model also included variables for acreage under cultivation in the year prior and acreage owned by the household (n=385).

Using ration amounts as the measure of program participation does not show any significant impacts of program participation, prime-age illness or death or their interactions (not shown). The coefficients' signs do point in the same direction as the analysis of program participation using a dummy for total rations received, prime-age illness and the interaction of prime-age illness and ration amount. This result supports the finding that households affected by prime-age illness increase land under cultivation unless given food aid.

4.3.5: Discussion

The results of the labor analysis are very informative to understanding the dynamic nature of the impact that HIV/AIDS has on household livelihoods and food security.

The period of prime-age illness is most critical in declining household productivity while the period after a prime-age death shows little impact. This emphasizes the role of illness in the HIV/AIDS-food security paradigm wherein when a prime-age household member becomes ill and household resources are diverted from productive uses to support for the ill individual. In this sample, prime-age men do not appear to alter their

labor employment in response to the presence of a prime-age ill household member. Prime-age women on the other hand, decrease their off-farm employment if there is a prime-age ill household member while maintaining their same level of farm labor. Households with a prime-age ill member increase the amount of land under cultivation although it is not clear from this sample just where the additional labor to do so comes from. Men in households with a prime-age ill member do appear to increase their farm labor in response, but that result is not statistically significant.

When food aid is provided to a household with an ill-prime age member, prime-age household members, especially women, appear to shift their food security strategy away from agriculture to off-farm income opportunities. This is also true among beneficiary households that do not contain an ill prime-age member. This result suggests that when faced with the loss of labor from an ill prime-age member, households will pursue a risk-averse food security strategy that depends on own agricultural production. But with the regular provision of food aid to the household, women are able to engage in more off-farm income activities: a food security strategy that may be more risky, but with potentially higher returns.

These data also inform the HIV/AIDS-food security paradigm on the role of food security in the health and productivity of individuals, especially chronically ill individuals. The results from this study show that ill prime-age adults living in a beneficiary household spend less time in convalescence than similar individuals in non-beneficiary households. However, this decease in convalescence hours for ill prime-age individuals does not affect hours spent in care-giving by prime-age household members in this sample.

4.4: School Attendance

One of the most important investments a household can make is in the education of its children. Unfortunately, since education is a long-term investment, many households in acute crisis will choose to employ their school age children in income generating activities or domestic labor so as to allow adults more time to earn income rather than to attend school. Children may also choose to forego school attendance due to a lack of energy and ability to concentrate as a consequence of poor nutrition. Primary education for children six to twelve years of age is free in Kenya, but older children may be forced to leave school because their families can no longer afford school fees. Provision of food aid to these households is expected to increase school attendance due to a reduced need for the children's labor contribution, increase in energy from better nutrition or the ability of the household to pay for school fees with money that would otherwise have gone towards food.

Yamano and Jayne's 2004 study of HIV/AIDS-affected households in Kenya found that children living in households with an ill prime-age adult were 20% less likely to attend school and children in the poorest households with an ill prime-age adult were 33% less likely to attend school.

Hypothesis: Children living in beneficiary households have higher school attendance than children living in similar households that do not receive food aid.

The general model specification predicting daily hours of school attendance is given below (for the sake of clarity, random effects for sample clustering are not incorporated into the model). Full model results for daily hours of school attendance by boys is presented in Appendix 6, Table A6.3.

$SA_{ij} = \alpha + \beta_1 AGE_{ij} + \beta_2 FREE_{ij} + \beta_3 MALE_{ij} + \beta_4 FA_j + \beta_5 ANY\_PA\_DEATH_j + \beta_6 FA_j * ANY\_PA\_DEATH_j + \beta_7 ANY\_PA\_ILL_j + \beta_8 FA_j * ANY\_PA\_ILL_j + \varepsilon$

Where:

SA_{ij} = Daily hours of school attendance for child i in household j

AGE_{ij} = Age of child i years

$FREE_{ij}$ = Dummy if child i is 6 to 12 years of age (i.e. qualifies for free schooling)

$MALE_{ij}$ = Dummy for gender of child i (=1 if male)

FA_j = Dummy for food aid receipt by household j (=1 if beneficiary)

$ANY\_PA\_DEATH_j$=Dummy for any prime-age mortality in prior two years in household j

$FA_j * ANY\_PA\_DEATH_j$=Interaction term for program participation and any prime-age death in household j

$ANY\_PA\_ILL_j$=Dummy for any chronic prime-age morbidity in household j

$FA_j * ANY\_PA\_ILL_j$= Interaction term for program participation and any prime-age chronic morbidity in household j

This hypothesis was tested at the level of individual children regressing daily hours of school attendance on the individual level variable of age and household level variables for program participation, prime-age illness and death and their interactions. Models using pooled data of both genders included a variable for gender. Models using data pooled across both primary and secondary school included a variable indicating if the child is primary-school age. The variable for primary school age reflects that primary schooling is free in Kenya while secondary schooling incurs fees.

4.4.1: Results

Table 11 gives the results of regression models for school attendance by gender, primary or high school, and combinations of gender and school levels. There is no evidence of a program effect for primary school children either alone or in interaction with prime-age illness and death, nor is there evidence for an effect of prime-age illness or death on primary school attendance (Table 11, rows 1-3).

There is a statistically significant program effect for high school boys with boys living in beneficiary households spending almost one hour and forty five minutes per day more in school (Table 11, row 4, columns 1 and 2). The coefficient for any prime-age illness was negative for high school boys and the coefficient for program status by prime-age illness was positive as expected but neither was statistically significant. School attendance of high school girls did not appear to be impacted by program participation or prime-age illness and death (Table 11, row 5). There was a significant program effect for both boys and girls combined on high school attendance, but it is clearly being driven by boy's attendance (Table 11, row 6, columns 1 and 2).

When combining school levels and looking at school attendance by boys and girls separately, there is a significant program effect for boys only (Table 11, row 7, columns 1 and 2). However, the effect for boys is clearly being driven by attendance of high school boys. There are no statistically significant effects for either boys or girls by prime-age illness or death or by the interaction of prime-age illness or death by program participation.

Table 11. Estimates and significance levels for each of the five key explanatory variables predicting hours of school attendance by gender and age group of children in propensity score matched households.

		Beneficiary Household		Any PA Illness		Beneficiary by Any PA Illness		Any PA Death		Beneficiary by Any PA Death	
Level	**Gender**	Estimate	P-Value	Estimate	P-Value	Estimate	P-Value	Estimate	P-Value	Estimate	P-Value
Primary School[1]											
	Boys	0.1893	0.6024	0.1175	0.8066	-0.2312	0.6964	-0.5859	0.4799	0.5261	0.5808
	Girls	-0.1527	0.6601	-0.0106	0.9813	-0.0235	0.9673	-0.4814	0.4475	-0.4767	0.5598
	All	-0.0116	0.9668	0.0952	0.797	-0.1667	0.7185	-0.5175	0.3485	0.1321	0.8454
High School[1]											
	Boys	1.7218	0.0026	-0.6247	0.4243	0.9295	0.3344	0.3951	0.7136	0.5126	0.6946
	Girls	0.4303	0.4705	-0.666	0.4271	-1.3938	0.1697	0.2838	0.8128	-0.1592	0.9083
	All	1.0897	0.0121	-0.5423	0.3637	-0.323	0.6597	0.3905	0.6491	0.1446	0.8872
All Grades[2]											
	Boys	0.7159	0.0422	0.0053	0.991	0.1094	0.8515	-0.1477	0.8388	0.3078	0.7194
	Girls	-0.028	0.9349	-0.4039	0.3763	-0.6373	0.2636	0.1305	0.8409	-0.4322	0.5854
	All	0.4347	0.1209	-0.2087	0.5827	-0.188	0.6901	0.008	0.9886	-0.0306	0.9638

1. All models also include a variable for age. Models for boys and girls combined also include a variable for gender. (n=311 primary boys, 318 primary girls, 629 combined primary children, 226 high school boys, 191 high school girls, 417 combined high school children)

2. All models also include a variable for age and a variable for tuition free primary schooling. Models for boys and girls combined also include a variable for gender. (n=537 boys, 509 girls, 1046 combined children)

4.4.2: Discussion

There is no evidence of an effect on children's school attendance by prime-age illness or death in this sample. Therefore, it is not surprising that there is also no effect of an interaction between prime-age illness or death and program participation.

High school attendance by boys is likely to be the most sensitive to household conditions. This is due to an expectation that boys are more likely to take advantage of an education in their adult lives while girls are expected to conform to traditional roles of women as mothers and farmers. Also, households must pay school fees for high school attendance whereas primary schooling is free. Therefore, the finding that high school boys spend more time in school if living in a beneficiary household provides evidence that household resources are critical to schooling decisions. But it does not inform the HIV/AIDS-food security paradigm. If prime-age illness or death were the driving factors behind household impoverishment that leads to lower school attendance, one would expect to see consistently negative coefficients for the prime-age illness or death variables in the models, but that is not the case. Nor do the results from this analysis support the assertion of prime-age illness and death leading to lower food consumption of household children with the consequence that they miss school out of hunger and lack of concentration. If that were the case, the provision of food aid to households experiencing the illness or death of a prime-age member should increase attendance. However, the coefficients do not show any consistent pattern supporting this.

It is possible that the way that school attendance is measured in this survey contributed to the null findings. School attendance was not measured by observation

(such as checking attendance logs), but was reported by an adult household member. The survey respondent may have been unwilling to admit to an apparently educated interviewer that his/her child did not attend school. Alternatively, the survey respondent may have been generalizing in his/her response by, for instance, stating that the child attended school for five hours a day when the child did attend school and not averaging in the days missed. It is also possible that the respondent was unaware that her/her child was skipping school. Such scenarios should be more prevalent with primary school children because if the household is paying school fees to a high school, they will be adamant that the child attend regularly.

These data suggest that schooling decisions in this sample are independent of factors put forth in the HIV/AIDS-food security paradigm, however, data from this survey were not designed to explore those other factors.

Chapter 5. Discussion

There is evidence from this sample that HIV/AIDS affects household livelihoods and that food security is a crucial aspect of that process. However, not all aspects of the HIV/AIDS-food security paradigm are borne out by these results. Methodological shortcomings of the survey design and instrument may explain why some of the hypotheses were not fully validated, but there are some unexpected lessons in these results as well about the impact of HIV/AIDS on small holder agricultural livelihoods. Since livelihood strategies vary by environmental and cultural conditions it may not be possible to extrapolate all of these findings beyond this population. But the findings do suggest several areas that merit consideration in the HIV/AIDS-food security debate in general and policy prescriptions to address the negative consequences of HIV/AIDS on small holders' livelihoods in specific.

5.1: Key Findings

The key findings of the study include:

- **Food aid receipt counteracts the erosive effects of prime-age illness on household assets**. Households with an ill prime-age member experienced an average loss of Ksh 2,416 worth of household goods while beneficiary households with an ill prime-age member more than made up for that loss with a Ksh 2,900 gain in household goods (although these findings were only marginally significant). See Table 6, row 6, columns 4, 5, 6 and 7.

