

THE IMPACT OF ADULT DEATH ON RURAL SMALLHOLDERS IN KENYA: IMPLICATIONS FOR HIV/AIDS

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THE IMPACT OF ADULT DEATH ON RURAL SMALLHOLDERS IN KENYA: IMPLICATIONS FOR HIV/AIDS

By

Melody Rebekah Mc Neil

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ABSTRACT

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The incidence of prime-age adult death is increasing as a result of HIV/AIDS and opportunistic infections. Because of these increases, the ability of smallholders to increase food security and maintain current on and off-farm activities is more constrained than ever. Using panel data, this paper empirically examines the effects of disease-related adult death on small farm households in Kenya. With increasing pressure on land and resources, the strategies employed by these households are currently centered around maintaining household composition consistent with their needs for household and farm labor. The demographic crisis being faced in some areas of Kenya is not repeated across all districts at this time. Government and non-government entities must shape policy and programs to stop adult death from becoming an extensive crisis, and to off-set the food insecurity created by loss of productive labor and increased dependency ratios.

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1.0 INTRODUCTION

Rural people in Sub-Saharan Africa are in a never-ending cycle of balancing the use of their limited resources to best fit their consumption, health, and social needs. Unforeseen death and other forms of severe household stress, catalyze people to trade-off between conflicting needs in order to continue to engage in the activities that best support them. Researchers have only a limited empirical understanding of how rural households cope with the adverse shocks to their livelihoods. Coping can be defined as "an array of short-term strategies adopted in response to crisis." Responses to crises can be understood as attempts to minimize not only the immediate effects of crises but also their long-term effects on the household (Adams, Cekan, and Sauerborn, 1998).

Food security, defined as access to enough food by a household for a healthy and active life, is a major concern of smallholders. With the advent of household level crisis, households will face the need to redistribute labor and responsibilities in order to try to maintain their welfare subject to a potentially more restricted opportunity set. The death of a family member is one important type of a household level crisis. Unexpected adult death has become a more salient type of crisis in Africa with the rise of the HIV/AIDS pandemic. Understanding the potential impacts of adult death allows policy makers as well as other groups to shape their attitudes and actions to more appropriately match what households will go through as the crisis becomes larger.

Adult death will become more common as prime-aged adults become more heavily affected by AIDS (World Bank, 1997). The growth of an AIDS crisis will also make other diseases such as tuberculosis more common and uncontrollable. Any

household-level effects of adult death will have important implications for the expected spread of AIDS. HIV/AIDS is a global epidemic affecting people in every part of the world. While AIDS is not necessarily a disease of poverty, it appears to have grown most rapidly in relatively poor parts of the world. Since poorer households suffer more intense and persistent effects of adult death from HIV/AIDS and other causes, all productive sectors have a role to play in combating AIDS, including agriculture, non-farm sectoral growth, health and education (Stillwaggon, 2000, World Bank, 1997, and NASCOP, 1999).

FAO estimates that about one tenth of world population lives is Africa; however, about 83% of AIDS related deaths, as of 2000, had occurred in Africa (FAO, 2000). AIDS's impact on farming communities and systems differs widely from place to place. Nevertheless, it is apparent that HIV/AIDS is and will continue to constrain the developmental process in many LDC's, specifically in Sub-Saharan Africa (SSA). Positive trends previously achieved in child health seem to be slowing and perhaps even reversing with the growing AIDS epidemic (Ainsworth and Semali, 2000). Understanding the potential household level shocks brought on by HIV/AIDS is crucial in order to develop and implement strategies and extension services that effectively deal with the AIDS epidemic in economic and agricultural development.

Economic costs may paralyze a household as an ill member loses income, their medical expenses increase, education of other members is foregone in order to continue agricultural activities and care for the sick. Both household production constraints and time constraints may be altered given the loss of resources associated with a particular household member. Resource and land endowments could be permanently altered with the death of an adult, especially if the adult is a household head. Human capital possessed by the deceased may change production constraints, as the technical know how or management capacity of a household changes (Bollinger and Stover, 1999).

Using panel data collected from households in rural Kenya in 1997 and 2000, this paper specifically examines how adult deaths, which are increasing as a result of AIDS, affects smallholder household activities. We determine the effect of a death of a household member on income and asset values as well as entry of new members, or the return of former resident members, into a household. We estimate this relationship while controlling for characteristics of the deceased person, such as age, gender, level of education, and interactions between these attributes. The household fixed-effects approach provides information on differences in household behavior and welfare between a period before adult death with a period after the occurrence of adult death, and helps to control for unobserved time-invariant household characteristics. Increased analysis of household behavior before and after adult death is important to predict the potential impacts of HIV/AIDS in a variety of settings.

In this paper we examine the effects of adult death from disease in general rather than focusing our attention on AIDS-related adult death. A paucity of information in the household surveys preclude differentiation between AIDS-related deaths and those caused by other diseases. Ainsworth and Semali (2000) examined the effects of adult death in

general for the same reason.¹ While adult death and AIDS-related adult death are not explicitly separated in this analysis, many conclusions can be drawn from this study about the possible effects of AIDS-related deaths on household behavior. However, it is acknowledged that the cause of death may have some differential effects on household behavioral responses and welfare. Furthermore, given the problem of unexpected or sudden adult death, an empirically-based description of rural household responses to a death in the family is important for the design of future rural development strategies.

¹ The survey data used in this paper does ask respondents to identify any deaths incurred in the household by accident, disease, or old age, but such information is typically regarded as unreliable.

2.0 LITERATURE REVIEW²

Many factors affect the behavior of smallholders in the face of adversity. However, there is limited quantitative information available about actual household response and the factors that cause differences in responses across households. Adult death affects household behavior at three distinct levels classified as the attributes of (1) the deceased individual; (2) the household; and (3) the community. Not only does the impact of death on the remaining household members differ by level, but coping strategies of the household unit will also vary depending on perspective (World Bank, 1997). At the individual level, coping may consist of doing less work at home to maintain a certain standard of productivity on the job. At the household or community level, those who fill in for an ill or injured adult may be drawn away from other productive activities. Investment in human and physical capital may also be sacrificed (Ainsworth et al, 2000, McPherson et al, 2000, and Over et al, 1992).

According to one source the percentage of adults in SSA who are presently HIV positive is 8.57% (Committee on World Food Security, 2001). In Kenya the percentage of adults (ages 15-49) who are HIV positive is reported to be 14.0%, much higher than the regional average (UNAIDS, 2000). While development agencies may be generously aiding in campaigns to educate and cope with the AIDS epidemic, they are not concurrently scaling down their other development projects to mirror this expected loss of

² This section, and following sections, include both empirical and anthropological information. Empirical results from Kagera remain the most important work done in quantifying the effects of HIV/AIDS to date. Published results of the Kagera study do have details which allow analysis of household coping with an AIDS death. Although data are still quite limited, the authors expect their findings to be consistent with further studies (World Bank, 1997).

adult life (Bonnel, 2000). However, a consequence of increased mortality of prime-aged adults in the next 10-20 years is higher dependency ratios of children and elderly people (McPherson et al, 2000).

The expectations for changes in income and income generating activities due to the incidence of adult death, changing demographics, and resource levels are explored empirically in the following sections of this paper. Hypotheses fall under three general categories: 1) household demographics, 2) on-farm effects, and 3) off-farm effects, and as such the literature review is structured similarly.

2.1 Household Level Effects

Farm household performance is dependent on the characteristics of each member. The loss of one has ripple effects for the entire household. A death will reduce a household's stock of human capital as well as time and disposable resources (du Guerny, 2001). The need to alter spending and labor allocation patterns to consider the needs of ill and ailing adult members in light of other household responsibilities, strains more than just one household. However, the ultimate death of an adult will also release the labor that had been taken up in caring for that individual (White and Robinson, 1999).

Illness also generates the need for increased expenditure on already stretched medical resources. Kenya has spent as much as 74% of a yearly health care budget on hospital care in more than one fiscal year over the past two decades (Over et al, 1992). An intensified AIDS crisis will only worsen the disparity in health spending, pulling it further away from primary care. Also, a widespread epidemic may jeopardize local and national governments' ability to continue adequately providing social services (Nampanya-Serpell,

2000, Bonnel, 2000, Committee on World Food Security, 2001, University of Nairobi, 1997, World Bank, 1997).

Household health may suffer even more, as labor shifts away from hygiene maintenance chores such as cleaning and proper food preparation towards caring for the ill (Over et al, 1992). This is expected to have an especially negative impact on child nutrition and health. For instance, stunting is more common in children whose parents have died, and evidence shows the death of a father can be equally as detrimental as the death of a mother. The death of a female adult has also been shown to increase the likelihood of older children discontinuing education and to raise infant mortality (Ainsworth, Beegle, Koda, 2000, Ainsworth and Semali 2000, Lundberg and Over, 2000).

While children are a main concern in this issue, women tend to be more vulnerable to the effects of disease in their households than men. Women typically carry out the task of tending to the ill as well as other dependents. They also continue carrying heavy workloads beyond these extra demands (Committee on World Food Security, 2001). Ironically desired family size increases as the need to share work also increases, but the potential health of those family members decreases (Over et al, 1992).

Changes in household composition can help to ameliorate the effects of an adult death on households. In Kagera, Tanzania households suffering an adult death showed very slight changes in average household size, from 6.0 to 5.7 members. A similar result was shown in Rakai, Uganda. Child dependency ratios, defined as the number of children in a household divided by the number of adults, were found to increase only very slightly in Kagera, from 1.2 to 1.4, compared to from 1.2 to 1.5 for households not suffering an adult death (World Bank, 1997). Furthermore, recovering households were more likely to be headed by women than those households who had not suffered an adult death in Kagera, 36% compared to 25% (World Bank, 1997). This result has serious implications for the health and well-being of other household members as it has already been stated that women are generally poorer than men. Moreover, if the head of household died from a communicable disease, the surviving spouse is likely to face health risks as well.

Responding households in Chiang Mai, Thailand showed different results. In households suffering a death in Chiang Mai, average household size was reduced by one full person, even after two years (World Bank, 1997). This result could stem from higher incomes in Chiang Mai than the surveyed areas in Africa. It also suggests different patterns of coping with household crisis. Household composition is expected to play a major role in the coping efforts of households trying to cope with an adult death in SSA.

As the crisis of adult death continues to grow in the Sub-Saharan region, the trends that have been observed in other reports concerning the household level responses to adult death may begin to show signs of breaking down. The likelihood for the average number of adult deaths per household to increase over the course of 2-3 years, considering the impact of HIV/AIDS and its accompanying opportunistic infections, should decrease. Continuing to give equal weight to AIDS related and other disease related deaths will be important in monitoring the household composition patterns of those coping with adult death, as secondary infections of HIV/AIDS become more widespread and malaria continues to take lives.

2.2 On-Farm Effects

On-farm effects are observable in some recent studies and are expected to become more pronounced within the next 1-2 decades. It is estimated that of the 14 million AIDS victims in SSA, at least 60% were engaged actively in agriculture. To lose no less than 25% of SSA's agricultural labor force over the next 20 years would not be unlikely (Development News, 2001).

The factors leading to farm-level changes as a result of an intense adult death crisis are varied. One community level constraint to agriculture in Kagabiro village, Tanzania, is compulsory funeral attendance. More importantly is the moratorium on all farming activities for 2-3 days and on planting anything for the 7 days of the mourning tradition. Researchers in that area say that the time dedicated to mourning deaths in the community can amount to 4-8% of yearly labor time (Tibaijuka, 1997). Many of the respondents to the study done in Tanzania indicated that they were concerned over their food security leading up to and following an adult death as a result of women planting fewer root crops (Tibaijuka, 1997). This is attributed to lack of labor to cover other household activities.

