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MINAGRI

Research Report

**Prime-Age Adult Morbidity and Mortality in Rural Rwanda:
Effects on Household Income, Agricultural Production, and Food
Security Strategies**

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Prime-Age Adult Morbidity and Mortality in Rural Rwanda: Effects on Household Income, Agricultural Production, and Food Security Strategies

I. Background and Objectives

Farmers in rural Rwanda have had to deal with many shocks in recent years. Increasing civil unrest in the early 1990s led to intense conflict in 1994, with almost one million people killed, large numbers of people fleeing into exile, others returning after years of exile, and still others facing uncertainty in land use rights. Adding to the stress are climatic variations with partial drought in 1999/2000. Malaria, tuberculosis and dysentery are now joined by HIV/AIDS as health related risks for farm households, hitting working age adults as well as elderly and children. With an estimated HIV infection rate of between 8.9% and 11.2 % for the adult population,¹ Rwanda is facing the loss of thousands of prime-age adults in the coming years. However there are no household-level studies of the characteristics of households receiving these shocks, comparing the behavior of households who are not experiencing these shocks.

The primary objective of this study is therefore to understand specific effects felt by the households when a member is ill or dies, and the strategies that the households develop to deal with the shocks and stress, particularly for their agricultural production. The present report will present basic descriptive information and tabular analysis conducted. A follow up report will focus on more complex analysis of the basic information, as well as more complete integration of all the data available on the sample households.

Although the study is not an HIV/AIDS study *per se*, prime age adults who are chronically ill or who have died of illness have a high probability of being HIV positive. Without robust medical tests, HIV status is not known for certain, and seems to be underreported as a cause of death in Rwanda (Hess 2002). Since malaria and other diseases can be more severe for a person with a compromised immune system, separating out the causes is difficult. By focusing on prime age adult illness and death, the research contributes to discussions on the effects of these shocks on rural households and agriculture, in light of the growing importance of morbidity and mortality associated with the HIV/AIDS epidemic. As noted by Baylies (2002), HIV/AIDS shocks may be similar to other shocks for the households, but there are also aspects that make them distinct from other shocks. Gillespie, Haddad and Jackson (2001) provide insight on why these shocks are different: 1) the long period of illness prior to death; 2) fatal and incurable; 3) possibility of other adults being infected as well; and 4) the alienation of persons with HIV/AIDS in the society. In addition, with high population densities and 90 percent of the population in rural areas, the effects of HIV/AIDS and other illnesses in Rwanda may differ from those in areas with less population pressure on resources, especially on land.

Adults between the ages of 15 and 60 are termed “prime-age” (PA) adults for they are in their most productive working years. At this time, they can most contribute to labor and income in rural households. Rwandan households are generally nuclear families, often comprising 2 to 3 PA adults with 2 to 4 children. When these PA adults become chronically ill, they change from productive members to members requiring care and medicines, no longer working in the fields or elsewhere. With death, funerals add expenses, but even more profound can be the effects of lost labor and skills. Each household chooses ways to deal with illness and death, but their choices are affected by public and private interventions to assist the families in

¹ UNAIDS (2002) estimates 8.9% rate while the 2000 Demographic and Health Survey estimates 11.2% (Ministry of Health, Rwanda 2001).

difficult times. Ideally public assistance programs to ameliorate the consequences of adult disease and death need to complement household and community strategies. Policy makers need to understand which households most frequently experience PA adult morbidity and mortality in the rural areas. Are these households different from other rural households, given all the additional stresses in the environment? With knowledge, the public sector is better able to develop programs that do not undermine, but rather support, the household's own strategies for dealing with illness and death.

II. Previous Work On HIV/AIDS And Its Effects On Agriculture

Researchers have posited many possible effects and the appropriate interventions to assist households under stress based on hypothesized effects on labor supply, knowledge, assets, and future prospects (Whiteside 2002; Gavian 2002; Gillespie and Haddad 2002; Gillespie, Haddad and Jackson 2001). For Malawi, Ngwira et al (2001) posited various links between agriculture and HIV/AIDS. They suggest that poverty and poor agricultural production can be related to malnutrition and increased susceptibility to HIV/AIDS infection. Agricultural activities may promote poles of gathering, such as markets and plantations, increasing situations of risk.