- **Livestock holdings were not affected by prime-age illness of death, nor were they affected by the receipt of food aid**. See Table 6, row 13.
- **Food aid receipt counteracts the expansion of land under cultivation seen in households with an ill prime-age member**. Households with an ill prime-age member increased their land under cultivation by an average of 0.1833 acres, while households with an ill prime-age member that received food aid reduced land under cultivation by an average of 0.237 acres. These findings were significant at the 0.05 level. See Table 10, rows 2 and 3.
- **Households experiencing the illness or death of a prime-age member increase the amount of land rented in**. Households with an ill prime-age member increased the amount of land they rented in by an average of 0.0682 acres while households experiencing the death of a prime-age member increased the amount of land rented in by an average of 0.0736 acres. Both of these findings were significant at the 0.05 level. Food aid receipt reduced the amount of land rented in among households experiencing the illness or death of a prime-age adult, but these findings were not significant. See Table 6, row 17, columns 3-10.
- **Neither food aid receipt nor prime-age illness or death affected the amount of agricultural labor by prime-age men and women**. See Table 8, rows 1-3.
- **Women in beneficiary households devoted more labor time to off-farm income activities**. Prime-age women living in beneficiary households spend

an average of 0.9908 hours per day more in off-farm labor. This finding was significant at the 0.01 level. See Table 8, row 5, columns 1 and 2.

- **Food aid receipt counteracts the decline in women's off-farm labor associated with the presence of an ill prime-age adult in the household.** Prime-age women living in a household with an ill prime-age member spend an average of 1.2972 hours per day less in off-farm income generating labor, while prime-age women living in a beneficiary household with an ill prime-age adult increase their off-farm labor by an average 1.1914 hours per day. Both of these results were significant at the 0.05 level. See Table 8, row 5, columns 3-6.
- **Food aid receipt does not affect time devoted to care-giving**. See Table 8, rows 10-12, columns 1-10.
- **Food aid receipt reduces the amount of time prime-age adults spend in convalescence**. For men and women combined, program participation reduces the hours per day spent in convalescence by an average of 1.4185 hours per day. This finding is significant at the 0.05 level. See Table 9, row 12.
- **Prime-age illness and death do not affect children's school attendance.** See Table 11, rows 1-9, columns 3-10.
- **Food aid receipt does not affect time spent in school by primary age children or girls**. See Table 11, rows 1-3, 5, 8 and 9.
- **Food aid receipt increases the amount of time high school boys attend school**. High school age boys living in beneficiary households spend an

average of 0.7159 more hours per day in school. This result is significant at the 0.05 level. See Table 11, row 4, columns 1 and 2.

These meaning of these results are discussed in more detail in the following sections.

5.2: Prime-Age Illness

There is evidence in this study that the period of prime-age illness is critical to small holder agricultural households' livelihoods. There were statistically significant reductions in total household goods and livestock and in women's productive labor when households hosted a prime-age individual.

The provision of food aid to households experiencing chronic illness of a prime-age member appears to ameliorate some of these negative impacts. Prime-age women living in households with an ill prime-age member make up most of the hours lost in off-farm labor when the household receives food aid. There is evidence that the provision of food aid prevents erosion of the asset base, but this result fails to achieve statistical significance (p-value=0.0616 for goods, p-value=0.1079 for goods and livestock).

The finding that prime-age illness negatively impacts assets and labor and that the provision of food aid ameliorates those negative consequences supports the HIV/AIDS-food security paradigm. Food aid would be unlikely have an ameliorative impact on assets and labor in prime-age illness affected households if prime-age illness were not impacting assets and labor through food security.

The indicator of prime-age illness used in most models, presence of any prime-age adult reporting usual daily convalescence, suffers from lack of specificity. The question asks, "In a typical weekday, how many hours a day does each household member on

average spend off work due to illness?" However, an asterisk tells interviews, "A typical weekday can be explained by referring to, for example, 'thinking back on the last week...'" This may lead to some confusion about the time period involved and may have prompted some respondents to report acute illnesses experienced by household members in the last week, rather than chronic illness lasting more than a week.

An additional issue with the indicator of prime-age illness used in the models (except as an outcome variable) is that it does not distinguish between persons reporting short daily periods of convalescence and persons reporting much longer daily periods of convalescence. The reason for using any daily period of convalescence was that if the provision of food aid improved the health of chronically ill prime-age adults leading to lower daily hours of convalescence then using a measure of total hours of convalescence would bias the results away from a true program effect.

Yamano and Jayne's 2004 study of HIV/AIDS in Kenyan households found that children living in households with a terminally ill adult were less likely to attend school. The lack of any such finding in this sample may reflect the change in educational policy by the Government of Kenya to make primary schooling free. However, since Yamano and Jayne conducted a panel study they were able to discern what ill adults in the baseline survey had died by the time of the follow-up survey. Those adults could then be safely defined as terminally ill. The Busia data did not have that level of specificity since it was cross-sectional.

5.3: Prime-Age Death

The only statistically significant effect of prime-age death is to increase the amount of land rented in by affected households. When prime-age death affected households receive food aid, they reduce the amount of land rented in by approximately the same amount although this is significant at the 0.1 level only. This finding confirms that households affected by prime-age illness or death put a greater emphasis on agricultural production unless part of their food needs are met by food aid.

While prime-age illness has shown to be a critical time for the households sampled in this survey, prime-age death had little effect. This may be because the period of prime-age illness is when the household experiences the greatest stress with the period after the ill person's death being one of livelihood stasis. However, the lack of evidence for a prime-age death effect in this sample may be due the way that the survey recorded information about prime-age deaths.

The survey instrument asked how many deaths of household members between the ages of 18 and 49 the household experienced in the previous two years. It did not ask when the person(s) died, their gender or their relationship to the head of household. These are all important factors in determining the impact on a household of a prime-age death (Mather, Donovan, Janyne, et al., 2004). Households may have replaced deceased prime-age members, but the survey did not ask the age of new household members so there is no way to tell.

Another potential problem with the prime-age death analysis is that the impact survey question asked about prime-age deaths in the household in the previous two years, but the food aid distribution had only been operational for eight months. There was a potential

lag of 16 months between the time of death and the beginning of the program that could have diluted any program effect seen in these data because it came too late to affect the household's response to the death.

The short time period for which the program had been operational when the impact survey was conducted could also be an issue in finding an effect on prime-age death affected households. Other than funeral expenses, there may be few short-term impacts of prime-age death, but there may be significant long-term impacts. Long term impacts would include the loss of knowledge held by the deceased and the failure to transfer that knowledge to younger or new household members. Property rights of widows or offspring may be compromised if the deceased was a male head of household. The social capital built up by the deceased person may begin to erode after his/her death and no longer accrue benefits to the household.

If the deceased had previously remitted money to the household from migratory earning, the loss of those remittances may affect the ability of the household to engage in petty trading or purchase inputs for other economic activities. The short term impact of the loss of remittances may only be reflected in current consumption, while the long term impact may be sustained lower productivity or falling into a poverty trap due to entry barriers to some activities.

Since these data do not come from a panel study, but rather from two cross-sectional surveys, they will have missed any households that previously dissolved due to being economically unviable after the death of a key prime-age member. However, there is no way of knowing to what extent such a bias may have affected the results.

5.4: Shifts in Livelihood Strategies

What about the curious finding that households with a chronically ill prime-age member increased land under cultivation and rented more land for cultivation, but if they received food aid they reduced land under cultivation? This does not conform to the HIV/AIDS-food security paradigm which emphasizes that prime-age illness reduces agricultural labor available to the household leading to poorer food security, which in turn leads to poorer livelihood outcomes. The problem with such a model is that it does not allow for the substitutability of off-farm labor for agricultural production in household livelihood strategies.

There are several results from this study that suggest that HIV/AIDS-affected households place a greater emphasis on agricultural production than unaffected households unless they receive food aid, then they shift their activities away from agricultural production.

Households with an ill prime-age member increased the amount of land under cultivation and increased the amount of land they rented (presumable for agricultural use). Households experiencing the death of a prime-age member also increased the amount of land rented in. In the analysis of ration amounts, households with an ill prime-age member decreased the amount of land that they leased out, although this was only marginally significant (p-value=0.0545).

However, if a household with an ill prime-age member received food aid they decreased the amount of land under cultivation. The estimate for the reduction in land under cultivation among beneficiary households with an ill prime-age member was larger than that of the estimate for the increase in the amount of land under cultivation for non-

beneficiary households with an ill prime-age member. There were non-significant decreases in land owned among beneficiary households with an ill prime-age member (p-value=0.07782) and land rented in among beneficiary households that experienced the death of a prime-age member (p-value=0.0771).

Prime-age women living in a household with an ill prime-age member spend less time in off-farm labor unless the household receives food aid, in which case women make up almost the entire amount of time lost in off-farm labor. Tellingly, program participation increases the amount of time prime-age women spend in off-farm labor independently of prime-age illness or death.

There is a substantial literature devoted to issues of off-farm income diversification in agricultural households, but no consensus has emerged as to the specific causes (Lemi, 2006). Diversification of livelihoods beyond agriculture is an important strategy to spread risk, smooth consumption, smooth labor allocation, or insure against shocks (Ellis, 1999). Agricultural households may engage in off-farm employment either because it offers higher rewards or because it is a coping strategy in response to insufficient or variable agricultural production.

While there is consistent evidence across Sub-Saharan Africa that off-farm labor employment by agricultural households is associated with increased earnings and household consumption (Barrett, Reardon and Webb, 2001), it appears that wealthy households engage in off-farm activities for different reasons than poorer agricultural households. Wealthy households are "pulled" into off-farm labor to take advantage of lucrative opportunities, while poorer households are "pushed" into off-farm labor out of necessity. Poor households face entry barriers to lucrative off-farm employment

opportunities due to a lack of skills, start up capital or access to credit. However, off-farm employment still offers benefits to poor households even if they are unable to realize the same potential as their wealthier neighbors.

Income diversification reduces risk in poor households' livelihood by deriving income from sources with little or negative correlation even if it reduces absolute income. Poor households tend to be risk averse and may be willing to forego some expected earnings in order to reduce income variability (Barrett, Reardon and Webb, 2001). Diversification to off-farm activities is a risk management strategy that has been demonstrated to be effective. Reardon and Taylor (1996) found that households in Burkina Faso with greater income diversification were better able to cope with the effects of drought induced food insecurity. Webb and Reardon (1992) found that income diversification among rural households in Ethiopia increased household welfare and improved the nutritional status of household members.

Demographic factors affect both risk aversion and off-farm labor employment as well. Yesuf and Bluffstone (2007) conducted an economic experiment among rural Ethiopian smallholder households to determine what factors were associated with risk aversion. They found that women are more risk averse than men, the presence and number of children in a household increases risk aversion, and poorer households are more risk averse than wealthier households. Demographic factors also affect the off-farm labor allocation of farm households with increasing age of household members and the number of female household members increasing the amount of time devoted to off-farm activities. Households with female household heads and increasing dependency ratios spend less time in off-farm employment (Lemi, 2006).