Substitution of labor-saving subsistence crops for labor intensive crops has been identified as a strategy that many households employ to deal with the hardship of an adult death (Committee on World Food Security, 2001). Labor intensive crops may seem less feasible in light of adult death (UNAIDS, 1999). In Rakai District in Uganda, there is already strong evidence of a switch to subsistence types of crops, likely resulting from increasing rates of adult death. Whereas in 1989 there was a great deal of savory banana cultivation accompanied by many different types of relishes, in 1993 there were far fewer relish crops planted (Bollinger, Stover, and Nalo, 2000).

Increased subsistence production was more prevalent in more impoverished households. Small farms are typically less able to absorb the shocks to adult labor availability associated with adult death. Farm families are also shifting away from food crops high in protein and other nutrients to root crops that are easier to produce (Development News, 2001, du Guerny, 2001). They have fewer resources to reallocate and opportunities to hire labor and animal power, and are rather selling off livestock including draft animals. (Development News, 2001, and Bollinger, Stover, and Nalo, 2000).

A shrinking labor base may also lead to abandoning cultivation of more remote fields. As some fields lay fallow because there is not enough time or manpower to cultivate them, food security and production may be further compromised (du Guerny, 2001). An alarming trend is less emphasis on conservation of land. In order to maintain survival, concern over long-term sustainability of farm land may decrease. Commercial production is also expected to suffer as the loss of seasonal workers may intensify and morbidity and mortality of employees may increase (Committee on World Food Security, 2001 and du Guerny, 2001). Some of these coping tactics are those usually expected only in famine periods, and are associated with a higher opportunity cost of adult labor as a result of AIDS.

Other strategies have also had an important impact on households. Dissaving and/or selling assets are also widespread (du Guerny, 2001, Tibaijuka, 1997, and World Bank, 1997). Studies in Kagera, Tanzania, Rakai Uganda and Chiang Mai, Thailand show

dissaving. In Kagera and Rakai selling durable goods like radios was very common in households recovering from an adult death. The Kagera study reported recovering households membership in credit groups decreased more than non-recovering households (51-36% compared to 41-36%). Chiang Mai results showed land sales were also a strategy (World Bank, 1997).

Although empirical results are shown from three studies, Kageara, Chiang Mai and Rakai, it has already been stated that data continue to be limited. Chiang Mai results do not have the ability to compare financial variables between households experiencing and those not experiencing death (World Bank, 1997), such that the characteristic comparative nature of this analysis remains an important exercise. Furthermore, much of the published material on this subject remains focused on impacts of adult death on children and education rather than cross-cutting farm-level issues.

2.3 Off-Farm Effects

There are many potential pathways by which adult death may affect households' labor productivity, although solid empirical information is so far lacking. Growth in production and labor are expected to decline along with the shifting of production functions. There is also an expected decline in human capital stock as well as lost incentives to continue investing in human capital (du Guerny, 2001, and Bonnel, 2000). The continued education of children and opportunities of transferring cultural awareness, knowledge of common practice and traditions is declining.

Through village case study, Adams (1998) finds that in Malawi's rainy season, death of a productive adult worker can limit a household's productivity and income

opportunities. Both food security and future productivity are priorities for household strategies dealing with adult death. In his case study, Mtika (2000) shows that during the rainy season families may send a worker off-farm in the event of an adult death. Sending a member away from the household will not necessarily eliminate his or her claim on household resources; however, it does imply a possibility for some remittances and perhaps a higher return to that person's labor (Adams, Cekan, and Sauerborn, 1998).

Help from neighbors and family may be forthcoming. According to the study done in the Kagera region of Tanzania, households in crisis were likely to receive in-kind or cash assistance from other households (World Bank, 1997). This study and others show that while a household suffers great loss after the death of an adult member, they also suffer during the illness, and transfers from other households tend to be greater after the death of a household member not during his or her illness (World Bank, 1997). The average length that an AIDS patient, for example, would spend bed-ridden in Kagabiro village, Tanzania is 6 months (Tibaijuka, 1997). This presents an even greater problem for the suffering household as a projected average of 29% of family labor stock was dedicated to the care of an AIDS patient (Tibaijuka, 1997).

A quantitative study on adult death in Cote d'Ivoire shows that in the ten months after the death of an adult member, household consumption dips and then partially recovers. Similar patterns are seen in studies done in Rakai, Uganda, Chiang Mai, Thailand, although these studies cannot confirm the results (World Bank, 1997). Also, the Kagera study shows that households recovering from an adult death consume a smaller amount of purchased food compared to households who had not incurred an adult death in the same

period. The authors found this supported the view that recovering households worked a lower number of hours for wages, and therefore had lower incomes (World Bank, 1997). The study from Kagabiro village, Tanzania also indicates a distinct increase in the cost of hired labor over the study period (1982-90), while farm incomes have decreased in real terms at the same time.

The impact of adult death on off-farm productivity cannot be underestimated as the studies discussed above have indicated that preservation of food security is the first priority and off farm activity will decrease for that purpose. Comparison of income variables over the two sets of households presented in this paper will show quantified results relating to these concerns.

3.0 DATA

This section presents the data set used in the empirical analysis. Quantitative analysis will be carried out using data from two linked household surveys conducted by Tegemeo Institute of Egerton University and Michigan State University. Both surveys visit the same sampled households. The first was completed in September 1997 and the second in July 2000; the recall period of both surveys covers the same crop season and marketing year. The surveys are designed to be representative of the main agricultural regions of the country (Tegemeo Institute, 2000).

The sample size of the 1997 survey was 1,574. In 2000, 1,443 of these households were revisited from the original 1997 sample. The attrition rate, therefore, is 6.3 percent. In the 2000 survey, 31 additional households were added as replacements. But, for comparison, we do not include them in the following analysis. The sample size was further reduced because of the following:

- A. Two primarily pastoral districts included in 1997 (Garrisa and Turkana) were excluded in the 2000 survey. The numbers of original households excluded are 40 in Garrisa and 34 in Turkana.
- B. Thirty-one additional households were excluded because of incomplete or unreliable information. This reduced the sample to 1,412 households interviewed in both 1997 and 2000.³

Information collected in the survey lends itself to the comparison of household-level changes in a before death/after death scenario. After controlling for other household-

³ I thank Takashi Yamano for his help in cleaning the data.

level and community-level factors through econometric analysis, the "before/after" analysis can be strengthened to a "with/without" analysis. Household-level panel data also controls for the effects of time-invariant unobserved variables, thereby mitigating the common omitted variable problem of cross-sectional analysis. Detailed income information was collected in both surveys, such that disaggregation up to crop income, non-farm income, remittances, and livestock income are comparable.

3.1 Inflation Discussion

In order to decrease the possibility of any bias caused by inflation between the two surveys, all 1997 price and income data was inflated to match the 2000 data. The inflator was calculated using monthly CPI data from Central Bureau of Statistics' Economic Digest 2000 (Government of Kenya 2000). Averaging the CPI from the 12-month recall period recorded in the two surveys was the method used to calculate the actual inflator. The recall period for the 1997 survey was September 1996-August 1997. The recall period for the 2000 survey was August 1999 to July 2000. The average of the indeces from the period covering the survey was 1.177. All price and income variables from 1997 were inflated using this number to derive 2000 constant prices.

3.2 Construction of Variables

Two kinds of variables are used in the econometric model presented in section 5. Both variables in levels and differences are used in the estimations.

3.2.1 Variables in levels and categorical variables

All variables presented in levels are taken from the 1997 data set. The variables include the characteristics of the deceased individual such as that person's age or

educational level at the time. These variables are taken from individual information in 1997 and are recorded as continuous variables. Educational level is referred to as number of years of education. Age is a continuous variable indicating the actual age of the deceased person in 1997. There are also other crucial variables included as categorical variables. The most notable of these is the adult death variable itself. This variable was calculated as taking a value of 1 when a disease-related death has occurred in a household and 0 when a disease-related death has not occurred. Disease-related death accounted for 92% of the total adult deaths in the sample.

An important distinction to be made concerning the adult death variable is that all reported disease-related deaths are included in this analysis regardless of how many months the deceased individual may have spent on farm in the previous 12 months. The rule of household membership used for all other individuals is those individuals living on farm for 5 or more months. This did not apply to deceased individuals for several reasons. Most importantly is their demonstrated importance to the household for income as shown in table 2. However, a more important reason for their inclusion regardless of time on farm is the inability of the researcher to account for the actual date of their death.

With other household members it is possible to tell between 1997 and 2000 if they have actually increased their number of months on farm. However, if a deceased member spent less than 5 months on farm in the 1997 enumeration period, it is impossible to tell if this pattern changed in the following three years if they died before 2000. It is also not possible to tell which month of the first enumeration period 1997 deaths occurred in. Furthermore, a striking characteristic of the 19 deceased individuals from the 2000 survey

is 1 is reported to have been on farm for less than 6 months. This indicates that an ill member may come home while ill to be cared for, effecting household decisions during that time. For these reasons all reported deceased members are included in this analysis.

Categorical variables included in the models are year of death variables, relationship of deceased member to the household head, and gender of the household head.

3.2.2 Differenced Variables

The construction of differenced variables is straight-forward: 1997 values were subtracted from 2000 values of household information included in the specifications. However, the construction of the components of the differenced variables are important to note.

1. Household income

Because of differences in the collection and recording of data, it was important to construct comparable measures of income between the two periods. Important notes to be made on the construction of a comparable data set for the two surveys are:

a. The 1997 survey did not ask for the cost of hired farm labor. Therefore the 2000 survey data did not subtract out hired labor costs in the calculation of farm income. Other cash input costs and land preparation costs were deducted. Livestock income is gross income, the sum of the sale of animals and the sale of livestock products.

b. The categories of off-farm or informal income were not the same between the two surveys, such that there could not be a high level of disaggregation of income by source.
Aggregation was done by category of off-farm work. The aggregation of categories made it possible to derive comparable measures of farm labor wages and business income.

Business income includes income from self-employment in off-farm activities. Furthermore, detailed cost information was not collected in 1997; so, off-farm income is compared between the two years in gross rather than net terms. This ensures the comparability of the two data sets. Final off-farm income is calculated as the sum of informal income, salary, remittance and pension income.

c. Constant prices are used across the two periods to value crop income. If the objective is to understand how adult mortality affects household behavior, one might choose to hold prices constant across the two survey periods, forcing changes in crop income to reflect changes in quantities harvested. This is because crop prices are exogenous from the standpoint of the household; households only have influence over physical production decisions, and even then only partially. For the main analysis in Chapter 5, I use 1997 district-level crop prices to value household crop production. However, to assess the robustness of the findings, I present the income measures using 1997 prices in 1997 and 2000 prices in 2000.

d. Information concerning fodder was well collected in 2000, but not 1997. Therefore, fodder has been dropped from both crop income measures.

e. Total household income is used in the analysis; however, it is important to stress that farm income is net of cash input costs, while non-farm income is measured in gross terms. This weights the total income variable disproportionately toward non-farm activities.

f. Finally, it is important to note that remittances were collected in 1997 as a combination of remittance, pension and miscellaneous other income. To ensure comparability of 1997

and 2000 remittance income measures, pension income was added into the remittance income measure for 2000.