It is often accepted that the provision of food aid is a disincentive to labor in recipient households. However, there is very little empirical evidence to support this argument (Lentz, 2003). Abdulai, Barrett and Hoddinott (2004) used data from three rounds of the Ethiopian Rural Household Survey collected in 1994-95. They found that while food aid recipient households spend less time in agricultural activities, they more than make up that amount of time in off-farm wage and own business employment. The authors found that women living in recipient households increase the amount of time they spend in non-agricultural own businesses, but men do not. Both men and women living in recipient households spend more time in wage labor than men and women in non-recipient households. The analysis was not able to examine the causes of shifts in labor allocation associated with the receipt of food aid. The authors ascribe the lack of a disincentive effect to the higher opportunity coast of leisure facing poorer households that makes poor households' labor supply less responsive to income.

The findings from the Nutrition and Care of People Affected by HIV/AIDS pilot project parallel many of the findings from Abdulai, Barrett and Hoddinott. There is not a statistically significant change in farm labor by program status in the Busia data, but the signs of the coefficients for agricultural labor employment are mostly opposite that for off-farm employment. The coefficients for treatment effect on agricultural labor are negative, the effect of any prime-age illness is positive for men and both genders combined, and the interaction effects are negative. Any household prime-age illness significantly increases land under cultivation while program participation by households with an ill prime-age adult significantly reduces land under cultivation. Thus, there is

evidence to suggest that program participation by beneficiary households reduces the amount of labor they devote to their own agricultural production.

The coefficients for off-farm labor allocation are consistent across genders, but only significant for women and both genders combined. This study found that program participation increases the amount of time devoted to off-farm labor while the presence of any ill prime-age adult in the household reduces time devoted to off-farm labor. But, households hosting an ill prime-age adult and receiving food aid increase the amount of time they spend in off-farm labor.

The survey data are not sufficient to test hypotheses as to why households change their labor allocation in response to the receipt of food aid. A possible explanation is that the income transfer effect enjoyed by beneficiary households allows them to invest in petty trading or craft making and they do so in order to manage the risks inherent in rain fed agriculture. Non-beneficiary households with an ill prime-age adult may increase their agricultural labor in an effort to maximize their output despite the risks in an attempt to meet household food needs.

It may also be that prime-age women need to spend more time at home when there is a chronically ill member in the household and that that precludes off-farm opportunities and only allows for agricultural activities near home. Regular food aid provision to a household decreases the amount of time prime-age members spend in convalescence in this sample. That should lessen the burden on care-givers and allow then to pursue off-farm income opportunities, however there is no evidence in these data to support the hypothesis that women in households hosting an ill prime-age adult spend less time in care-giving when the household receives food aid. In fact, the coefficients for the

interaction term for prime-age illness and program participation are positive although not statistically significant.

The provision of monthly food aid rations to households with a chronically ill prime-age adult appears to allow households to more effectively manage risk in their livelihood strategies. Off-farm activities such as petty trading or informal labor are means by which households can earn cash income that can be saved and used to smooth consumption over time. Given Reardon and Taylor's (1996) finding that households in Burkina Faso with greater income diversification were better able to cope with the effects of drought induced food insecurity, beneficiary households in Busia may have been better prepared to deal with the 2004 drought.

5.5: Data

The greatest strength of these data is their uniqueness. While there are many published articles and reports speculating on the usefulness of welfare interventions in this context, there are no published reports or articles of an evaluation of the effectiveness of such a program. For that matter, there is not any evidence that such a large-scale trial has been tried elsewhere and, given the cost and logistics of such a program, it is unlikely that any others will be initiated. These data may be the only chance to test the effects of a general food aid distribution on the welfare of HIV/AIDS-affected households.

2003, when the baseline survey was done, was a normal year in terms of agricultural yield while 2004, when the impact survey was conducted, was a very poor agricultural year; so much so that the World Food Programme began large scale commodity distributions throughout Kenya only three months after the survey was completed. While

devastating to Kenyans, the drought of 2004 provides an optimal situation for exploring the effect of food aid since food insecurity was heightened and the contrasts between beneficiary households and similar non-beneficiary households may be sharpened.

This timing of the study is opportune in another way as well. The pilot project was undertaken in a high HIV prevalence area prior to the introduction of antiretroviral therapy regimes. These data reflect the conditions of people living with HIV/AIDS in a social environment in which infection was a terminal condition with all of the ramifications of such.

Unfortunately, the data derived from WFP's pilot food distribution in Busia, Kenya suffers from poor survey design and imprecise measurement. A panel study would have been ideal to establish causality in the relationship between food aid assistance and issues of labor, assets and schooling. However, this survey was conducted within the confines of WFP/Kenya's specific program evaluation needs and not intended as an academic exercise. The fact that it serves a useful academic purpose anyway reflects WFP personnel's comprehension of the subject.

Proxy variables to determine HIV/AIDS affectedness are not specific to HIV/AIDS and necessarily contribute some misclassification error to the model. Therefore, the model of HIV/AIDS and household food security may better be thought of as a model of prime-age chronic illness and mortality and intra-household dependency rather than specifically that of HIV/AIDS. However, in a high HIV prevalence population such as Busia District, HIV/AIDS may be assumed to be the primary cause of prime-age adult mortality and chronic morbidity. Apart from issues of stigma, it is immaterial to the

outcome whether an adult household member is ill with or died from AIDS or diabetes as the impact on household productivity may be expected to be the same.

5.6: Propensity Score Matching

The results reported here were derived from a subset of households surveyed that had been matched by propensity score using a nearest neighbor approach with a caliper of 0.01 and allowing for replacement. In developing the analysis several different approaches were tried, including covariate adjustment without use of any propensity score techniques, propensity score weighted regressions, matching by propensity score using an optimal match that seeks to minimize global differences in propensity scores between treatment groups, and nearest neighbor matching by propensity score using 0.01 and 0.001 calipers both with and without replacement. The matching scheme used was chosen as a balance between precision (similarity between treated and non-treated households) and power (maximizing the number of observations included).

The seven approaches employed showed similar patterns of response to program participation, prime-age illness and death, and interactions between program participation and prime-age illness and death with the exception of models that did not employ any propensity score techniques. Without any propensity score matching or weighting, the program effect, singly or in interaction, was clearly an indicator of poverty as that was how the program was largely targeted. Wealthier households are better able to cope with the loss of prime-age labor through illness and death than poorer households and inclusion of wealthier households in the models that did not employ propensity scores introduced selection bias in the results.

There are some disadvantages to propensity scoring techniques though. The greatest disadvantage is the loss of data. Of 900 households originally sampled by WFP/Kenya fieldworkers, only 385 were employed in the analysis: 250 of 276 beneficiary households and 135 of 620 non-beneficiary households. Most of the loss of information was from non-beneficiary households, but almost ten percent of beneficiary households were lost as well.

Although stratification by propensity score would have preserved all of the data, it was not used due to the heterogeneity of response by households to the presence of an ill prime-age member or the death of a prime-age member. Wealthier households are better able to absorb the expenses of illness or death or replace lost labor through attracting new members or hiring labor without altering their livelihood strategies. Poorer households, as were targeted for the food aid distributions, are less able to afford expenses related to illness and death and must alter their livelihood strategies to compensate. The inclusion of wealthier households in the comparison group would introduce bias due to their difference in response to HIV/AIDS-affectedness.

The beneficiary households not included in the analysis were predominantly those with the highest propensity scores for which there were no comparable non-beneficiary households. Since the program was generally targeted to destitute households, the households that were not matched were some of the most destitute of households originally sampled. Assuming a diminishing marginal utility of the food aid ration as households become wealthier, it is possible that the households realizing the greatest benefit from the food aid were not included in the analyses. This exclusion of some of

the most destitute households may result in an underestimate of the true impact of the program.

An additional complication in propensity score matching with this sample is at the other end of the welfare spectrum. While it appears that the community management committees were generally diligent in their duties to target only the neediest households, there appears to be some leakage of benefits to households that are relatively well off compared to other beneficiary households. This higher relative wealth is reflected by a low propensity score. But, households with a lower propensity score are much more likely to find a match since non-beneficiary households tend to have lower propensity scores. The inclusion of these relatively better off households in the analyses may still induce some of the wealth affect that propensity scoring was meant to avoid.

There is some speculation in the literature about possible endogeneity of HIV/AIDS in analyses of food security (Beegle, 2003). The conclusion that HIV/AIDS affects wealthier households disproportionately is supported by the Tanzania Commission for AIDS Indicator Survey (2008) and, in rural areas, the 2003 Kenya AIDS Indicator Survey. The use of propensity score techniques does not address endogeneity arising from HIV/AIDS-affectedness directly, but may do so indirectly by largely eliminating wealthier households from the analysis. Therefore, leakage of program benefits to wealthier households may introduce some degree of endogeneity to the models.

5.7: Internal Validity

Analyses of food aid interventions typically encounter two threats to internal validity: 1) difficulty in teasing out the effect of the food aid intervention from the effect of the

crisis that prompted the intervention, and 2) isolating the effects of the food aid intervention to the target population (Abdulai, Barrett and Hoddinott, 2004). This study is unique in that the crisis that prompted the intervention (HIV/AIDS-affectedness) is not generalized to the entire population as drought or flooding would be, but instead varies among households. In addition, the use of propensity score matching addresses the issue of isolating the analysis to a set of households with similar characteristics as those targeted.

However, propensity score matching does not directly address issues of endogeneity should it exist. The two key factors tested in the models are program participation and HIV/AIDS-affectedness and both are potentially endogenous.

The use of a difference-in-differences approach to evaluate changes in household goods and livestock, land ownership and access, and land under cultivation is effective in circumventing many of the endogeneity problems that often arise in such group comparisons under the assumption that the source of endogeneity is time invariant. Difference-in-differences estimates are especially effective when there is little attrition between study periods, the comparison group is very similar to the treatment group and the pre-treatment outcomes for the two groups are similar (Meyer, 1995). Since the outcomes were measured retrospectively there is no attrition between study periods and the propensity score matching creates a similar comparison group. Table 12 gives pre-treatment means used in seven outcome measures by beneficiary status among matched households. The table also gives the p-value for t-tests of differences in the group means. Only the group means for land leased out by households was significantly different before the food aid distributions began.

Table 12. Pre-treatment group means and significance levels for tests of group differences by household asset for propensity score matched households.

	Beneficiary	Non-Beneficiary	P-Value
Livestock (Ksh)	9,014	9,334	0.8432
Household Goods (Ksh)	15,417	14,727	0.6498
Total Goods and Livestock (Ksh)	24,431	24,061	0.8871
Land Owned (acres)	2.00	2.11	0.6242
Land Leased Out (acres)	0.13	0.01	0.0026
Land Rented In (acres)	0.10	0.14	0.5397
Land Under Cultivation (acres)	1.20	1.45	0.1252

n=385

For those models that employed difference-in-differences models, with the possible exception of the model of land leased out, it appears that endogeneity should not be a significant source of bias given Meyer's (1995) criteria. However, the models of labor employment and school attendance may still be subject to engogeneity. Propensity score matching restrains the analysis to households with similar observed characteristics, but there may still be some reason why some were chosen for participation and others were not. A potential exogenous factor driving selection into the program by Community Management Committees is social capital. If some households are more connected to the community than others, they may receive preferential treatment either because the CMC is more aware of their problems or more sympathetic to them. Social capital is an amorphous concept that is useful theoretically, but very difficult to measure empirically. A number of proxy variables were examined for use as an instrumental variable in the labor and school attendance models, including frequency of food purchases on credit and the community ranking of begging for food as an indicator of poverty. None of these measures were correlated with program participation but not outcomes in the matched dataset and were therefore not appropriate instrumental variables.