2. Demographic Characteristics

Several household level demographic characteristics are differenced for the estimations reported in section 6. The methods for calculating these variables are discussed here. Please note that the deceased household member was not included in the differencing process for econometric estimation. The interest is in the movements of other household members in and out of the household. Therefore, the 1997 value of household size (hhsz) is calculated as hhsz-1 when a household has a death recorded and hhsz when a household doesn't have a death recorded. Similarly, when this variable was disaggregated to adult females, males and number of children, 1 was subtracted from the 1997 observations when a death of that gender was recorded in a household. This same method was followed when constructing tables.

3.3 Characteristics of Sampled Households

This section presents a discussion of some important characteristics of the interviewed households. Each of the tables highlights specific points about the data that will make evident the disparity between households experiencing adult mortality and those that do not. It also gives insight into the adjustment pattern that households may undertake in order to maintain their integrity during and after a crisis.

Table 1 shows that of 1412 households included in the total sample the most important cause of adult death is disease. The provinces suffering the highest incidence of adult death are Nyanza and Coast. Siaya and Kisumu, both districts in Nyanza, are believed to have some of the highest rates of HIV/AIDS prevalence in Kenya. However, both are also well known malaria areas. In Nyanza province household size is below the national average while the number of children in the household remains close to or above the national average. This does give support to current literature that says households are likely to increase their number of children in order to increase labor availability. Fostering children to make-up some extra labor is also an important possibility resulting from widespread disease related adult death.

Table 2 highlights the income of the deceased members as recorded in 1997. The table indicates that the deceased members were still contributing a substantial amount to household income. Of the 89 deaths reported in this paper, 21 had income in 1997. Of these 21, 13 were from either Nyanza or Coastal provinces. These are the provinces with the most adult death from disease in this survey.

Province	Cause o (% of Ho Disease	of Death ouseholds) Other	Total (%)	Total Number of Deaths	Total Number of Disease related Deaths
Coast	7.14	1.14	8.33	7	6
Eastern	3.90	0.43	4.31	10	9
Nyanza	14.50	0.76	15.27	40	38
Western	5.21	0.35	5.56	16	15
Central	3.45	0.57	4.02	7	6
Rift Valley	4.03	0.53	4.57	17	15
Total	6.30	0.56	6.87	97	89

 Table 1. % of Households Suffering an Adult Death by Province and Cause

"Tegemeo/MSU Agricultural Monitoring and Policy Analysis Household Survey database", 1997 and 2000, Tegemeo Institute, Nairobi, Kenya.

 Table 2. Income Characteristics of Deceased Household Members (Off-farm Income measures are averaged for only those deceased members reporting that category of income in 1997)

	% of members with zero off- farm income	1997 informal off-farm income (Ksh)	% of members with zero off- farm income values	1997 farm wage income (Ksh)	% of members with zero values	1997 salary (mean Ksh)	% of members with zero values	1997 remittances (mean Ksh)
Male (n=46)	86.96	73,090	97.83	5,000	82.61	70,880	93.48	11,800
Female (n=43)	90.70	24,023	0.00	0.00	97.83	21,600	90.7 0	11,400
All (n=89)	88.76	53,463	98.90	5,000	88.90	65,404	92.13	11,571

"Tegemeo/MSU Agricultural Monitoring and Policy Analysis Household Survey database", 1997 and 2000, Tegemeo Institute, Nairobi, Kenya.

 Table 3. Household Characteristics of Sampled Households (2000) by Province (all numbers are household averages)

	Coast	Eastern	Nyanza	Western	Central	Rift Valley	National
		Number	of Househo	ld Members			
Children							
Below 6	0.81	0.78	0.82	1.18	0.42	0.85	0.84
Girls 6-16	1.27	0.83	0.96	1.20	0.70	1.09	1.06
Boys 6-16	1.36	0.81	1.04	1.32	0.66	1.13	1.01
Adults							
Women	2.27	1.82	1.67	2.08	1.73	1.92	1.89
Men	2.11	1.53	1.52	1.92	1.68	1.88	1.75
Houshold Size	8.36	5.74	6.03	7.53	5.20	6.85	6.54
Total Acres Cultivated	5.54	6.36	3.77	5.37	3.21	6.02	5.15
Value of Assets (Ksh)	38,179	64,568	41,089	56,295	58,760	16,2905	84,256
Members engaged in off- farm Employment	2.80	1.92	1.23	1.49	1.33	1.53	1.58

"Tegemeo/MSU Agricultural Monitoring and Policy Analysis Household Survey database", 1997 and 2000, Tegemeo Institute, Nairobi, Kenya.

Table 4 shows that all adults in households incurring and not incurring adult deaths had spent most of 2000 within the household. This is a strong indication that household members have been identified as those who actually inhabit the household a majority of the time. These members are, on average, over 30, and the women have generally less education than the men for both household incurring (6.26 years for women, 7.31 for men) and not incurring (6.28 years for women, 7.45 for men) adult death.

For many households that incurred a death in the family since the 1997 survey, there were probably strong effects from any long illnesses effecting the 1997 data. The 1997 data did not collect information on illness in the family. Hence, the effects of illness may already be picked up in the 1997 for some households that later incurred a death. Again the figures in Table 5 do not show large shifts, however it is impossible to characterize the exact movement of the demographic changes from 1997 to 2000 without knowledge of exact timing of illness and death. Table 5 shows that across all provinces, the number of adult household members increases from 1997 to 2000, but that the number of children decreases. Then table 6 further supports this at the national level. Even in households recovering from an adult death, the number of men and women members only decreases slightly between the two surveys.

	Average <u>Rela</u>		Relations	nip to housel	nold head		Average	# months	
	age	Head	Spouse	Son/ Daughter %	Other Relatives	Others	years of education	spent on farm in last year	
Households	Incurring an	Adult Dea	th						
Female	34.13	10.43	38.04	1.23	33.13	20.25	6.26	11.66	
Male	32.13	24.24	1.21	0	56.97	18.79	7.31	11.33	
All adults	33.14	17.12	19.22	0.60	44.44	18.62	6.78	11.50	
Households	not Incurring	; an Adult	Death						
Female	34.85	6.94	42.33	3.11	36.15	11.47	6.28	11.64	
Male	34.60	37.67	0.75	0.67	45.90	14.76	7.45	11.49	
All adults	34.73	21.90	22.10	1.92	41.40	13.07	6.85	11.57	

 Table 4. Comparative Demographics of Adult Household Members, 2000 survey

"Tegemeo/MSU Agricultural Monitoring and Policy Analysis Household Survey database", 1997 and 2000, Tegemeo Institute, Nairobi, Kenya.

Province	Coast	Eastern	Nyanza	Western	Central	Rift Valley
Percent of Households incurring an adult death	6%	4%	14%	5%	3%	4%
Average # Men 1997	2.11	1.38	1.23	1.71	1.59	1.65
Average # Men 2000	2.11	1.53	1.52	1.92	1.68	1.88
Average # Women 1997	2.17	1.75	1.34	1.75	1.62	1.67
Average # Women 2000	2.27	1.82	1.67	2.08	1.73	1.92
Average # Children 1997	4.05	2.54	3.19	3.66	2.15	3.44
Average # Children 2000	3.44	2.42	2.82	3.70	1.78	3.06

 Table 5. Demographic Characteristics of Sampled Households by Province

"Tegemeo/MSU Agricultural Monitoring and Policy Analysis Household Survey database", 1997 and 2000, Tegemeo Institute, Nairobi, Kenya.

	×						_
Variable	1997 Average w/out death	2000 Average w/out death	Average change	1997 Average w/death	2000 Average w/death	Average change	
Women	1.67	1.89	0.22	1.95	1.87	-0.08	
Men	1.58	1.75	0.17	1.84	1.79	-0.05	
Children	3.17	2.90	-0.27	3.12	2.96	-0.15	

Table 6. Demographic Changes from 1997 to 2000 Number of Individuals Fitting the Category (differentiating between households experiencing adult death and those not experiencing adult death and including the deceased member in 1997)

"Tegemeo/MSU Agricultural Monitoring and Policy Analysis Household Survey database", 1997 and 2000, Tegemeo Institute, Nairobi, Kenya.

Table 7 begins a detailed look into the changes in income generating activities undertaken on and off the farm by surveyed households. It is important to stress here that households who have recorded an adult death may have been affected in many ways before the actual event of a death. Asset values alone indicate a large difference between the 1997 values for households with and without an adult death. Dissavings and disinvestment are both expected for households with a terminally ill individual. Therefore, the 1997 values of some of the variables in Table 7 may already reflect to some extent the effects of illness, at least for the subset of households in which the cause of death was a disease that affected the household's behavior even before the 1997 survey.

Farm wage labor income increases for families who have suffered an adult death while it shows a decrease for those families not incurring an adult death. Again this supports the assumption that a terminally ill household member induces a household to make decisions concerning labor allocation, savings, and investment contrary to the decisions they would make under normal circumstances. The increase in farm wage labor income indicates a greater number household labor hours being dedicated to wage labor. The extra hours may come from a household member who was either doing the work of the ill member or caring for that member.

Crop income increases over the 1997 to 2000 period also. The finding that households suffering from an adult death had a smaller increase in their crop income than do households not reporting an adult death is consistent with prior expectations.

Finally remittances do fall in line with a priori expectations. The level of remittance income has declined for all households between 1997 and 2000. But the decline is especially great for households incurring an adult death between 1997 and 2000 according to table 8. An important question to ask at this point is what role does adult death play in the decrease in remittances. From table 2 we saw that the deceased members were not earning a large value of remittance income. Therefore the loss of a deceased adult's remittance income is not the reason for the dramatic decrease in remittances between the two surveys. The loss of remittance income appears to reflect the reallocation of household labor and the return of household members from off the farm back onto the farm, as shown in Table 12. One important impression that emerges from these findings is that a death in the family may result in family members working off the farm being brought back onto the farm to handle the on-farm labor activities of the deceased member. This might reflect a priority on food production objectives over cash, or it might reflect the household's need for someone to handle other kinds of tasks not measured in the survey that the deceased member was formerly handling.

	househ	old not incurr (1323)	ing a death	househ	g an adult		
Variable	1997 Mean	2000 Mean	Mean change (2000-1997)	1997 Mean	2000 Mean	Mean change (2000-1997)	w/death- w/out (t-stat)
Area Cultivated (hectares)	4.25	5.15	0.90	3.75	5.26	1.51	0.61 (0.9822)
Asset Value (Ksh)	95,618	81,061	-14,555	61,537	52,888	-8649	5609 (0.2599)
Crop Income (Ksh)	59,023	70,442	11,419	48,201	54,244	6043	-5376 (0.4979)
Crop Income/Ha (Ksh)	16,560	17,433	873	13,660	13,824	164	-709 (0.2328)
Maize Production (KG)	1,196	1,566	370	787	984	198	-172 (0.5186)
Livestock Income (Ksh)	36,701	33,260	-3,441	29,623	25,564	-4060	-619 (0.0869)
Total hh income	211,631	190,369	-21,262	205,595	133,642	-71953	-50691 (1.5281)

Table 7. Changes in Farm Characteristics Between 1997 and 2000, stratified by
whether households incurred an adult death in the interim period.

"Tegemeo/MSU Agricultural Monitoring and Policy Analysis Household Survey database", 1997 and 2000, Tegemeo Institute, Nairobi, Kenya.

	household not incurring a death (1323)			household incurring an adult death (89)			
Variable	1997 mean	2000 mean	Mean change (2000-1997)	1997 mean	2000 mean	Mean change (2000-1997)	w/death- w/out (t-stat)
Off-farm employment (members per hh)	1.21	1.59	0.38	1.18	1.52	0.34	-0.04 (0.285)
Remittance income (Ksh)	9,875	5,072	-4,803	11,772	2,909	-8,863	-4,060 (-1.05)
Off-farm income(Ksh)	90,020	63,009	-27,011	104,795	39,191	-65,604	-38,593 (1.358)
Farm Wage labor income (Ksh)	2,401	2,026	-375	781	1,509	728	1,103 (0.549)

Table 8. Changes in Off-farm Activities and Income from 1997 to 2000, stratified by Whether the Household Incurred an Adult Death

"Tegemeo/MSU Agricultural Monitoring and Policy Analysis Household Survey database", 1997 and 2000, Tegemeo Institute, Nairobi, Kenya.

Finally the next three tables explore the changes in household make-up in more detail. As has been found in other studies including the Kageara study (World Bank, 1997), the dependency ratio actually decreases in household experiencing an adult death. In this study, the dependence ratio does decrease less than the dependency ratio decreases in households not suffering from the loss of an adult (Table 9). New members were identified in the 2000 survey. New adult members are a combination of members who lived on farm less than 5 months in 1997 and then increased their time on farm to more than 5 months by 2000 and members who are not recorded at all in the 1997 survey but are included in the 2000 survey. Table 10 shows that most new male members are children of the head of the household they are entering. However, most new female members are in the "other" category. This category includes both relatives and non-
relatives that are not given a specific category.

Tables 11 and 12 look further at the income characteristics of the new adult members. Because the category "new people" is made up of those members in 2000 who were not included in the 1997 survey at all, income measures are not available for them. Therefore, table 11 gives the characteristics for only the new members who were enumerated and earned income in the 1997 survey. Theses members are called new members because they spent less than 5 months on farm in the 1997 survey but more than 5 months on farm in the 2000 survey. The two tables show that new members are important to the income earnings of their households in 2000. One interesting result of a close look at the new members is that while none of the 44 new members in the Coast and Western provinces earned income in 1997, all of them are new members of households incurring an adult death. This shows conclusively that households incurring adult death do increase their adult membership as part of the coping process.

	Ratio in 1997	Ratio in 2000	Change	
Households w/death	1.27	1.04	-0.23	
Households w/out death	1.56	1.05	-0.51	

Table 9. Dependency Ratios (#Children(-	(<15 vears old)	/#Adults(>15 v	vears old))
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"Tegemeo/MSU Agricultural Monitoring and Policy Analysis Household Survey database", 1997 and 2000, Tegemeo Institute, Nairobi, Kenya.

	Total # of new members	Age (ave.)	Years of School (ave.)	Rela head	ationship t spouse	o Househ parent	old Head child	(%) other
Male	43	28.56	8.09	6.98	2.33	0	60.47	30.23
Female	36	30.28	7.64	0	22.22	. 0	33.33	44.44
All	79	29.34	7.89	3.79	11.39	0	48.10	36.71
Households no	ot Incurring Adult D	Death						
Male	692	31.07	7.19	22.11	0.87	1.16	47.54	28.32
Female	585	31.90	6.40	2.05	25.81	5.30	42.05	24.79
All	1277	31.45	6.83	12.92	12.29	3.05	45.03	26.70

Table 10. Characteristics of New Members by Gender 2000

"Tegemeo/MSU Agricultural Monitoring and Policy Analysis Household Survey database", 1997 and 2000, Tegemeo Institute, Nairobi, Kenya.

 Table 11. Characteristics of New Members Reporting Non-farm Income in 2000 by

 Gender

	Total # of new members	# of new members deriving income	Age (ave.)	Years of School (ave.)	Off Farm Income in 2000 (Ksh)	Rela head	tionship t spouse	o House parent	hold Hea child	d (%) other
Households Incurring Adult Death (Percent of members reporting zero off farm Income in 2000: Male-96.65, Female-90.82, All-94.58)										
Male	43	6	32.83	10.50	50200	33.33	0	0	66.67	0
Female	36	9	32.67	6 .78	44078	0	33.33	0	33.33	33.33
All	79	15	32.73	8.27	46527	13.33	20.00	0	46.67	20.00
Households not Incurring Adult Death (Percent of members reporting zero off farm Income in 2000: Male-3.35, Female-9.18, All-5.42)										
Male	692	173	39.57	8.22	58957	49.71	2.31	0.58	39.31	8.09
Female	585	89	36.67	6.78	32432	8.89	35.56	3.33	31.11	21.11
A11	1277	262	38.57	7.73	49947	35.74	13.69	1.52	36.50	12 55

"Tegemeo/MSU Agricultural Monitoring and Policy Analysis Household Survey database", 1997 and 2000, Tegemeo Institute, Nairobi, Kenya.

Table 12. Characteristics of New Members (differentiating between those members newly entering the household and therefore not included in the 1997 survey, *new people*, and those who have increased their time on farm from <5 months in 1997 to >=5 months in the 2000 survey, *extra members*)

	Number of Members in the category	Mean Age	Years of School	% of new members deriving income in 1997	Informal Income from 1997	Farm Wages from 1997	Remittance and Pension from 1997	Salary from 1997	
New Peo	New People								
Male	559	30.43	6.51	n/a	n/a	n/a	n/a	n/a	
Female	532	32.56	5.97	n/a	n/a	n/a	n/a	n/a	
All	1,091	31.47	6.24	n/a	n/a	n/a	n/a	n/a	
Extra Me	Extra Members (Income is reported for only those members reporting that category of income in 1997*)								
Male	176	32.49	9.60	43.18	170,896	0	22,470	61,191	
Female	89	27.28	9.48	24.72	18,800	0	240,000	56,057	
All	265	30.74	9.56	36.98	166,555	0	42,245	59,980	

"Tegemeo/MSU Agricultural Monitoring and Policy Analysis Household Survey database", 1997 and 2000, Tegemeo Institute, Nairobi, Kenya.

* Percent of members reporting zero values for income by category: Salary: Male-61.36, Female-76.40, All-66.42. Informal Income: Male-93.75, Female-98.90, All-95.47. Remittance and Pension: Male-94.32, Female-98.88, All-95.85.

Farm level effects of disease-related adult death have and will continue to be important to agricultural research. The possibility that productivity is already at a weakened state from continued morbidity conditions related to common diseases in SSA shouldn't be overlooked in the literature. This is why, while this paper examines the impacts of disease -related deaths on a series of household and farm characteristics, it also emphasizes the points in the data which indicate already compromised status, especially at the farm level.

4.0 ANALYTICAL FRAMEWORK

This section outlines the framework for our empirical analysis. The data sets used for this analysis do not record the specific disease causing an adult death. Rather they record "disease" as a general cause of death. Therefore, this study analyzes the effects of disease-related deaths at the household level.

The costs of adult death on households can be both direct and indirect. Direct costs are those associated with caring for a terminally ill individual, if death was preceded by a long illness, as well as paying expenses associated with funerals and burial. Indirect costs are associated with losing the income generated by a productive adult as well as their embodied human capital and labor potential. This paper will treat disease-related economic impacts as loss of labor and assets and look for evidence of loss in income and demographic characteristics.

4.1 Household Model

In this section we address the question: How does adult death affect household decision making and behavior? First we need to understand the factors which affect the options available to households. If income generating activities are chosen at the household level then household decisions will be affected by household resource constraints. The approach used here is to assume that a household maximizes its utility function for each given production period. In a unitary model of household decision making there are several constraints facing utility maximizing behavior. There is an income constraint, time constraint, as well as a production constraint (Singh, Squire and Strauss, 1986). These constraints affect productivity and have many implications for this

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study.

Each household will allocate its resources given a set of objectives for leisure, market goods, non-marketable goods, and future productivity (Singh, Squire and Strauss, 1986 and Haddad et al, 1997). If the household's budget constraint is not binding, and where labor markets function, households will hire labor when they find the marginal value product of additional labor on their crops exceeding the agricultural wage rate. However, the death of a productive adult may simultaneously increase the need for hired labor and reduce the household's ability to afford it.

Several types of deaths are typically preceded by a long illness. As with any terminal illness, economic impacts at the household level will be felt strongly while an individual is still alive (Beegle, 1997). For those households incurring a death shortly after the 1997 survey, it is quite possible that the impacts will not be measurable between the 1997 and 2000 surveys, because the effects of a terminal illness would have already been measured in many of the 1997 data. Figure 1 introduces alternate time lines associated with illness and death over the period of the two surveys used in this paper. The first shows the possibility that disease onset happened before the 1997 survey was conducted, while on the second time line disease is shown to have come on after the survey was implemented in 1997.

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Figure 1. Timing of Illness and Death



Depending on which of the graphs in figure 1 is actually the case, the results of any analysis done using this data without morbidity information will be different. As there are no morbidity indicators in the data it may will be difficult to control for some impacts that will have been felt prior to the death of a household member. The timing of illness and death in relation to the timing of the 1997 and 2000 surveys is raised to draw the readers' attention to the potential limitations of measuring the effects of illness and death. Table 13 also shows that both scenarios are completely plausible.

	1997	1998	1999	2000	Total number of Deaths
Number of Deaths	11	29	30	19	89
Percentage of total deaths	12.36	32.58	33.71	21.35	100

Table 13 Distribution of Deaths by Year of Death

"Tegemeo/MSU Agricultural Monitoring and Policy Analysis Household Survey database", 1997 and 2000, Tegemeo Institute, Nairobi, Kenya. 4.2 Household Framework

4.2 Household Flamework

4.2.1 Effects on Household Size

Household demographics are expected to change when adult death occurs. The specific effects of a terminal illness ending in death and an unexpected death may differ with respect to many household level outcomes. However, data is not available on the duration of illness before death, and therefore my analysis focuses on how households that have incurred an adult death in the family affects the household's demographic features, specifically. For household demographics this paper will focus on death's effect on the number of children and adults within a household. The change in the number of adults is measured after controlling for the adult who died. I hypothesize that the number of children living in the household will be affected by adult death as shown in figure 2.

Figure 2 Number of Children living in a Household



A household experiencing an increased drain on its resources, such as a terminal illness, may decide to send unproductive members to live elsewhere. As net consumers of household resources, children may be the first members to be sent to live with other relatives. Thus I hypothesize that the number of children in a household is expected to decrease in the event of an adult death.

The additional needs of care giving during illness and other related household tasks after death may cause the number of adult members to increase due to an adult death (not counting the adult who died). A household with an ill member might find itself allocating more labor to care-giving than it expected. The need would be increased by the presence of a terminally ill individual. This would indeed drain the labor resources of the household. Figure 3 shows that while a household member is ailing the care giving requirement is expected to be higher than before the member fell ill. I hypothesize that the number of care givers would then drop after the member has passed away as shown in figure 3.

Figure 3 Caregiving Needs



At the same time household use of family and hired labor for farm and other income generating activities is hypothesized to decline during an illness because of drains on time having to do with care giving as well as redistributing tasks of members otherwise engaged in farm or wage labor. After the occurrence of an adult death the availability of such labor is expected to decline. The changes in patterns of household use of family and hired labor are dependent on the completeness of labor markets and the budgetary limitations of a household, as well as the marginal product of farm labor(MPL_t) and the market wage(w_m). There are three proposed scenarios:

Figure 4 Sum of Hired and Family Labor



In the first scenario farms are operating under well-functioning labor and credit markets such that there is no difference in any household's use of labor due to adult death. It is only necessary for these households to hire in labor, which is assumed to be available, to compensate for the labor lost from the death of the adult member. However, if budgets are constrained, households may find that they cannot pay the actual marginal productivity for hired laborers, so the second two scenarios may be more plausible. In the second scenario there are two alternatives, 2a) labor markets are imperfect and additional family members are not available to compensate for the loss of a productive member, and 2b) labor markets are imperfect, additional family members are available, but $MPL_f < w_m$. In these alternatives the same result is expected,⁴ a reduction in the number of laborers used on farm. The difference in number of men in a household is one way to estimate the effects of adult death on family labor.