It is also possible that the CMCs disbursed food aid along familial lines. However, without any data on clan association or residential proximity to CMC members, no instrumental variables were available. All of the households surveyed resided in rural areas that are predominantly Luhya and may be assumed to be inhabited by ethnically Luhya persons. Therefore, it is unlikely that language barriers played a role in the distribution of benefits.

Household HIV/AIDS-affectedness may also be endogenous in the labor and school attendance models. Most of the speculation in the literature focuses on the role of household wealth in determining the likelihood of a household being HIV/AIDS-affected. As described above, the 2007 Kenya AIDS Indicator Survey found no evidence for significant differences in HIV prevalence in rural areas by wealth quintile. Also, the propensity score matching approach taken in these analyses equalized measures of wealth between treatment groups.

HIV/AIDS-affectedness may still be predicted by other household level factors such as attitudes towards women, attitudes towards sex or risk perception. A number of variables were examined for use as an instrumental variable in the matched dataset, but none of them met the criteria.

5.8: External Validity

The results of this study are informative in many respects but caution must be used in generalizing them to other settings or contexts. There are a number of factors that, while not unique to Busia District, must be taken into consideration.

Busia District is a densely populated rural area characterized by small land holdings. Therefore, these results reflect the situation in a land constrained rather than a labor constrained environment. In sparsely populated rural area, the effect of HIV/AIDS on household productivity may be far grater than it is in this population.

Busia District is also characterized by a relatively high prevalence of HIV. While lower than the Kenya national prevalence of 7.1 percent of adults age 15 to 65, Busia's prevalence of 5.4% (Republic of Kenya, 2009) is still high. In rural areas with much lower prevalence, households may be able to better absorb the shock of a chronically ill prime-age adult through appealing to community support systems. In areas of high HIV prevalence, those support systems may be over burdened and households may have to bear the burden alone.

The targeting criteria of the program coupled with the propensity score matching approach restricted the analysis to low income households. It is unclear what the effect of such a food aid intervention would be if wealthier households were included in the program. While it is unlikely that NGOs would target wealthy households for food aid, it is possible that a generalized distribution would include many non-low income households.

The impact survey was conducted at the end of the long rains (the main agricultural season) when it was already apparent that the rains had been insufficient to produce average maize yields. The prospective food shortage and/or price increase in staples may have affected individual's labor decisions. Since all agricultural households in a village faced the same climatic conditions it is unlikely that the drought affected the relative

labor employment of individuals in beneficiary and non-beneficiary households. However, their labor allocations may have shifted due to increased food insecurity.

The particulars of the program modalities must also be considered. Food aid beneficiaries were assured a monthly supply of staples with no definite cut-off date. This is very different than a one time distribution and becomes a integral part of a household's food security strategy. Also, households were targeted with multiple rations rather than individuals receiving a single ration. Other food aid schemes provide rations to ill individuals only and sometimes only individuals on ARV therapy. It is not necessarily possible to predict the impact of other program designs from evidence from this study.

5.9: Programming Implications

The results from this study suggest that food aid provision to HIV/AIDS-affected smallholder households in Sub-Saharan Africa can be effective in maintaining household productivity. However, the scope of the Nutrition and Care of People Affected by HIV/AIDS pilot project in Busia District was beyond the capacity of almost any organization other than the World Food Programme and even the WFP would be sorely pressed to replicate such a program on a national level. There are some lessons to be drawn from this experience though.

The data demonstrate that the critical period in which household livelihoods are severely eroded in this population is during the illness of a prime-age adult. Food aid rations targeted to HIV infected persons presenting to local health facilities and/or rations targeted to participants in community health support networks appear to be an effective means of reaching households during their most difficult time. In fact, WFP/Kenya

changed the targeting structure of the Nutrition and Care of People Affected by HIV/AIDS to provide food aid to persons presenting at hospital. So while clinical targeting is nothing new, this study provides new evidence to support its effectiveness.

The finding of a change in labor allocation to more off-farm employment for beneficiaries of the food aid offers insights into making HIV/AIDS-affected households more productive and more secure in their livelihoods. Micro-financing coupled to food aid disbursements may allow beneficiaries the chance to break through entry barriers to off-farm opportunities that they would otherwise not have been able to exploit. WFP/Kenya used the monthly food aid disbursements to provide health education to recipients and these lectures and demonstrations were regarded by field staff as effective. Information about livelihood diversification and small business management could also be included in the monthly disbursements.

Much of the literature on HIV/AIDS and food security focuses on the role of smallholder agriculture. The findings here show that rather than allowing household agricultural production to atrophy during the period of prime-age illness, households struggle to maintain their productivity by increasing land under cultivation, decreasing off-farm labor while maintaining levels of farm labor, and retaining livestock while selling household goods. These findings may be characteristic of the land constrained/labor abundant environment in Busia District, but nonetheless suggest that agricultural support and extension policies can play important roles in mitigating the effects of prime-age illness.

5.10: Future Research

It is unlikely that the Nutrition and Care of People Affected by HIV/AIDS pilot project will ever be replicated again, but if it is, a rigorous panel study of the sort University of Michigan researchers have conducted to examine the effects of HIV/AIDS on food security would be very informative. That calls for greater cooperation and coordination between international NGOs and academic institutions to take advantage of the opportunities that humanitarian programming affords. All too often programming and academic research are seen as separate fields with divergent objectives where, in truth, they share many common interests and should be complimentary. Stronger partnerships between NGOs and academic institutions will allow each to exploit the strengths of the other to simultaneously improve the provision of services and understand the dynamics behind the issues being addressed.

In reviewing the literature for evidence of a shift in labor allocation following the provision of food aid it became apparent that there is a dearth of empirical evidence on this subject. The results from this study corroborate some of the findings that Abulai, Barrett and Hoddinott (2004) found in Ethiopia showing that the provision of food aid increases labor employment by recipients rather than having a disincentive effect as often theorized. Recent thinking that HIV/AIDS is a food security crisis necessitating a humanitarian response begs the question of how beneficiary households would react in labor allocation and employment outside the context of a generalized crisis such as crop failure or civil unrest. An understanding of how poor households shift labor allocations and livelihood strategies with income transfers could lead to more effective targeting and livelihoods programming that dovetails with food aid provision. Such evidence could

also bring to light how the very poor structure their livelihood strategies and inform an array of anti-poverty policies.

Much of the thinking behind providing food to HIV/AIDS-affected households centers on improving the health of chronically ill prime-age adults through improved nutrition. This study did not include any anthropometric measures for chronically ill adults. Time series data on body mass, physical activity and survival for chronically ill adults receiving food aid could provide valuable clinical insights. Contextual data on household livelihoods and demographics would further serve to elucidate how food aid can be effective in improving the quality of life for individuals infected with HIV and their households.

5.11: Conclusion

Despite some weaknesses in these data, the results do shed light upon the HIV/AIDS-food security debate. There is evidence to support the HIV/AIDS-food security paradigm as presented in Chapter 3 but not in its entirety. The paradigm may best be thought of as a generalization capturing all possible cause-effect pathways rather than a specific set of experiences that all HIV/AIDS-affected households share. Where the HIV/AIDS-food security paradigm fails by this analysis is in its lack of flexibility to allow for the emergence of alternative livelihood strategies in response to changing labor and asset levels brought on by prime-age illness or death.

Speculation about the impacts of food aid on HIV/AIDS-affected households generally regards the livelihood strategies of households as fixed and that the provision of food aid (or some other intervention) will allow the household to resume its former

livelihood strategies. Such thinking simplifies the jobs of policy planners and makes the case to funding agencies much easier, but misses opportunities for substantial impact. Policies designed to improve the lives of people affected by HIV/AIDS must consider the universe of opportunities that are available to those persons and anticipate shifts in behavior as a result of enacted programs and policies.

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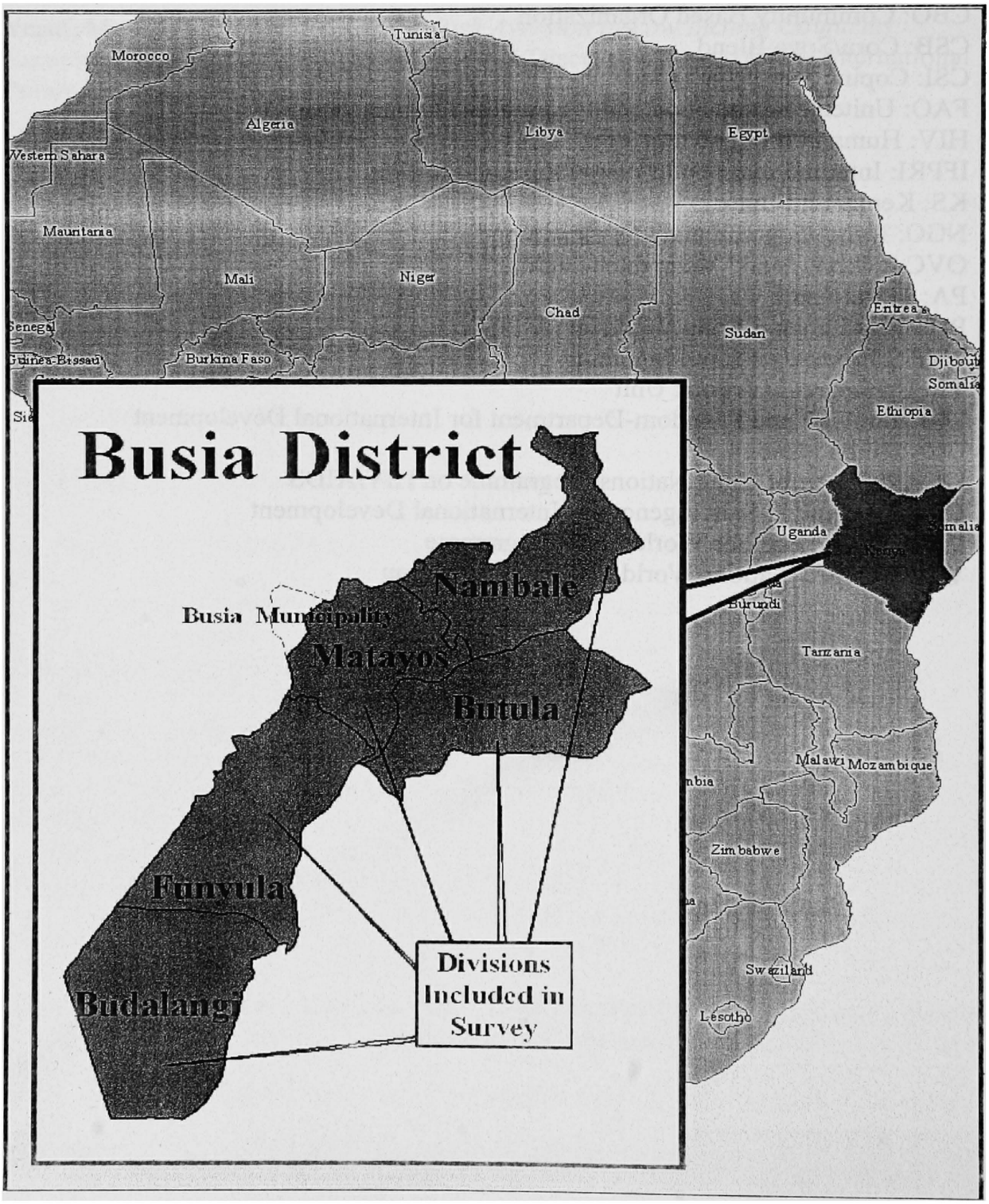
Appendix 1: Acronyms