The third scenario is such that labor markets are imperfect, additional family members are available and $MPL_f > w_m$. In this situation these members will work on farm rather than to engage in off-farm employment. Likewise a decision tree could be constructed to demonstrate what may happen to family labor specifically in scenarios two and three.



⁴Noted here is the common practice of having household or family members off-farm working and remitting income back to the farm. Those members remitting income to the farm play an important role in the event of an adult death. As described above, they may indeed come back to the farm in order to further help the family to continue current farm practices. They may alternatively stay off-farm to continue remitting income home (World Bank, 1999).

4.2.2 Effects on Assets

The quantity and value of assets are expected to decline in households incurring a death in the family. Effects on assets may be difficult to measure, though, for households in which the death of a family member is preceded by a long period of illness. Assets may be reduced for many reasons relating to death of a family member. Medical expenses and the loss of any labor income may induce reduction in asset levels. The need for proper funeral and burial arrangements might further reduce household assets. Although, the year of death of a household member will be very important in quantifying its effects on household income, there is little way of knowing where the 1997 survey falls in terms of the time line offered in Figure 5.





If the enumeration of households in 2000 begins somewhere near the death, it would be difficult to measure the effect. If the enumeration began in 1997 before the onset of an AIDS related illness, the results of any subsequent analysis may be far more telling of a pattern of asset reduction. One result of asset level reduction is the loss of productive agricultural assets. This could exacerbate any loss of productivity suffered by a farm.

4.2.3 Effects on Off-farm Income

Off-farm income can be separated into three distinct portions for this framework: 1) Remittance income of other family members not living on the farm, 2) off-farm income of the deceased, and 3) off-farm income of remaining household members living on the farm. The distinctions are important. The income of the deceased is expected to be lost to the household. In order to examine household coping mechanisms I compare off-farm income of surviving household members. Remittance is treated separately as it is not expected to move in the same direction as other income off-farm variables. Off-farm income may be conceptualized this way:

Dis	ease Onset Dea	th
Income of deceased	Zero	
 Remittance income	Remittances possibly increase	
Income of remaining family members	Income of others could remain or decrea	e t

Figure 6 Off-Farm Income

Off-farm income has the potential to progress similarly to labor as the result of an adult death. If the $MPL_f > w_m$ then off-farm income may go down as family members are called back to the farm. The death of an adult may actually provide some opportunities for other adults in the family to now manage the family farm and therefore migrate back to the farm to assume new responsibilities. On the other hand, if $MPL_f < w_m$, then off-farm

income may remain unchanged as members continue in their off-farm employment. Remittances, however, may increase if household members choose to stay away from home instead of returning home because: when a household is in more need there is the possibility that those sending income to the household will increase their remittances.

4.2.4 Effects on Farm-Income

Farm income may be affected in several ways. This analysis considers three variables, 1) area cultivated by a household, 2) crop income per hectare, and 3) differences in yields of specific crops. The only crop examined individually in this paper is maize⁵ as it is the most important and widely cultivated food crop in Kenya, and allows for within-district comparisons for almost all districts. The effects of adult death on farm income are demonstrated in Figure 7.

Figure 7 Farm Income



Many of the same arguments used in subsection 4.2.2 will apply here. 1) With perfect labor markets and unconstrained household budgets, it is likely that the area under cultivation will not change, similarly crop income would not change nor would crop

⁵ A problem of examining the effects of death on maize production is the inability to make gender differentiations in crop cultivation patterns. The death of a male, for example, may decrease cash crop production, but increase food crop production

yields. 2) With a less than optimal amount of labor, it is still possible that area under cultivation would not change, although yield may decrease with lower labor inputs. 3) It is also possible that area under cultivation would decline as a result of reduced labor inputs. In this case, output per hectare may not go down, but overall yield and therefore income would be reduced. Composition of crops cultivated on farm may also change to reflect labor saving strategies being implemented. These strategies may further hurt farm income.

Chapter 5 will explore the hypotheses presented conceptually here, empirically.

5.0 EMPIRICAL SPECIFICATION

This section presents the empirical methodology for analysis. Variables will be included in this study predominantly as differences between 1997 and 2000 survey values. Differencing the data is designed to control for time-invariant unobserved variables and therefore eliminate some of the omitted variable problems that commonly introduce bias in cross-sectional analysis.

For estimation purposes the sample has been aggregated from the individual to the household level, such that all interpretations will be at the household level. It is important to clarify here that most information was available only at the household level, such that aggregation was a necessary step. Individual data was available for non-farm income measures as well as personal characteristics such as education and age. Individual contributions to farm labor were not available, such that all on-farm variables were taken from the household level. The individual information that is included in the estimation process includes the personal characteristics of the deceased household member. The empirical model can be reduced from the following two equations:

- (1) $Y_{i,1997,j} = \alpha_{0,1997} + \alpha_1 X_i + \alpha_2 Z_{1997} + \alpha_3 \Sigma D_j + \varepsilon_i$
- (2) $Y_{i,2000,j} = \gamma_{0,2000} + \gamma_{I}X_{i} + \gamma_{2}Z_{2000} + \gamma_{3}\Sigma D_{j} + \varepsilon_{i}$

Where i is the household and j is the district, Y_i is a vector of endogenous, time-variant, household-level variables, α_0 is a constant, X_i is a vector of characteristics of the deceased individual of the household, Z is a vector of time-invariant variables like soil quality, agroecological profile, access to infrastructure, etc.; D is a vector of district dummy variables, and ε is the error term assumed to be normally distributed with zero mean. Since this paper is comparing specific households across two time periods, the dependent variables are differences(2000 survey-1997survey). Therefore the regressions will be carried out by subtracting equation 1 from equation 2,

$$(3) (Y_{i,2000j} - Y_{i,1997j}) = (\gamma_{0,2000} - \alpha_{0,1997}) + (\gamma_1 - \alpha_1)(X_{i,2000} - X_{i,1997}) + (\gamma_2 - \alpha_2 \Sigma D_j)$$

The time-invariant variables have dropped out of the equation as they are not expected to vary over a three year period. This will eliminate potential bias that would occur in crosssectional data from the omission of relevant time-invariant variables. Equation 3 will reduce to:

(4)
$$(Y_{i,2000,j} - Y_{i,1997,j}) = (\pi_i) + \beta_1(X_i) + \beta_2 \Sigma D_j * 1 + \varepsilon_i$$

Because the X vector is characteristics of the deceased members, they only have observations for 1997 and hence this vector of variables enters the model in levels, not differences, as shown in equation 4.

5.1 Description of Variables

5.1.1 Independent Variables

The X vector includes the following individual-specific information:

a. A 0/1 dummy variable for household incurring an adult death between 1997 and 2000;

b. A 0/1 dummy variable specifying the gender of the deceased adult member (=1 if female);

c. A continuous variable specifying the age of the deceased in 1997 (I also test for nonlinear effects of age of the deceased);

d. A continuous variable specifying the years of education of the deceased;

e. A dummy variable specifying the relationship of the deceased to the head of household

f. A set of 0/1 dummy variables as to whether the household incurred a death in 1997, 1998, 1999, or 2000.

I enter these variables into the model in the following sequence, and report the results for each model in appendix 1:

(5) same as equation (4) with the X vector including only the adult death dummy variable;

(6) same as (4) but with the X vector including the adult death dummy and gender of deceased member dummy;

(7) same as (4) but with the X vector including the adult death dummy, gender of the deceased, age of the deceased, years of education of the deceased;

(8) same as (4) but with the X vector including the adult death dummy, gender of deceased, age of deceased member, years of education of deceased member, relationship to household head dummy, and year of death dummy.

Regressions will also be re-run using the quadratic form of age, with F-tests used to determine its applicability. The quadratic form of age will only be reported if relevant.

The characteristics of deceased household members are hypothesized to be important to explaining the possible impacts of an adult death on the household unit. Age and education level are used here as proxies for human capital. A household would be expected to suffer more severely from a death if the deceased member was an important store of human capital. Gender of the deceased member may also elicit different household responses in bringing in new members or sending others away. The deceased member's relationship to the household head is also expected to play a role in the coping strategies employed by the household, particularly if the member was indeed the

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household head. This variable also plays a role in the human capital assumption. The household head is expected to make important decisions for the household. The loss of this person may be particularly difficult to cope with. To ameliorate the problems of lacking morbidity data, the year of death is included as a dummy variable. This will help to control for timing issues in the dependent variables.

5.1.2 Dependent Variables

Household composition

There are three household composition variables used in this analysis. They are differences in number of women, men and children in a household between the 1997 and 2000 surveys. The differences exclude the effect of the loss of a member due to death, such that the estimation looks at the size of a household excluding the deceased member. A priori expectations of these variables were discussed in Chapter 3, however, it is reinforced here as depending on the timing of the 1997 survey between onset of illness and actual death of a family member. The number of children is expected to decrease in order to reduce the number of net consumers in the household; however, this hypothesis may be reversed if the number of adult household members increased sufficiently to accomodate necessary household functioning. The number of men and women are expected to increase if the household is not able to hire labor to compensate for the loss of an adult and to compensate for the extra labor needed care for an ill adult.

On-farm effects

The variables for farm level effects are differences in value of assets, total crop income and crop income per hectare (the calculation of on-farm income was discussed in chapter

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3), area under cultivation, and maize harvests in 90 kg bags. Depending on the location of the survey on the time line from figure 1, the effects of an AIDS related adult death may vary. If there is compensation within the household as per labor allocation, there may be negligible effects of adult death on income, cultivated area, and harvests. Assets are expected to be liquidated during an illness such that the placement of the 1997 survey may fail to catch a large portion of the actual effect if the onset of illness preceded the 1997 survey. Again, lack of data on morbidity in the data set inhibits effective measurement of the household impact of an AIDS-related death, reflecting the more general effect of an adult death.

Off-farm effects

The change in both off-farm income and number of family members living on farm and engaging in off-farm employment will be analyzed. Off-farm income will be separated into three different variables, 1) difference in off-farm income, this will include labor income and small-medium scale enterprises, 2) difference in farm labor income only, and 3) differences in the value of remittances. The calculation of these income variables are further discussed in chapter 3.

Previous literature finds that remittances will be decreased in the event of an adult death, all other effects held constant (Ainsworth, 1998). This study hypothesizes that while income is expected to go down as a result of adult death, remittance could either stay the same or increase, depending on the marginal productivity of household members in off-farm employment relative to expected returns from reallocating that person back to the farm (which may also involve a combination of farm and off-farm employment, but

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based from the rural domicile rather than from different employment opportunities elsewhere). With greater need on farm, members who live away may send more money home than usual or at least not decrease their contribution.

The last off-farm dependent variable is number of household members engaged in off-farm employment. This variable, like the demographic variables, omits the effect of the deceased member. Therefore, the number of household members engaging in off-farm employment in 1997 was calculated to exclude the deceased member, and then subtracted from the 2000 figure.

District level dummy variables

To control for effects on the dependent variables district level dummy variables were included. The district experiencing neutral effects of the dependent variables were dropped from the analysis. When analysis is presented on the district variables, the comparison to an average district will make the analysis consistent.