AIDS: Acquired Immune Deficiency Syndrome
ARV: Antiretroviral
CBO: Community Based Organization
CSB: Corn/Soya Blend
CSI: Coping Strategies Index
FAO: United Nations Food and Agriculture Organization
HIV: Human Immunodeficiency Virus
IFPRI: International Food Policy Research Institute
KS: Kenya Shillings
NGO: Non-Governmental Organization
OVC: Orphans and Vulnerable Children
PA: Prime-Age
PLWHA: Person Living With HIV/AIDS
PSM: Propensity Score Matching
TLU: Tropical Livestock Unit
UK-DFID: United Kingdom-Department for International Development
UN: United Nations
UNAIDS: Joint United Nations Programme on HIV/AIDS
USAID: United States Agency for International Development
WFP: United Nations World Food Programme
WHO: United Nations World Health Organization

Appendix 2: Survey Area



Appendix 3: Village Characteristics

		N		
			PS Matched	
District	Village	Total	Beneficiaries	Non-Beneficiaries
Budalangi				
	Mumoni	30	9	5
	Budonga	30	11	5
	Napara	30	5	8
	Ukunda	30	6	6
	Nambaine	30	10	6
	Mundere	30	5	4
	Lugare	30	8	3
	Khusyobuya	4	2	0
	Khunambusi	13	9	1
	Khulugingo	9	4	3
	Khusyoba	4	2	1
	Nadero	30	14	4
	Mwangalalo	30	11	4
Butula				
	Mukhuyu	30	6	5
	Igulla East	30	8	5
	Kongolo	30	6	4
	Bukati	30	4	2
	Nyaluanda	29	12	5
Funyula				
	Siwongo	30	11	5
	Masanyi	30	8	7
	Mundaya	30	4	3
	Mudoba	30	6	4
	Muberi	30	8	4
	Sirekeresi	30	6	4
	Bukhola	30	7	6
	Mumbao	29	6	5
	Buloma	30	7	5
	Magogongo	30	16	6
Matayos				
	Nakhomake	30	9	3
	Ebumakanda	30	2	2
	Bukalama	30	10	4
	Khurale	30	7	5
Nambale				
	Kisoko	30	11	1

Appendix3: Continued

District	Village	Percent						
		Beneficiary	Below Poverty[1]	Any Prime-Age		Female Head	Orphans Under 15	Children Enrolled[2]
				Illness	Death			
Budalangi								
	Mumoni	33.3	73.3	33.3	3.3	46.7	14.0	91.7
	Budonga	40.0	40.0	13.3	13.3	46.7	13.9	97.6
	Napara	16.7	13.3	16.7	13.3	43.3	25.4	94.7
	Ukunda	20.0	63.3	20.0	13.3	43.3	17.6	96.6
	Nambaine	36.7	40.0	30.0	3.3	36.7	17.0	93.3
	Mundere	20.0	60.0	30.0	3.3	50.0	44.1	100.0
	Lugare	30.0	46.7	36.7	6.7	46.7	31.9	94.0
	Khusyobuya	50.0	75.0	0.0	50.0	25.0	16.7	100.0
	Khunambusi	69.2	53.8	15.4	15.4	76.9	11.1	100.0
	Khulugingo	44.4	33.3	22.2	33.3	33.3	16.0	100.0
	Khusyoba	50.0	0.0	0.0	0.0	0.0	17.6	100.0
	Nadero	50.0	36.7	20.0	6.7	33.3	17.1	83.3
	Mwangalalo	40.0	5.0	50.0	0.0	43.3	34.9	100.0
Butula								
	Mukhuyu	23.3	66.7	30.0	3.3	36.7	18.1	91.7
	Igulla East	30.0	63.3	10.0	0.0	50.0	37.1	90.5
	Kongolo	20.0	70.0	46.7	6.7	26.7	10.5	87.5
	Bukati	13.3	36.7	23.3	0.0	26.7	9.7	91.7
	Nyaluanda	43.3	65.5	23.3	10.0	41.4	22.8	88.5
Funyula								
	Siwongo	43.3	63.3	10.0	10.0	46.7	29.5	96.2
	Masanyi	26.7	60.0	26.7	13.3	30.0	18.7	97.6
	Mundaya	13.3	46.7	30.0	13.3	53.3	12.9	97.8
	Mudoba	20.0	63.3	23.3	0.0	23.3	27.7	93.3
	Muberi	33.3	53.3	46.7	13.3	63.3	12.9	97.6
	Sirekeresi	20.0	73.3	40.0	10.0	46.7	19.0	97.7
	Bukhola	23.3	46.7	23.3	3.3	33.3	4.8	95.7
	Mumbao	23.3	69.0	16.7	3.3	27.6	12.5	97.5
	Buloma	23.3	46.7	23.3	10.0	26.7	15.8	100.0
	Magogongo	63.3	60.0	26.7	6.7	53.3	41.4	94.7
Matayos								
	Nakhomake	40.0	36.7	27.7	6.7	40.0	8.9	86.4
	Ebumakanda	10.0	50.0	33.3	3.3	20.0	21.2	94.2
	Bukalama	43.3	36.7	30.0	13.3	43.3	15.1	88.1
	Khurale	30.0	53.3	40.0	3.3	43.3	28.5	88.5
Nambale								
	Kisoko	40.0	60.0	36.7	10.0	53.0	26.5	77.6

1. Percentage of households below the food-poor poverty line
2. Percentage of children 6 to 12 years of age reporting any school attendance

Appendix 3: Continued

District	Village	Mean Land Holding[1]	Mean Total Assets[2]
Budalangi			
	Mumoni	1.3	32,410
	Budonga	1.4	34,147
	Napara	1.0	34,777
	Ukunda	1.0	36,570
	Nambaine	2.7	31,263
	Mundere	2.6	40,893
	Lugare	1.6	36,730
	Khusyobuya	0.9	45,325
	Khunambusi	1.5	29,569
	Khulugingo	1.7	56,900
	Khusyoba	1.6	48,850
	Nadero	1.7	59,840
	Mwangalalo	1.5	42,280
Butula			
	Mukhuyu	2.1	43,080
	Igulla East	2.0	43,810
	Kongolo	2.0	45,000
	Bukati	2.8	51,747
	Nyaluanda	2.6	25,793
Funyula			
	Siwongo	1.7	21,787
	Masanyi	3.8	43,833
	Mundaya	3.2	37,520
	Mudoba	1.6	43,327
	Muberi	3.1	38,057
	Sirekeresi	2.8	39,643
	Bukhola	1.6	43,060
	Mumbao	2.2	33,537
	Buloma	2.7	61,360
	Magogongo	2.2	26,310
Matayos			
	Nakhomake	2.7	59,287
	Ebumakanda	2.8	44,740
	Bukalama	3.4	43,817
	Khurale	2.3	43,217
Nambale			
	Kisoko	3.3	31,343

1. Land holdings in acres at the time of the impact survey
2. Value of household goods and livestock at time of impact survey in Kenya Shillings

Appendix 4: Adjusted Regression Analysis

The use of propensity score matching to balance treatment groups was employed in the main analysis due to the wide disparity between beneficiary households and non-beneficiary households with regard to some covariates; especially measures of wealth. It is informative to examine what the results of the regression models employed in the propensity score matching analysis would be if all households and prime-age adults were included in the data with predictors of program participation included in the models. While models from both approaches included covariates other than program participation, prime-age illness and death and their interactions, the analysis using all households and including predictors of program participation will be referred to here as the "adjusted regression analysis" for sake of abbreviation.

A4.1: Statistical Methods

The adjusted regression analyses employed all 898 household records and all 5,131 prime-age individual records from the impact survey. The models were not weighted by propensity score nor was the propensity score employed in any other manner.

The models employed in this analysis use all of the same variables as the models used in the propensity score matched analysis with the addition of five variables that are predictive of program participation. Not all 28 variables used in creating the propensity scores were included in this analysis in order to preserve degrees of freedom. The five variables included in this analysis were the only statistically significant predictors among

the 28 variables used to create the propensity scores. The five variables used to adjust for program participation include:

- If the household head is married (Y/N): households with married heads were less likely to participate in the program. Marriage may be indicative of the relative wealth and status of the household head and may also reflect the ability of the household to attract and retain members.
- Total daily expenditures divided by total household adult equivalents: this is a proxy indicator of current household consumption measured in Kenya Shillings. Total daily expenditure includes all cash expenditures and consumption of own produce. It is divided by the total household adult equivalents to make expenditures comparable across households regardless of age/sex composition.
- Number of type 2 orphans: Community Management Committees were instructed to target households affected by HIV/AIDS. One indicator of need used by many CMCs was the number of orphans in the household without either a mother or father.
- The dependency ratio calculated with adult equivalents: a measure of the relative burden on prime-age adult members of the household to provide for all members. Adult equivalents were used in the calculation to make households comparable regardless of age/sex composition.
- Proportion of household expenditures for food: this variable includes the value of both purchased food and own produce and expressed in Kenya Shillings. Households will meet their food needs before other needs. Thus, the larger the proportion of total expenditures devoted to food, the greater the deprivation.

All models included dummy variables for program participation, presence of a prime-age ill adult, death of any prime-age adult in the household in the previous two years and interaction terms for program participation and prime-age illness and death. In addition to these variables, any other covariates that were included in the propensity score matched regression analyses were included in the models to facilitate the comparison of results (see section 4.10.8).

An obvious drawback to this approach is the possibility of collinearity between the predictors of program participation and the variable for program participation. The PROC MIXED procedure in SAS 9.1 was used for the adjusted regression analysis as it had in the matched analysis in order to account for sample clustering. However, PROC MIXED presents problems for running regression diagnostics and there is no readily available test for collinearity in the procedure. Therefore, PROC REG was used to test for collinearity in the adjusted models even though it does not allow for the intra-class correlations inherent in clustered data. The use of PROC REG found that none of the variance inflation factors were above 10; from which it is assumed that collinearity is not a problem in these results.