Variable	Definition	Mean of differenced variable	Std. Dev.
Dependent Vari	ables (Y _i)		
off-farm income	Change in all labor income, formal and informal, including small-medium scale enterprises (these numbers are gross and overestimated)	-29,334	253,976
farm wage income	Change in labor income, from farm related work	-309	18,001
off-farm employment	Change in number of household members engaged in off-farm employment	0.3746	1.2517
remittance	Change in value of remittances	-5,047	34,178
farmed land	Change in area(ha) under cultivation	0.9377	5.5480
assets	Change in the value of a household's assets	-14,201	203,080
maize harvest	Change in maize harvests in kgs	360	2,981
women	Change in the number of women in a household, excluding the effect of the loss of a female member to death	0.2238	1.2063
children	Change in the number of children in a household	2592	2.1964
men	Change in the number of men in a household, excluding the effect of losing a male member to death	.1941	1.3424
livestock income	Change in livestock income, including sale of livestock and livestock prices	-3,478	63,646
crop income	Changes in both crop income and crop income per hectare will be used	11,095	96,475
crop income per hectare	This will not be done by crop, as area planted to a specific crop is not included in the data	831	27,210
household income	change in total household income, includes crop income, livestock income, remittances and pension, non-farm income, including farm wage income.	-24,313	296,637
Categorical Exp	lanatory Variables	Frequency (number of households reporting a 1)	% households incurring a death reporting a 1
adult deaths	Equals 1 if a household has reported any deaths on the 2000 survey, 0 otherwise	85	100
head deceased	Equals 1 if the household head is dead, 0 otherwise	24	28.23
spouse deceased	Equals 1 if the household head's spouse is dead, 0 otherwise	13	15.30

Table 14. Definition of Variables and Descriptive Statistics

other relative deceasedEquals 1 if the relationship of the deceased member to the household head is other than spouse or actual head, 0 other wise		12	14.12	
sex of deceased	This is a dummy variable taking a value of 1 if the deceased member is female,	39	45.90	
	0 if the deceased member is male	46	54.12	
year of death 1997	This is a dummy variable taking a value of 1 if the death occurred in 1997, 0 otherwise	11	12.94	
1998	takes a value of 1 if the death occurred in 1998, 0 otherwise	26	30.60	
1999	takes a value of 1 if the death occurred in 1999, 0 otherwise	29	34.12	
2000	takes a value of 1 if the death occurred in 2000, 0 otherwise	19	22.35	
Variables in Le	vels:	Mean	Standard Deviation	
education level	Indicates the level of education attained by the deceased, if the household has reported more than one death it equals the highest level of education among the deceased	6.60	4.09	
deceased age	This variable indicates the age of the deceased member	37.53	12.51	
deceased age squared	The age of the deceased member squared, accounts for non-linearity in the age term	1,563	943	
district	Dummy variables for province and district of residence	included in all regressions		

6.0 RESULTS

This section presents the results of the econometric estimation discussed in section 5. There are 4 separate estimations for each dependent variable. They all include district dummy variables as well as the independent variables listed in section five under points 5-

8. The contents of the alternative X vector for each estimation are:

(1) X_1 vector including only the adult death dummy variable;

(2) X_2 vector including the adult death dummy and gender of deceased member dummy;

(3) X_3 vector including the adult death dummy, gender of the deceased, age of the deceased, years of education of the deceased;

(4) X_4 vector including the adult death dummy, gender of deceased, age of deceased member, years of education of deceased member, relationship to household head dummy, and year of death dummy.

Discussion will focus on the results significant at least at the 10% level. This section will be organized according to the following categories of the dependent variable: household demographics, off farm effects and on-farm effects. The first part of each subsection will begin by presenting some of the general predictions. Further sub-sections will discuss significant results in more detail. Results in tables 15-17 highlight some significant results from the regressions. A comprehensive set of regression results is available for all regressions in Appendix 1.

6.1 Household Demographics

The effects of an adult death on household composition are the most interesting of this analysis.⁶ The results are consistent with a priori expectations as well as some of the findings of earlier research presented in the literature review. One key hypothesis was that an adult death in the family would induce other non-resident adults in the family to return to the farm because of increased demands for labor within a household. Number of men and women were estimated separately because the potential effects of an adult death, depending on the individual characteristics of the deceased household member, may be different for men and women.

Table 15 presents the predicted effects of on the change in the number of household members resulting from an adult death. The predicted response is sensitive to the deceased's gender, age, and level of education. For example, the predicted effect of the death of a 35 year old adult male with 4 years of education on the change in number men in a household is 0.38, all else held constant. This prediction is statistically significant at the 5% level as are the predictions shown in table 15 for effects of death on change in number of children. The predictions listed for change in number of women are not significant and are therefore not listed in table 15, however, the analysis will refer to the regression results from Appendix 1: table 1 to discuss significance in the regressions using change in number of women as the dependent variable.

⁶Please note that the dependent variables were constructed to omit the deceased individual in the 1997 totals for both number of men and women.

		Predicted Household Behavioral	Response
Household Member who	Δ # of Women	Δ # of Men	Δ # of Children
died from disease			
Male aged 35, edu: 4yrs	-0.2236	0.38047	0.922
Male aged 35, edu: 9yrs	-0.1166	0.5579	0.8195
Male aged 55, edu: 4yrs	-0.226	-0.3656	-0.468
Male aged 55, edu: 9yrs	-0.119	-0.1881	-0.5705
Female aged 35, edu: 4yrs	0.3495	-0.6275	0.2965
Female aged 35, edu: 9yrs	0.4565	-0.45	0.194
Female aged 55, edu: 4yrs	0.3471	-1.3735	-1.0935
Female aged 55, edu: 9yrs	0.4541	-1.196	-1.196

Table 15. Predicted Effects of Adult Death on Household Composition

"Tegemeo/MSU Agricultural Monitoring and Policy Analysis Household Survey database", 1997 and 2000, Tegemeo Institute, Nairobi, Kenya.

6.1.1 Men

Results reported in Table 15 are predictions based on the combination of age, gender and education of the deceased household member. In the case of change in number of men, these variables are jointly significant at the 5% level.

Education

The general results are interesting across all characteristics of deceased members. As can be seen from table 15, when moving from a deceased member of education 4 years to education 9 years, the effect on the number of men in a household becomes either a larger negative or a smaller positive. This supports the possibility that a member with more education may also spend less time on farm, therefore not requiring replacement from the production side.

⁷Results significant at least at the 10% level of significance are bold in tables 15-17.

With the death of an older woman a household is less likely to increase its number of men than with the death of younger women or men. This may show that the death of a younger person, especially a younger man induces a household to replace adults with men in greater proportion because of family relationships. Tasks carried out by elderly members would be handed over to younger family members, so there is no major labor shock when an elderly person dies. Replacing young adults who have died may manage to preserve the social and familial integrity of the household.

Gender

The death of a fifty-five year old male member has a negative impact on the number of male household members (-0.51). The reasons for these differences may indeed be because of age. The older member may carry a lesser work load such that the death of an older member may not negatively effect the labor supply within the household. If the older member was ill for some time leading up to his death, he may have required more care than any younger members, requiring the extra attention of female members. Upon his death, the members caring for him can take up more farm activities, freeing men to pursue off-farm activities.

The effects of the death of a woman on the number of male household members appears to be negative at all three test ages. The death of a thirty-five year old woman (-0.19), and a fifty-five year old woman (-1.37), both of education 4 years, show that the death of a woman does not increase the demand for male labor within the household. The death of the woman may also lead to husbands or sons losing rights to land in matrilineal

Age

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societies, and so going elsewhere. In patrilineal areas, the death of the woman may induce another caregiver (sister or cousin of the deceased wife) to come into the family while the man goes to work in the town for awhile. Rather the death of these women at different levels and in keeping with their age may indicate the need for fundamental changes in the family structure, including the possibility of men then to leave the household in search of other occupation following the death of a woman. The death of an older woman may induce some male members to leave, especially older male members. They may leave to join households of older children. The exit of older adult members does not indicate the dissolution of the household, as the older members may not make up the core of the household.

6.1.2 Women

The general results relating to the change in number of female adult household members are similar to those reported in 6.1.1 in that the more education the deceased individual has the smaller the negative impact on the number of adult women in the household. It seems very possible that in some cases, it is in the best interest of the household both for productive concerns, food security and even perhaps community relations to send female members away following the death of a member because of their potential worth to the household in bride prices or for any earnings they may get as househelp or other such employment.

Gender and relationship to household head

In the fourth specification of the regression both gender of the deceased member and the spouse of the household head dummy variable were significant (Appendix 1: table

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1). The regression results show that, all else remaining constant, if the deceased member is a woman and the spouse of the household head then the effect of her death on the change of female household members is (-0.56). For a woman who is not the head's spouse the effect is (0.57); for a man who is the spouse of the household head the effect is (-1.13). These results may not be all that surprising as the death of a male spouse may induce female adult members to move to other households. Again this does not necessarily mean the household will dissolve; there are typically more than one male and female adults residing in the household, and these other members may continue to hold the household together. The death of a female spouse may also induce other female members to seek other opportunities, or flee in areas where staying would imply becoming the man's wife.

Age

The third regression using this dependent variable found that the age of the deceased member was significant (Appendix 1: table 1). The death of sixteen year old has a smaller impact (-0.31) than do the deaths of older adults and similarly a thirty-five year old has a smaller impact (-0.68) on the number of women in a household than does the death of a fifty-five year old member (-1.07). These results are somewhat similar to those from the regression using change in men as the dependent variable. A household unit may be more likely to replace younger members than older members because of their potential productivity over time. It may also be easier to replace younger people than older people because of the roles they play in the household and the ease with which a younger person may be called home by older people.

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6.1.3 Children

Change in the number of children resulting from an adult death did not coincide with a priori expectations of a decrease in the number of children. Results presented in Table 15 for change in number of children are jointly significant for the characteristics of the deceased adult presented at the 5% level. These results were contrary to the changes in other household composition shown in table 5. Where number of men and women decreased slightly in response to an adult death, the number of children increased. The results of the regressions mirror this difference.

Age

As Table 15 shows, the younger the deceased adult the more likely the household is to increase its number of children. As of yet the emotional ties to the deceased members have not been discussed. In this case, especially when considering the death of a younger member, additional children in the household following a death may have something to do with pain involved with the loss of a child, albeit an adult-child. Continuing a similar family balance of young and old may also be a priority to families. Furthermore, as the stronger positive effect of the death of a young male as opposed to that of a young female may indicate a balance of labor between young men and women.

Education

Education also seems to have interesting effects on the number of children in a household following an adult death. From Table 15 it can be seen that the higher the education of the individual, regardless of other characteristics, lower the increase in number of children. For younger men and women this effect manifests itself as a smaller

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positive change, while for the death of an older person it shows a larger negative change.

This result may show that households with individuals at a higher level of education may

see the importance of either family planning or relocating children in a crisis situation.

6.2 Off Farm Effects

As is shown in table 16 the predicted values of specified characteristics of deceased members are not as consistent with a priori expectations as they were in the household composition simulations.

Table 16. Predicted Effec	ts of Adult Death on	Off-farm Household Indicat	ors
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	Predicted Household Behavioral Response				
Household Member who died from disease	∆ # of hh members engaged in off-farm employment	∆ in Value of Remittances (Ksh)	∆ in Value of Off- Farm Income (Ksh)	∆ in Value of Farm Wage Income (Ksh)	
Male aged 35, edu: 4yrs	-0.2571	-372	-19939	-225.656	
Male aged 35, edu: 9yrs	0.0369	-822	-34914	-248.976	
Male aged 55, edu: 4yrs	-0.8151	-6472	-81599	1534.344	
Male aged 55, edu: 9yrs	-0.5211	-6922	-96574	1511.024	
Female aged 35, edu: 4yrs	-0.6357	3370	-92252	2484.344	
Female aged 35, edu: 9yrs	-0.3417	2920	-107227	2461.024	
Female aged 55, edu: 4yrs	-1.1937	-2730	-153912	4244.344	
Female aged 55, edu: 9yrs	-0.8997	-3180	-168887	4221.024	

"Tegemeo/MSU Agricultural Monitoring and Policy Analysis Household Survey database", 1997 and 2000, Tegemeo Institute, Nairobi, Kenya.

6.2.1 Off farm labor

The predictions reported for change in number of family members engaged in offfarm labor are statistically significant at the 10% level. Regression results do not include the off-farm labor hours of the deceased individual.

Age

Generally the more negative impacts on change in members engaged in off-farm employment come when the deceased members are older members. This could be due to the important role that older members play in the household's everyday activities as well as the household's social fabric. The loss of older members may signal the need for others to take over the care of young children. Since the regressions done on household composition indicate that the death of an older member does not positively effect the number of adults, then it stands to reason that instead of increasing the number of adults on farm, a household may just require the remaining adults to spend more of their time on farm.

Education

As table 16 shows, the more education the deceased member has the smaller the negative impact or larger the positive impact on the members engaged in off-farm employment. These results may say something about the education of the other household members or it may indicate the perceived value of household members' time spent on-farm. It is possible that the deceased member with more education spent less time on farm, such that replacing their income is better done off-farm. This may be especially true in the case of the young member with a large number of years of education. This household member is likely to have spent a good deal of his or her time off farm anyway, such that sending another member off-farm for employment in their absence doesn't necessarily take away from existing family labor availability.

6.2.2 Remittances

Gender

Table 16 predicts that the impact of various sets of characteristics of a male death in the household will increase the value of remittances sent to the household. However, if the deceased member is a woman, her death will decrease the value of remittances received by the household. An observation of Kenyan culture is that often women are sent to other areas as house-help with the agreement that they will send their earnings home. The death of a female member may require the return to the household of those women off-farm and remitting income. Therefore, this prediction seems to keep with a priori expectations as well as observed family structure. The opposite effect of the death of males on remittances may indicate that with the loss of a male, and a strong tendency for males to join the household, women are indeed seeking other opportunities for outside employment.

Adult death

The effect of adult death on remittance income was hypothesized in section 4 to cause no change or perhaps an increase in the level of remittances to the suffering household. However, the only regression using change in value of remittances received by a household that had significant results was the first regression (Appendix 1: table 8) which uses only the adult death dummy and district dummies as explanatory variables. This regression shows a negative impact of adult death on remittances (-6441). This may be in part due to the loss of any remittance income from the deceased member or the return of other household members who had been earning remittance income to the household.

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The results of changes in household composition are consistent with this finding. As members previously working off the farm are called back to the farm in response to another adult member's death, the income that they might have been remitting dries up when they migrate back.

6.3 On Farm Effects

An interesting outcome in Table 17 is that for every prediction except that associated with crop income per hectare, the value of the prediction is negative. The special role of older women in a household has already been touched upon in earlier discussion. It is highlighted again here as many of the predicted effects of the death of an older woman for on-farm indicators are negative. Women are understood to do a large portion of the farm work such that the loss of a woman may be more devastating to crop income and maize harvests. The cause of negative impacts on total household income may stem from the effects of the death of an older woman on household composition and off-farm income indicators. If a younger woman comes home to replace an older women, and off-farm income decreases, the loss of the older woman and her farm experience causes crop income to decrease, then total household income may also decrease.

6.3.1 Crop Income and Crop Income per Hectare

Education

The loss of a well educated man may reduce the farm management capacity, or the farming expertise of a household. Therefore the loss of such human capital could justifiably reduce the productivity per hectare of land. The same result does not hold for a well educated woman, although her loss does increase crop income per hectare less than

the loss of a less educated woman.

Gender

While table 6 shows that crop income per hectare increases between 1997 and 2000, it is not what was hypothesized in section 4. The second regression using crop income per hectare as the dependent variable (Appendix 2: table 3) shows that if the deceased member is a woman, then crop income increases ksh 9772 all else remaining constant. This result makes less sense when considering the regression on household composition. The death of a woman in those regressions does not seem to increase the number of men or the number of women in the household. Perhaps the positive effect of an adult death on the change in the number of a household's children has something to do with this, if the children are working. Also any new members with special skills or trading businesses may have something to do with this result.

	Predicted Household Behavioral Response						
Household Member who died from disease	Δ # of hectares under crops	∆ value of Crop Income (Ksh)	∆ value of Crop Income per Hectare (Ksh)	Δ value of Livestock Income (Ksh)	∆ in quantity Maize Harvest	∆ in total household asset value (Ksh)	Δ in total household income (Ksh)
Male aged 35, edu: 4yrs	-0.9416	-11,320	1,897	5,728	-239	-4,217	-27,268
Male aged 35, edu: 9yrs	-0.6421	-15,055	-2,353	1,538	-139	-20,637	-50,713
Male aged 55, edu: 4yrs	-1.7036	-31,960	437	2,108	-699	-41,357	-125,688
Male aged 55, edu: 9yrs	-1.4041	-35,695	-3,813	-2,082	-599	-57,777	-149,133
Female aged 35, edu: 4yrs	-1.5967	13,505	12,210	-2,061	-26	-32,453	-76,815
Female aged 35, edu: 9yrs	-1.2972	9,770	7,960	-6,251	74	-48,873	-100,260
Female aged 55, edu: 4yrs	-2.3587	-7,135	10,750	-5,681	-486	-69,593	-175,235
Female aged 55, edu: 9yrs	-2.0592	-10,870	6,500	-9,871	-386	-86,013	-198,680

Table 17. Predicted Effects of Adult Death on Farm Household Level Indicators

"Tegemeo/MSU Agricultural Monitoring and Policy Analysis Household Survey database", 1997 and 2000, Tegemeo Institute, Nairobi, Kenya.

7.0 CONCLUSIONS

The above analysis shows the households included in the data that are recovering from an adult death have compensated in large part through changes in household composition, which have led to decreased remittances and fewer members engaged in offfarm work. These strategies are completely understandable as households attempt to continue functioning as close to "normal" as they can. The importance of education in reducing a household's need to replace adult members demonstrates what education can do to reduce dependence on one activity. In Kenya, many rural households have diversified into areas outside of farming because the education of young members presented opportunities not available before.

However, with the loss of the intermediate generation, traditional knowledge can be lost. The ability of households to cope with the loss of external income, and the loss of expertise in farming or animal husbandry passed from parent to child, will leave them without formal and informal education. As dependency ratios are increasing in Kenya, the number of children in the care of the elderly becomes higher and higher. The environment for education and knowledge transference is strained.

Adult death is a very difficult subject to tackle. A deepening crisis of adult death, especially one related to such a controversial disease as HIV/AIDS, can make quantitative work even more difficult. The differing epidemiological patterns of HIV/AIDS compared to other diseases such as Malaria show a need to look at these diseases separately. However, finding specific data on HIV/AIDS is very difficult where families do not necessarily volunteer such information.

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Farm households in particular are of great concern in this field as agriculture is so crucial to the development food security and stable economies in Kenya and in other developing countries. While an urban bias in many societies can sideline the importance of investing in the health and well being of the rural sector, more research such as this shows that a crisis in the rural areas could easily transmit to a crisis in urban areas. Labor availability as well as food availability are important considerations.

With the understanding that adult death is not decreasing in SSA, relief, development, and technology development and transfer organizations, and governments need to ensure that the activities they pursue are mindful of possible labor shortages, and increased morbidity and mortality. New technologies cannot be labor intensive. Rather, labor saving technologies will do the most to help households cope with less labor, and to hopefully continue off-farm enterprise and education.

Continuing the research on off-farm effects such as remittances in households who have experience an adult death can it shed light on the deepening crisis of adult-death that is expected in SSA, and may help to explain urban effects as well. If the food security crisis is observed to be worse for farm families, implications for city families could be observed concurrently. The possibility that an urban to rural population drain may occur is another issue, which may be captured in looking at effects on remittances as well as offfarm income between households with and without adult death.

NGO's and government agencies might be able to target their services dependent on whether the most vulnerable households are those with diverse income bases or mainly farming households. Implementing services for households consisting primarily of elderly

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and very young members would be a major priority as these are marginal households with little ability to cope with any further crisis.

To understand more fully the coping mechanisms employed in across small farm households, tracking families who have experienced adult illness and death over many years is important. It is also important to track their members and where they go if indeed they leave the farm for other opportunities. Decisions taken by households thought to be dissolved may offer lessons on how to preserve household integrity or on what other options exist for struggling households. Members of dissolved households may give insights on what is to come for other households as adult death becomes more common.

Concerted efforts in recording morbidity information for rural households in future research will allow researchers to more accurately characterize the process of coping from disease onset to death. Loss of assets and drain on labor resources are likely to be felt very intensely during a terminal illness. Results showing this information will be equally interesting to researchers and policy makers as the actually results relating to adult death.

Social services and infrastructure to help households as they cope with these difficulties may be better targeted with research such as what is presented as well as what is suggested. With a knowledge of areas where the crisis is most developed governments and other organizations can gauge where information dissemination regarding measures to be taken for prevention and treatment of HIV/AIDS should be focused. Facilities for care of orphans, or patients may be needed more acutely in certain areas, especially in Western Kenya for instance. Communication between various stakeholders in the country should be facilitated such that efforts towards prevention and education would not be redundant.

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Rather governments, the private sector, NGO's, and churches, among others, should have a consistent message and methods.

The above analysis leaves many questions concerning the ability of households to effectively cope with adversity with traditional mechanism in this special situation. Ultimately this research is about people who face an already difficult set of factors regarding choices dictating their health and well being. Trade-offs between healthy and unhealthy options can be unclear. Diverting the attention of policy makers, donors, NGO's or relief organizations from long term sustainable development operations to HIV/AIDS prevention or treatment would have detrimental effects on other areas of concern within the developing world. It is, however, crucial to remember that this crisis factors into people's lives more and more. Ensuring an HIV/AIDS component in poverty reduction strategies will allow development to hopefully progress while also trying to slow the advancement of adult death. **APPENDICES**

Appendix 1. Regression results

This appendix presents the regression results for all dependent variables except crop income, crop income per hectare and total household income. The latter three will be presented in appendix 2. There are four separate versions of the regression reported for each dependent variable. Please note the following:

1. All regressions include district dummy variables,

2. Coefficients are reported with the absolute value of the corresponding t-statistics

reported in parentheses directly below,

3. Significance is indicated by an asterisk (*=10%, **=5%, ***=1%).

	Regression 1	Regression 2	Regression 3	Regression4
Adult Death	0.1426	-0.1237	0.5553	-0.305
	(1.036)	(0.671)	(0.949)	(0.432)
Sex of Deceased		0.5724**	0.4564	0.5731*
		(2.171)	(1.629)	(1.898)
Age of Deceased			-0.0194*	-0.0001
•			(1.739)	(-0.008)
Education of			0.0159	0.0234
Deceased			(0.477)	(0.639)
Deceased				-0.2924
Member: Household Head				(0.706)
Shouse of Head				-1 1345***
Spouse of ficau				(2.649)
Death Occurred				0.2498
in: 1998				(0.564)
1999				0.1416
-				(0.320)
2000				0.7958
				(1.713)