A4.2: Asset Change

Table A4.1 presents the results of the difference-in-differences analysis of asset retention. A comparison of these results with those presented in Table 6 shows several differences. Most notably, the finding in the propensity score matched analysis that there is a statistically significant reduction in total household goods and livestock associated with the presence of an ill prime-age member and a positive effect of program

participation on asset retention among households with an ill prime-age member (although this effect was not statistically significant). The results for total goods and livestock from the adjusted regression analysis are not significant for prime-age illness and the estimate changed sign (Table A4, row 3, columns 3 and 4). These results may reflect that wealthier households are more likely to have an ill prime-age member and that poorer households are more likely to participate in the program.

Table A4.1: Estimates and significance levels for each of the five key explanatory variables predicting change in household asset levels as valued in Kenya Shillings for all households.

	Program Participation		Prime-Age Illness		PA Illness*Program		Prime-Age Death		PA Death*Program	
Assets	Estimate	P-Value	Estimate	P-Value	Estimate	P-Value	Estimate	P-Value	Estimate	P-Value
Total Livestock[1]	-1168	0.2839	1109	0.2593	-2177	0.2080	2375	0.2197	-3552	0.1956
Total Household Goods[2]	449	0.4679	-868	0.1240	791	0.4223	-235	0.8305	-1397	0.3700
Livestock and Goods[3]	-1007	0.4538	746	0.5401	-1439	0.4996	1732	0.4677	-4392	0.1942
Land Owned[4]	0.0040	0.8736	-0.0073	0.7527	-0.0521	0.1998	-0.0082	0.8565	0.0334	0.6035
Land Leased Out[5]	-0.0282	0.0900	0.0041	0.7836	-0.0386	0.1458	-0.0001	0.9971	0.0085	0.8396
Land Rented In[6]	0.0022	0.8765	0.0375	0.0037	-0.0076	0.7364	0.0367	0.1465	-0.0378	0.2921

1. Model also includes value of livestock in year prior, acreage owned in 2004, if head is married, total household expenditures per day per adult equivalent, number of type 2 orphans in household, dependency ratio and proportion of budget devoted to food. (n=898)
2. Model also includes value of household goods in 2003, female headship, acreage owned in 2004, acreage cultivated in 2004, if household head is married, total household daily expenditures per adult equivalent, number of type 2 orphans in household, dependency ratio and proportion of budget devoted to food. (n=898)
3. Model also includes value of goods and livestock in 2003, female headship, cash expenditures per day, acreage cultivated in 2004, if household head is married, total household daily expenditures per adult equivalent, number of type 2 orphans in household, dependency ratio and proportion of budget devoted to food. (n=898)
4. Model also includes acreage owned in 2003, if household head is married, total household daily expenditures per adult equivalent, number of type 2 orphans in household, dependency ratio and proportion of budget devoted to food. (n=898)
5. Model also includes acreage leased out in 2003, acreage owned in 2004, if household head is married, total household daily expenditures per adult equivalent, number of type 2 orphans in household, dependency ratio and proportion of budget devoted to food. (n=898)
6. Model also includes acreage rented in in 2003, acreage owned in 2004, if household head is married, total household daily expenditures per adult equivalent, number of type 2 orphans in household, dependency ratio and proportion of budget devoted to food. (n=898)

For total household goods, the directions of the estimates are all the same as in the propensity score matched analysis. However, the estimates are smaller (with the exception of the effect of a prime-age death) and the p-values are larger. While the effects of prime-age illness and prime-age illness by program participation are marginally significant in the matched analysis (0.0515 and 0.0616 respectively), they are above the 0.1 level for both effects in this analysis (Table A4.1, row 2, columns 3-6).

The results for land ownership, lease and rental also show some differences. Many of the coefficients change direction, but given that there were few statistically significant results for land ownership, lease and rental in the matched analysis, this is not surprising. There is a remarkable amount of agreement between the analytical results for land rented in by households. While the sign of the coefficient for program participation changed, the signs for prime-age illness and death and their interaction terms remained the same (Table A4.1, row 6, columns 3-10). The finding that there was a statistically significant increase in land rented in by households with an ill prime-age member was consistent across both approaches except that the estimate from the matched analysis was almost twice that from the adjusted regression. Also, while the matched analysis found a statistically significant increase in land rented in by households that had experienced the death of a prime-age adult, the estimate from the adjusted regression was almost half and not statistically significant (Table A4.1, row 6, columns 7-8).

A4.3: Prime-Age Labor Employment

Results from the matched analysis and the adjusted regression were remarkably similar in the analysis of prime-age labor employment. Table 8 gives the results for the

propensity score matched analysis and the results from the adjusted regression analysis are presented in Table A4.2. No statistically significant associations were found using either approach for farm labor and the signs of the coefficients were the same as from the matched analysis.

The results from the adjusted regression analysis for off-farm labor reach different conclusions than the matched analysis. While the matched analysis found significant associations between program participation, prime-age illness and their interaction for women but not men, the adjusted analysis found associations for men but not women for program participation and prime-age illness (but not their interaction) (Table A4.2, rows 4-5, columns 1-4). The adjusted analysis also found a significant association between prime-age death and a reduction in men's off-farm labor hours that was not evident in the matched analysis (Table A4.2, row 4, columns 7-8). The two approaches did agree in the findings that program participation boosted off-farm labor hours for both sexes combined and that any prime-age illness in the household reduced the off-farm labor hours of both sexes. However, the coefficients from the adjusted analysis were smaller than those from the matched analysis.

The results for all income generating labor combined from the adjusted regressions are much the same as the matched results, but with lower magnitude estimates (bias to 0). The adjusted regression found the same statistically significant decrease in prime-age women's income generating activities associated with any household prime-age illness as did the matched analysis, but the coefficient was only a third the magnitude as that for the matched analysis (Table A4.2, row 8, columns 3-4). The adjusted analysis found a statistically significant decrease in men's income generating labor hours associated with

any prime-age illness that was not found in the matched analysis (Table A4.2, row 7, columns 3-4).

No statistically significant results were found for care-giving in the adjusted regression analysis just as none were found in the matched analysis (Table A4.2, rows 10-12).

Table A4.2: Estimates and significance levels for each of the five key explanatory variables predicting adult labor and land under cultivation for all households.

		Beneficiary Household		Any PA Illness		Beneficiary by Any PA Illness		Any PA Death		Beneficiary by Any PA Death	
Labor	**Gender**	Estimate	P-Value	Estimate	P-Value	Estimate	P-Value	Estimate	P-Value	Estimate	P-Value
Farm Labor[1]											
	PA Men	-0.2694	0.3635	0.1939	0.3753	-0.6574	0.1328	0.3688	0.4548	-0.7998	0.3882
	PA Women	-0.0343	0.8499	-0.0053	0.9685	-0.1945	0.4401	0.2304	0.4072	0.3426	0.4146
	All PA Adults	-0.0697	0.6933	0.0603	0.6518	-0.3172	0.2121	0.2424	0.3956	0.1372	0.7594
Off Farm Labor[1]											
	PA Men	1.3140	0.0069	-0.7186	0.0449	0.6238	0.3827	-2.1607	0.0076	2.7742	0.0675
	PA Women	0.1608	0.5053	-0.3230	0.0695	0.2229	0.5053	0.0293	0.9365	-0.6840	0.2194
	All PA Adults	0.6630	0.0100	-0.4680	0.0148	0.3320	0.3646	-0.8887	0.0305	0.5052	0.4354
Income Generating Labor[1]											
	PA Men	0.7524	0.1560	-0.9119	0.0200	0.1977	0.8002	-1.1334	0.1989	2.0212	0.2237
	PA Women	0.1345	0.6660	-0.5340	0.0207	0.1797	0.6789	0.5662	0.2397	-0.2958	0.6834
	All PA Adults	0.4376	0.1540	-0.7239	0.0018	0.2484	0.5724	-0.2183	0.6582	0.5501	0.4788
Care-Giving[2]											
	PA Men	-0.1226	0.2306	0.1197	0.1410	-0.0881	0.5602	-0.0484	0.7752	-0.1508	0.6462
	PA Women	-0.0319	0.8108	0.0822	0.4355	0.0736	0.6919	-0.3457	0.0933	0.3218	0.3020
	All PA Adults	-0.0685	0.4744	0.0930	0.2341	-0.0059	0.9662	-0.1510	0.3320	0.0991	0.6852
Land Under Cultivation[3]		0.0150	0.7135	0.0787	0.0339	-0.1318	0.0434	-0.0285	0.6950	-0.0829	0.4214

1. Models also include age, if household head is married, total household daily expenditures per adult equivalent, number of type 2 orphans in household, dependency ratio and proportion of budget devoted to food. Models for men and women combined also include a variable for gender. (n=712 men, 892 women, 1604 combined)

2. In addition to variables included in 1 above, models include a variable for any ill child and for any ill elder in the household.

3. Model also includes acreage cultivated in 2003, acreage owned in 2004, if household head is married, total household daily expenditures per adult equivalent, number of type 2 orphans in household, dependency ratio and proportion of budget devoted to food. (n=898)

The results for change in land under cultivation are similar between the two approaches with the adjusted regression coefficients smaller than that of the matched analysis. The adjusted regression found that households hosting an ill prime-age adult increased the area of land under cultivation, unless they were program participants, in which case they reduced the area under cultivation (Table A4.2, row 13, columns 3-6). While the estimate for any prime-age illness was 0.1833 acres in the matched analysis (p=0.0349) it was only 0.0787 in the adjusted regression (p=0.0339). The estimate for any prime-age illness by program participation was -0.237 acres in the matched analysis (p=0.0279) and -0.1318 acres in the adjusted regression (p=0.0434).

A4.4: School Attendance

Table 11 presents the results of the propensity score matched analysis of school attendance while the results of the adjusted regression analysis are given in Table A4.3. There were no statistically significant results for primary school attendance in either analysis, however many of the signs of the coefficients did change in the adjusted analysis. High school age boys living in beneficiary households did attend significantly more hours of schooling in both analyses, but the estimate of the adjusted analysis was more than a half hour less per day than that of the matched analysis (Table A4.3, row 4, columns 1-2). The greater impact on high school boys attendance in the matched analysis carried over into the model of attendance by both sexes of high school age with a statistically significant increase found. However, the result from the adjusted analysis for both sexes of high school age was not significant (Table A4.3, row 6, columns 1-2). The increase in high school age boys' attendance associated with program participation

carried over into the estimate of all boys' school attendance in both analyses with a slightly lower estimate from the adjusted analysis.

The adjusted analysis did find a statistically significant decrease in school attendance for high school age girls who live in a beneficiary household hosting an ill prime-age adult (Table A4.3, row 5, columns 5-6). The adjusted analysis found that high school age girls living in a beneficiary household with an ill prime-age adult spend more than two hours less in school per day compared to girls from non-beneficiary households that did not experience any prime-age illness or death. The estimate from the matched analysis was less than an hour and a half, but it was not significant. The difference between these two results may be due to the relative greater deprivation of beneficiary households and the inability of poor households to afford school fees or perceive an advantage to educating girls.

A4.5: Discussion

The results from the propensity score matched regression analyses and the results from the regression models adjusted for program participation find many of the same associations. The analyses of labor and school attendance are most similar while the results for change in assets show some differences. The most notable difference between the two approaches is a reduction in the magnitude of many of the coefficients from the adjusted regression analyses. The bias towards zero in the adjusted regression estimates likely reflect that wealthier households are more likely to be HIV/AIDS-affected while poorer households are more likely to participate in the program.

Table A4.3: Estimates and significance levels for each of the five key explanatory variables predicting school attendance by children 6 to 17 years of age for all households.

	Beneficiary Household		Any PA Illness		Beneficiary by Any PA Illness		Any PA Death		Beneficiary by Any PA Death	
	Estimate	P-Value	Estimate	P-Value	Estimate	P-Value	Estimate	P-Value	Estimate	P-Value
Primary School[1]										
Boys	0.1334	0.6099	0.0454	0.8572	-0.0308	0.9387	0.2502	0.6380	-0.3315	0.6238
Girls	-0.0939	0.7261	-0.0377	0.8703	0.1059	0.7944	0.1369	0.7742	-1.0898	0.1082
All	0.0426	0.8347	-0.0373	0.8412	0.0953	0.7619	0.1976	0.6088	-0.5924	0.2593
High School[1]										
Boys	1.1152	0.0114	-0.1851	0.6963	0.4044	0.5764	0.8534	0.2973	0.0425	0.9692
Girls	-0.1920	0.6801	0.3179	0.4807	-2.2274	0.0023	0.7132	0.4098	-0.7212	0.5164
All	0.5560	0.0980	0.0206	0.9525	-0.7909	0.1462	0.8528	0.1745	-0.3502	0.6750
All Grades[2]										
Boys	0.6150	0.0176	0.1041	0.6915	0.1673	0.6838	0.6101	0.2266	-0.4565	0.4868
Girls	-0.2465	0.3565	0.1009	0.6728	-0.9347	0.0226	0.7477	0.1278	-1.1856	0.0720
All	0.3212	0.1217	0.0479	0.8082	-0.1921	0.5566	0.6921	0.0799	-0.7825	0.1385

1. Models also include age, if household head is married, total household daily expenditures per adult equivalent, number of type 2 orphans in household, dependency ratio and proportion of budget devoted to food. Models for boys and girls combined also include a variable for gender. (n=644 primary boys, 722 primary girls, 1366 primary children combined, 413 high school boys, 385 high school girls, 798 high school children combined)

2. In addition to the variables included in 1 above, models also include an indicator if the child is primary school age and eligible for free tuition. (n=1057 boys, 1107 girls, 2164 combined)

Appendix 5: Observed/Expected Analysis

The analysis presented in the body of this paper only uses the impact data. Ideally, the study would have employed a panel data approach and measure the same households at baseline and at follow-up. Since the households sampled for the impact study were not the same as those sampled at baseline, it is not possible to examine asset, labor and school attendance levels in the complete absence of the program.

An analytical approach that employs information from the baseline data is presented here. Households from the baseline survey were matched to the subset of households used in the regression analyses as presented in the body of this text. Regression analysis was performed to estimate outcomes of interest in the baseline data and then those coefficients were applied to the impact data to calculate expected outcomes. The difference between the observed and expected outcomes for the impact data was compared across groups using non-parametric tests.

A5.1 Statistical Methods

Households from the baseline study were matched to those 385 households employed in the analysis of the impact data. Propensity scores were calculated using PROC GLIMMIX in SAS version 9.1. Since none of the villages sampled at baseline were sampled again in the impact study, a random effect for village was not included. Rather, a random effect for district was included as it was found to be statistically significant.

Variables included in the propensity score logistic regression for baseline matching included all variables that were used to calculate the propensity score in the analysis of the impact data with the exception of educational level of the household head as education of household members was not included in the baseline questionnaire.

A nearest neighbor matching algorithm developed by Coca-Perraillion (2007) was employed with a caliper of 0.01 allowing for replacement. Ultimately, of the 385 matched households used in the analysis of the impact data, 379 were matched to 225 households in the baseline study.

Using the RSQUARE option in PROC REG a set of variables were identified that maximized model fit when predicting the outcomes of interest. Estimation of covariate coefficients for the baseline data was performed using PROC MIXED with a random effect for village clustering in the case of asset levels and land under cultivation and a random effect for household clustering when predicting labor employment and school attendance.

A difference-in differences approach was not used in the analysis of asset levels and land under cultivation. Rather, asset levels and land under cultivation at time of interview were predicted directly with the inclusion of levels of those assets or land under cultivation the year prior in the model.

The coefficients estimated from the 225 matched households from the baseline survey data were applied to the 379 matched households from the impact survey data to calculate expected outcomes. The difference of the observed and expected values was tested between groups (prime-age illness and program participation) using the Wilcoxon rank sum scores method. The null hypothesis is that households that did not receive the

food aid should perform as expected while households receiving food aid should perform better than expected in regards to asset levels, labor employment, land under cultivation and school attendance.

Results from the regression analyses using propensity score matched households demonstrated that some aspects of the HIV/AIDS-food security paradigm were evident among households hosting a chronically ill prime-age adult. The analysis presented here examines the cross effects of prime-age morbidity and program participation on the outcomes of interest.

A5.2 Results

Table A5.1 presents the results for household assets by program participation and prime-age illness. Both beneficiary and non-beneficiary households performed more poorly than expected with regards to total household goods with the presence of a chronically ill prime-age adult. There is not a statistically significant difference between groups in observed minus expected values of livestock and total livestock and household goods by prime-age morbidity using this approach nor is there evidence for a program effect on such holdings.

While the difference-in-differences approach did not find any significant effect of prime-age morbidity on land owned, this analysis found that both beneficiary and non-beneficiary households that were hosting a prime-age ill adult had lower land holdings than expected (however the result was significant at the 0.1 level only for non-beneficiary households). Program participation did not affect expected land holdings.

Table A5.1 Nonparametric test results comparing median differences between observed and expected values of asset levels for beneficiary and non-beneficiary households by presence off an ill prime-age adult.

	Non-Beneficiary Households			Beneficiary Households			Wilcoxon P-Value	
	Median Difference			Median Difference				
	No Ill PA Adult	Any Ill PA Adult	Wilcoxon P-Value	No Ill PA Adult	Any Ill PA Adult	Wilcoxon P-Value	No Ill PA Adult	Any Ill PA Adult
Assets								
Total Goods	787.74	-745.59	0.0279	573.41	-1223.60	0.0012	0.4169	0.3250
Total Livestock	1704.76	0.00	0.3533	2233.39	1840.08	0.3410	0.4289	0.2767
Total Goods and Livestock	2224.58	580.55	0.2514	4616.02	308.93	0.0757	0.2641	0.4908
Land Owned	-0.1298	-0.2107	0.0885	-0.1103	-0.1749	0.0383	0.3672	0.3918

Table A5.2 gives the results for labor employment. Men in beneficiary households with an ill prime-age adult spent more time in farm labor than expected compared to men living in beneficiary households without an ill prime-age adult. In the comparison between beneficiary and non-beneficiary households stratified by presence of an ill prime-age adult, men living in beneficiary households spent more time in farm labor than expected. Women showed no difference in expected farm labor by either presence of an ill prime-age adult or program participation. All prime-age adults living in non-beneficiary households with an ill prime-age adult spent more time in off-farm labor than expected, but this was not true for beneficiary households and there was no apparent impact of program participation on off-farm labor in this analysis.

Total productive labor by men, women and both was higher than expected among prime-adults living in a household with a chronically ill prime-age adult except for women in beneficiary households. However, the result for men in non-beneficiary households was significant at the 0.1 level only. Although not apparent from Table A5.2, women living in beneficiary households without an ill prime-age adult performed more productive labor than expected compared to women living in non-beneficiary households without an ill prime-age adult (this result is marginally significant with a p-value=0.0505).

Not surprisingly, men, women, and both, living in households with a prime-age ill adult spent more time than expected in care-giving compared to those in households without an ill prime-age adult (except for women in beneficiary households). What is interesting to note is that men, women, and all prime-age adults in beneficiary households hosting a chronically ill prime-age adult devoted significantly less time than expected to

care-giving than those in non-beneficiary households. Both prime-age men and women living in beneficiary households without an ill prime-age adult spent less time than expected in care-giving than those living in non-beneficiary households.

Non-beneficiary households hosting a chronically ill prime-age adult had less land under cultivation than expected while beneficiary households with an ill prime-age adult had as much land under cultivation as expected. Among households with an ill prime-age adult, beneficiary households had more land under cultivation than expected compared to non-beneficiary households, but this apparent improvement did not extend to households without an ill prime-age adult.

Table A5.2 Nonparametric test results comparing median differences between observed and expected values of prime-age labor hours for beneficiary and non-beneficiary households by presence off an ill prime-age adult.

	Non-Beneficiary Households			Beneficiary Households			Wilcoxon P-Value	
	Median Difference			Median Difference				
	No Ill PA Adult	Any Ill PA Adult	Wilcoxon P-Value	No Ill PA Adult	Any Ill PA Adult	Wilcoxon P-Value	No Ill PA Adult	Any Ill PA Adult
Farm Labor								
Men	-0.5198	-0.0644	0.2776	0.4094	0.9388	0.0286	0.0221	0.0082
Women	0.0502	0.3682	0.1323	-0.1044	0	0.3484	0.3532	0.2989
Men and Women	-0.0298	0.0478	0.1846	0.2036	0.2053	0.1140	0.0904	0.2216
Off-Farm Labor								
Men	0.4674	1.0111	0.1063	0.2929	0.5665	0.4254	0.2787	0.2746
Women	0.4467	0.4139	0.1702	0.7375	0.8576	0.1123	0.1699	0.1725
Men and Women	0.5512	0.7889	0.0284	0.6348	0.7859	0.3245	0.1440	0.2565
Total Productive Labor								
Men	0.0000	2.3834	0.0869	0.5041	2.2032	0.0211	0.4422	0.4262
Women	-4.0000	-4.0000	0.0191	-4.0000	-4.0000	0.4414	0.0505	0.3091
Men and Women	0.3179	1.4322	0.0226	0.7215	0.9900	0.0306	0.4025	0.3729
Care-Giving								
Men	0.0372	1.4023	<0.0001	0.0000	0.6410	<0.0001	0.1734	<0.0001
Women	0.0442	0.1685	0.0258	0.0587	0.0621	0.4628	0.1290	0.0411
Men and Women	0.0508	0.1753	0.0746	0.0000	0.0000	0.0355	0.0199	0.0004
Land Under Cultivation	-0.8421	-1.4175	0.0012	-0.9639	-1.0000	0.1234	0.3134	0.0139

Table A5.3 gives the results for school participation. With the notable exception of high school age girls, children living in households hosting an ill prime-age adult spent less time in school than expected compared to children living in households without an ill prime-age adult. This is true of both beneficiary and non-beneficiary households. While there was no significant effect of prime-age illness for high school age girls in non-beneficiary households, high school age girls living in beneficiary households spent more time than expected in school than those living in a household without an ill prime-age adult.