Table 1. Change in 3	Number	of V	Vomen
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	Regression 1	Regression 2	Regression 3	Regression4
Adult Death	0.2937**	0.6924***	1.9676***	1.5439**
	(1.917)	(3.382)	(3.036)	(1.967)
Sex of Deceased		-0.8568***	-1.075***	-1.008***
		(2.925)	(3.461)	(3.002)
Age of Deceased			-0.037***	-0.0372**
C			(2.995)	(2.249)
Education of			0.0334	0.0355
Deceased			(0.901)	(0.955)
Deceased				0.2095
Member:				(0.455)
Household Head				
Spouse of Head				0.1229
				(0.258)
Death Occurred				0.0681
in: 1998				(0.138)
1999				0.4244
				(0.864)
2000				0.6332
				(1.226)

Table 2. Change in Number of Men

	Regression 1	Regression 2	Regression 3	Regression 4
Adult Death	0.1342	0.4533	2.8965***	3.4365***
	(0.531)	(1.34)	(2.70)	(2.650)
Sex of Deceased		-0.6857	-1.1043**	-0.6254
		(1.416)	(2.149)	(1.127)
Age of Deceased			-0.0551***	-0.0695**
-			(2.687)	(2.541)
Education of			-0.0279	-0.0206
Deceased			(0.456)	(0.334)
Deceased				0.9685
Member:				(1.272)
Household Head				
Spouse of Head				-0.3768
				(0.479)
Death Occurred				-0.2776
in: 1998				(0.341)
1999				-1.2267
				(1.511)
2000				0.0906
				(0.106)

Table 3. Change in Number of Children

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_	Regression 1	Regression 2	Regression 3	Regression4
Adult Death	-0.0368	0.0613	0.6998	0.4842
	(0.260)	(0.323)	(1.162)	(0.664)
Sex of Deceased		-0.211	-0.3196	-0.3786
		(0.776)	(1.108)	(1.214)
Age of Deceased			-0.0261**	-0.0279*
			(2.273)	(1.815)
Education of			0.0603*	0.0588*
Deceased			(1.752)	(1.702)
Deceased				0.0158
Member:				(0.037)
Household Head				
Spouse of Head				0.4856
				(1.098)
Death Occurred				0.0559
in: 1998				(0.122)
1999				0.4115
				(0.902)
2000				0.3707
				(0.773)

Table 4. Change in Number of Household Members Engaged in Off-farm Employment

"Tegemeo/MSU Agricultural Monitoring and Policy Analysis Household Survey database", 1997 and 2000, Tegemeo Institute, Nairobi, Kenya.

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	Regression 1	Regression 2	Regression 3	Regression4
Adult Death	0.6958	1.2962	0.7281	0.1523
	(1.101)	(1.531)	(0.270)	(0.047)
Sex of Deceased		-1.2906	-1.1929	-0.6551
		(1.065)	(0.925)	(0.472)
Age of Deceased			0.0079	-0.0381
C			(0.154)	(0.556)
Education of			0.0347	0.0599
Deceased			(0.226)	(0.390)
Deceased				3.3143*
Member: Household Head				(1.793)
Spouse of Head				-0.0726
				(0.037)
Death Occurred				-0.5599
in: 1998				(0.275)
1999				3.549
*				(1.746)
2000				-0.3783
2000				(0.177)

Table 5. Change in Number of Hectares Cultivated

	Regression 1	Regression 2	Regression 3	Regression 4
Adult Death	1788	10138	80261	73914
	(0.077)	(0.327)	(0.814)	(0.619)
Sex of Deceased		-17950	-29995	-28236
		(0.404)	(0.635)	(0.552)
Age of Deceased			-1160	-1857
-			(0.616)	(0.736)
Education of			-3218	-3284
Deceased			(0.571)	(0.580)
Deceased				24267
Member:				(0.246)
Household Head				
Spouse of Head				9604
				(0.133)
Death Occurred				51492
in: 1998				(0.686)
1999				10580
				(0.141)
2000				20048
				(0.255)

Table 6. Change in Value of Assets

	Regression 1	Regression 2	Regression 3	Regression4
Adult Death	-73.57 (0.221)	-198 (0.445)	506 (0.357)	486 (0.283)
Sex of Deceased		268 (0.421)	148 (0.218)	213 (0.290)
Age of Deceased			-20.30 (0.750)	-22.88 (0.631)
Education of Deceased			17.39 (0.215)	19.55 (0.240)
Deceased Member: Household Head				231 (0.229)
Spouse of Head				-321 (0.308)
Death Occurred in: 1998				194 (0.180)
1999				55.23 (0.051)
2000				-89.35 (0.079)

Table 7. Change in Kgs of Maize Harvested

	Regression 1	Regression 2	Regression 3	Regression4
Adult Death	-6441* (1.650)	-6571 (1.256)	-2226 (0.134)	10663 (0.530)
Sex of Deceased		279 (0.037)	-467 (0.059)	3742 (0.435)
Age of Deceased			-72.22 (0.227)	-305 (0.719)
Education of Deceased			-197 (0.208)	-89.53 (0.094)
Deceased Member: Household Head				13626 (1.154)
Spouse of Head				-11436 (0.937)
Death Occurred in: 1998				-4854 (0.384)
1999				-9254 (0.734)
2000				-18606 (1.405)

 Table 8. Change in Value of Remittances

	Regression 1	Regression 2	Regression 3	Regression4
Adult Death	-32221	-3293	104815	99946
	(1.127)	(0.086)	(0.861)	(0.678)
Sex of Deceased		-62184	-80734	-72313
		(1.134)	(1.384)	(1.147)
Age of Deceased			-2078	-3083
-			(0.893)	(0.991)
Education of			-3280	-2995
Deceased			(0.474)	(0.429)
Deceased				59761
Member:				(0.691)
Household Head				
Spouse of Head				56835
				(0.636)
Death Occurred				-43335
in: 1998				(0.468)
1999				61736
				(0.669)
2000				15450
				(0.159)

Table 9. Change in Value of Off-farm Income

	Regression 1	Regression 2	Regression 3	Regression4
Adult Death	1365	1031	-3243	-3287
	(0.660)	(0.372)	(0.368)	(0.308)
Sex of Deceased		718	1449	2710
		(0.181)	(0.344)	(0.594)
Age of Deceased			111	88.36
-			(0.659)	(0.392)
Education of			-34.22	-4.66
Deceased			(0.068)	(0.009)
Deceased				2766
Member:				(0.442)
Household Head				
Spouse of Head				-1269
				(0.196)
Death Occurred				-1409
in: 1998				(0.210)
1999				-854
				(0.128)
2000				1107
				(0.158)

Table 10. Change in Value of Farm Wage Income

	Regression 1	Regression 2	Regression 3	Regression4
Adult Death	-2113	2207	23022	15415
	(0.289)	(0.225)	(0.738)	(0.408)
Sex of Deceased		-9287	-12863	-7789
		(0.662)	(0.861)	(0.482)
Age of Deceased			-344	-181
-			(0.578)	(0.227)
Education of			-958	-838
Deceased			(0.537)	(0.468)
Deceased				2426
Member:				(0.109)
Household Head				
Spouse of Head				-15928
				(0.695)
Death Occurred				-142
in: 1998				(0.006)
1999				-8055
		•		(0.341)
2000				12957
				(0.521)

Table 11. Change in Value of Livestock Income

Appendix 2. Regression Results

The results presented here are mostly for comparison. Remember that the analysis uses the regression results associated with constant 1997 prices; note again that all prices have been inflated to 2000 terms. The comparison is between regression run using the constant price approach and regressions run using 1997 prices in 1997 and 2000 prices in 2000, again all prices inflated to 2000. Please note:

1. All regressions include district dummy variables,

2. Coefficients are reported with the absolute value of the corresponding t-statistics reported in parentheses directly below,

3. Significance is indicated by an asterisk (*=10%, **=5%, ***=1%).

	Regression 1	Regression 2	Regression 3	Regression 4
Adult Death	-3322	-11623	11142	27787
	(0.314)	(0.820)	(0.247)	(0.509)
Sex of Deceased		17843	13934	24825
		(0.880)	(0.646)	(1.063)
Age of Deceased			-397	-1032
C			(0.461)	(0.896)
Education of			-928	-747
Deceased			(0.360)	(0.289)
Deceased				33869
Member:				(1.058)
Household Head				
Spouse of Head				-5384
				(0.163)
Death Occurred				727
in: 1998				(0.021)
1999				-18739
				(0.548)
2000				-6848
				(0.191)

Table 1. Change in Crop Income (Constant 1997 prices)

	Regression 1	Regression 2	Regression 3	Regression4
Adult Death	609	-6097	15717	30006
	(0.058)	(0.434)	(0.352)	(0.555)
Sex of Deceased		14417	10675	21589
		(0.718)	(0.499)	(0.934)
Age of Deceased			-427	-1240
-			(0.501)	(1.087)
Education of			-620	-463
Deceased			(0.243)	(0.181)
Deceased				39880
Member:				(1.258)
Household Head				
Spouse of Head				4089
				(0.125)
Death Occurred				8036
in: 1998				(0.237)
1999				-12540
				(0.371)
2000				665
				(0.019)

Table 2. Change in Value Crop Income

	Regression 1	Regression 2	Regression 3	Regression4
Adult Death	-243 (0.079)	-4789 (1.164)	1726 (0.132)	7852 (0.496)
Sex of Deceased		9772 * (1.660)	8646 (1.381)	10313 (1.523)
Age of Deceased			-10.84 (0.043)	-73.36 (0.220)
Education of Deceased			-857 (1.147)	-850 (1.132)
Deceased Member: Household Head				2097 (0.226)
Spouse of Head				-708 (0.074)
Death Occurred in: 1998				-2660 (0.268)
1999				-10467 (1.056)
2000				-3180 (0.305)

Table 3. Change in Crop Income per Hectare (Constant 1997 prices)

	Regression 1	Regression 2	Regression 3	Regression4
Adult Death	430 (0.139)	-3471 (0.839)	4040 (0.307)	11969 (0.752)
Sex of Deceased		8386 (1.417)	7091 (1.126)	9185 (1.349)
Age of Deceased			-54.51 (0.217)	-176 (0.526)
Education of Deceased			-746 (0.993)	-742 (0.983)
Deceased Member: Household Head				4046 (0.433)
Spouse of Head				1593 (0.165)
Death Occurred in: 1998				-2900 (0.29)
1999				-12060 (1.21)
2000				-3338 (0.319)

Table 4. Change in Value of Crop Income per Hectare

	Regression 1	Regression 2	Regression 3	Regression4
Adult Death	-45221	-21835	145424	163723
	(1.355)	(0.488)	(1.024)	(0.951)
Sex of Deceased		-50272	-78976	-49547
		(0.786)	(1.160)	(0.673)
Age of Deceased			-3158	-4921
C			(1.164)	(1.355)
Education of			-5427	-4689
Deceased			(0.668)	(0.575)
Deceased				112940
Member:			,	(1.119)
Household Head				
Spouse of Head				21514
				(0.206)
Death Occurred				-46813
in: 1998				(0.433)
1999				25510
				(0.237)
2000				582
				(0.005)

Table 5. Change in Value of Total Household Income (Constant 1997 prices)

	Regression 1	Regression 2	Regression 3	Regression4
Adult Death	-37556	-17196	133008	145912
	(1.209)	(0.413)	(1.005)	(0.910)
Sex of Deceased		-43767	-69539	-41736
		(0.734)	(1.097)	(0.609)
Age of Deceased			-2902	-4648
C			(1.148)	(1.374)
Education of			-4496	-3839
Deceased			(0.594)	(0.505)
Deceased				108311
Member:				(1.152)
Household Head				
Spouse of Head				25556
				(0.263)
Death Occurred				-32843
in: 1998				(0.326)
1999				25242
				(0.252)
2000				11897
				(0.113)

Table 6. Change in Value of Total Household Income

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