High school age boys and all girls living in non-beneficiary households without an ill prime-age adult spent more time in school than similar children living in beneficiary households without an ill prime-age adult, although these finding were significant at the 0.1 level only. High school age children and all children living in beneficiary households with an ill prime-age adult spent more time in school than expected compared to similar children living in non-beneficiary households with an ill prime-age adult.

Table A5.3 Nonparametric test results comparing median differences between observed and expected values of school attendance hours for beneficiary and non-beneficiary households by presence off an ill prime-age adult.

	Non-Beneficiary Households			Beneficiary Households			Wilcoxon P-Value	
	Median Difference			Median Difference				
	No Ill PA Adult	Any Ill PA Adult	Wilcoxon P-Value	No Ill PA Adult	Any Ill PA Adult	Wilcoxon P-Value	No Ill PA Adult	Any Ill PA Adult
Primary School Attendance								
Boys	0.6327	-1.0098	0.0024	-0.0039	-0.4800	0.0650	0.3573	0.1442
Girls	0.7211	-0.8465	0.0011	0.4932	-0.8011	0.0002	0.1897	0.3823
Both Boys and Girls	0.2258	-0.6922	0.0005	0.0144	-0.6468	0.0013	0.3035	0.2150
High School Attendance								
Boys	1.0916	-3.8789	<0.0001	0.4206	-0.4449	0.0364	0.0765	0.0138
Girls	-1.0692	-0.4377	0.4248	-0.8391	0.8459	0.0020	0.4283	0.0266
Both Boys and Girls	-0.3690	-2.6055	<0.0001	-0.2243	-0.3063	0.4421	0.3850	0.0003
All Schooling								
Boys	0.0517	-2.5065	<0.0001	-0.1318	-0.5267	0.0481	0.2770	0.0031
Girls	0.3466	-0.9713	0.0016	-0.0861	0.0000	0.3842	0.0670	0.0298
Both Boys and Girls	0.1746	-0.9952	<0.0001	-0.1051	-0.3225	0.0414	0.1198	0.0094

A5.3 Discussion

The results from this analysis provide evidence supporting the role of prime-age adult illness in the deterioration of household productivity and reduced investment in future productivity as theorized in the HIV/AIDS-food security paradigm. Households hosting a prime-age ill adult showed a greater reduction in household goods and land owned than expected than those without an ill prime-age adult. Prime-age men and women spent more time in care-giving than expected in households with an ill prime-age adult and children living in a household with an ill prime-age adult spent less time than expected in school compared to those living in households without an ill prime-age adult.

However, contrary to the HIV/AIDS-food security paradigm, the provision of food aid did not necessarily ameliorate the loss of productivity or investment in future productivity of households hosting an ill prime-age adult. Prime-age men living in beneficiary households hosting an ill prime-age adult spent more time in agricultural labor than expected compared to prime-age men in non-beneficiary households with an ill prime-age adult. There were no other significant effects on prime-age adult labor for those in beneficiary households compared to those in non-beneficiary households when broken down by presence of an ill prime-age adult.

Prime-age adults living in beneficiary households with an ill prime-age member did spend less time in care-giving than expected compared to prime-age adults living in non-beneficiary households with an ill prime-age adult. This is evidence for the HIV/AIDS-food security paradigm that hypothesizes that improved nutrition of PLWHA will increase their physical activity and reduce their need for care-giving.

The remarkably consistent finding for greater school attendance than expected by children living in beneficiary households with an ill prime-age adult compared to children living in non-beneficiary households with an ill prime-age adult is strong evidence for the HIV/AIDS-food security paradigm. The paradigm hypothesizes that improved nutrition through the provision of food aid will give children the increased energy necessary for regular school attendance or that the transfer effect will free household resources that would have been used to acquire food to paying school fees. The fact that the significant improvements were found in high school age students but not in elementary age students suggests that it is the transfer effect that is mostly at work since primary school is free in Kenya while high school students must pay fees.

The analytical approach used here employed coefficients estimated from the baseline data to calculate expected outcomes in the impact data. This assumes that the outcomes are independent of the time periods. However, such an assumption may not be tenable given that Kenya experienced widespread crop failures in the years 2000 and 2004. The baseline data recorded asset levels in years 2002 and 2003 (both average agricultural years), while the impact data recorded asset levels from the years 2003 and 2004. Transitioning from one average agricultural yield year to another may have a very different effect on household livelihood strategies than transitioning from an average year to one of poor yields. The surveys were taken at the end of the long rains (Kenya's most productive agricultural season) when crop yields would be evident even though harvesting had not yet begun.

The results of the regression analyses demonstrate the importance of the flexibility of livelihood strategies. Prime-age adults adjust their labor employment and resource

expenditures to maximize potential earnings. Livelihood strategies take into account expected risks and returns on labor and resource investments and these expectations are likely to be affected by the food security outlook of the household. In the food insecure environment of widespread crop failure, households will likely pursue a more risk averse strategy than they otherwise would have in a more food secure period. Thus, predictors of labor and resource utilization estimated from data characterizing a period of relative food security may not accurately predict labor and resource utilization in periods of acute food insecurity.

While the results from the analysis do conform, in many respects, to the HIV/AIDS-food security paradigm, they fail to tell us much beyond that. There is no estimate of the magnitude of the effects observed in this analysis, nor is there any way to estimate the interaction of prime-age adult illness and program participation while controlling for the individual effects of those factors.

Appendix 6: Full Model Results for Key Findings

Table A6.1. Complete model results for difference-in-differences models of change in total household goods, total livestock and total goods and livestock measured in Kenya Shillings, and for change in acreage under cultivation.

	Total Household Goods		Total Livestock		Total Assets		Land Cultivated	
	Coeficient	Prob>t	Coeficient	Prob>t	Coeficient	Prob>t	Coeficient	Prob>t
Intercept	1662.32	0.0551	-781.10	0.1823	1088.90	0.3510	0.0719	0.1024
Program Participation	1087.35	0.2209	-617.34	0.4231	608.65	0.6088	0.0057	0.9275
Prior Year's Value	-0.0824	0.0006	-0.1453	<0.0001	-0.0834	<0.0001	-0.1663	<0.0001
Any PA Illness	-2416.00	0.0515	-650.48	0.5394	-3283.08	0.0494	0.1833	0.0349
Program Participation by Any PA Illness	2875.86	0.0616	217.89	0.869	3307.18	0.1079	-0.2370	0.0279
Any PA Death	-51.34	0.9762	1422.77	0.3427	1314.91	0.5707	-0.0903	0.4565
Program Participation by Any PA Death	-1811.51	0.3935	-2555.69	0.17	-4239.91	0.1401	-0.0137	0.9275
Female Headed Household	-1949.89	0.0071	n/a	n/a	-2286.98	0.0176	n/a	n/a
Current Acreage Owned	-491.34	0.0528	448.76	0.0046	n/a	n/a	0.0794	<0.0001
Daily Cash Expenditures Per AE	n/a	n/a	n/a	n/a	-17.97	0.2118	n/a	n/a
Current Acreage Under Cultivation	1213.30	0.002	n/a	n/a	1093.95	0.0038	n/a	n/a
Restricted Log-Likelihood	7723.10		7650.30		7949.10		527.8	
n	385		385		385		385	

Table A6.2. Complete model results for prime-age adult off-farm and all income generating labor and by gender.

	Off-Farm Labor						All Income Generating Labor					
	Men		Women		Both		Men		Women		Both	
	Coef.	Prob>t	Coef.	Prob>t	Coef.	Prob>t	Coef.	Prob>t	Coef.	Prob>t	Coef.	Prob>t
Intercept	-0.7446	0.2137	0.6039	0.1106	-0.0836	0.8176	2.7821	0.0005	2.9389	<0.0001	2.4603	<0.0001
Program Participation	0.5668	0.2664	0.9908	0.0042	0.8526	0.0056	0.1336	0.8589	0.8030	0.0800	0.6134	0.1584
Age	0.0724	0.0001	0.0102	0.2927	0.0315	0.0009	0.0818	0.0005	0.0442	0.0011	0.0600	<0.0001
Male	n/a	n/a	n/a	n/a	0.4895	0.0129	n/a	n/a	n/a	n/a	0.7314	0.0036
Any PA Illness	-0.6405	0.2957	-1.2972	0.0016	-1.1586	0.0015	-0.2914	0.7441	-1.4996	0.0059	-1.2085	0.0200
Program Participation by Any PA Illness	0.5811	0.4504	1.1914	0.0215	1.0539	0.0225	-0.1248	0.9127	1.2116	0.0780	0.8906	0.1757
Any PA Death	-1.0919	0.3084	0.2348	0.7131	-0.2360	0.6873	-0.8599	0.5651	0.8045	0.3433	0.1862	0.8222
Program Participation by Any PA Death	1.4683	0.0289	-0.8405	0.2885	-0.2289	0.7564	1.2824	0.5329	-0.5659	0.5903	0.0220	0.9832
Restricted Log-Likelihood	1133.7		1432.3		2602.2		1261.1		1632.4		2916.4	
n	236		337		573		236		337		573	

Table A6.3. Complete model results for hours of school attendance by primary and high school age boys.

	High School		All School	
	Coef.	Prob>t	Coef.	Prob>t
Intercept	14.3059	<0.0001	3.6624	<0.0001
Program Participation	1.7218	0.0026	0.7159	0.0422
Age	-0.5183	<0.0001	0.2264	<0.0001
Free	n/a	n/a	-0.0168	0.9659
Any PA Illness	-0.6247	0.4243	0.0053	0.991
Program Participation by Any PA Illness	0.9295	0.3344	0.1094	0.8515
Any PA Death	0.3951	0.7136	-0.1477	0.8388
Program Participation by Any PA Death	0.5126	0.6946	0.3078	0.7194
Restricted Log-Likelihood	1088.1		2512.2	
n	226		537	

Biography

Brian G. Luckett was born in Ames, Iowa to Mrs. Marjorie Ann Luckett and Dr. Dudley G. Luckett. He graduated from Ames Senior High School in 1981.

After high school, Mr. Luckett studied photographic illustration at the Rochester Institute of Technology in Rochester, New York and then finished his BA in Anthropology at Tulane University in 1986. Later in 1986, he entered the Peace Corps and was stationed in Sierra Leone as an agricultural extension agent. In 1991 he finished a MSPH in biostatistics at the Tulane University School of Public Health and Tropical Medicine. Still not satisfied, he enrolled at Iowa State University in agricultural economics where he finished his MS in 1994. The title of his master's thesis was "Targeting Food Subsidies to Food-Poor Households in Zambia".

In 1994 Mr. Luckett was employed by the Louisiana State University Health Sciences Center to work with Dr. Elizabeth T. H. Fontham on a study of pollution and cancer. He has remained at LSUHSC since working on a variety of epidemiologic studies of cancer that incorporate survey data, biomarkers and geographic information systems.

Mr. Luckett pursued his doctoral studies at the Tulane University School of Public Health and Tropical Medicine – Department of International Health which, eventually, resulted in the dissertation you're reading.