In the past five years, there has been a rapid increase in the number of microeconomic studies developed to understand the effects on households. Barnett (2002) cites several household studies in Uganda, Zimbabwe, Malawi and Kenya that show how agricultural production and land use changes with HIV/AIDS and other illnesses causing death of PA adults. Cash cropping may be reduced; less land may be cultivated; diversity of diet may be lessened as crop production focuses on the main staple crops; weeding and insect prevention may be reduced, resulting in lower land productivity of crops. The Malawi study by Shah et al (2002) is similar to the current study in that it works with the households to determine what they perceive to be the effects and their strategies to deal with death due to illness. A recent study in Uganda (MAAIF/Uganda and IP/FAO, 2002), where HIV/AIDS is cited by households as a cause of death, shows a range of agricultural effects and responses of households. In the Uganda study, small landowners, those with less than 8 acres, are seen to cultivate less land due to deaths, as well as to reduce weeding and other productivity enhancing practices that require labor. As the MAAIF/Uganda and IP/FAO report states, "HIV/AIDS was reported to have resulted in depletion of labour force, increased workload, poor management and care of gardens/fields, increased dependency burden, loss of skills and knowledge, income disruption, loss of time, land and property grabbing" (p.viii).

A recent Tegemeo Institute/MSU study in Kenya (Yamano and Jayne 2002) was based on a nationally representative panel data set of rural households visited first in 1997 and then revisited in 2000. Among other aspects of the study, they evaluated changes in off-farm income, crop production, assets, and household demographics for households with PA adult mortality, compared to households that suffered no such deaths. Fixed-effects models determined important differences between households. They found that the age range, gender, and role in the household of the adult who died are important in determining the effects and the severity of changes. When a male household head dies, off-farm income and cash crop production are more affected, whereas when a female head or spouse dies, there is a greater decline in cereals production. Critical to this work is the development of a panel set of representative households that are followed through time.

There is no systematic and representative empirical study in Rwanda that examines which households are most affected and how they respond in their cropping and related livelihood decisions. Given the high population density and low average household cultivated land area

(0.6 ha per household in Mpyisi, Shingiro and Nyarwaya, 2002), the dynamics of labor and land allocation might be quite different from areas with lower land constraints. In a relatively early study of the agricultural impacts of HIV/AIDS, Gillespie (1989) attempted to assess how households in Rwanda might be affected based on assumptions regarding prevalence, projected deaths, labor allocation to agriculture by gender, and farming systems in 5 zones of Rwanda, with 260 households in the study. For each of the main crops for four seasonal periods (November, February, May and August), Gillespie (1989) estimated a labor balance, based on labor availability of men and women and labor requirements of the crop estimated for men and women, using household labor data. In general, women were found to work more intensively in food crops with men investing more time in cash crops, although both men and women worked on most crops.² Gillespie posits that the loss of male labor would be particularly hard on households in which female labor is already highly occupied, such as in the volcanic highlands. The loss of female labor may not be as negative for the household, for the remaining males have time available that could be more intensively used, but the range of food crops might be reduced, as males continue their cash cropping. The results of this work suggest that households may develop different strategies based on different cropping environments, as well as labor availability in the household and the gender of the person who has died.

The Gillespie study above used economic logic to understand the potential variations in effects on households in Rwanda. It was not based on a panel set, such as that developed in Kenya. While the current study is not a full panel, as will be seen below, it goes a step further than other work in Rwanda, to ask households about morbidity and mortality and its effects, as well as how they deal with them, while also tracking agricultural production and land use.

III. Data and Methodology

Collaboration between MINAGRI and MINECOFIN has produced four household surveys with overlapping samplings: 1) FSRP/DSA production and land use survey; 2) FSRP/DSA Demographic survey (Feb 2001); 3) FSRP/DSA rural labor and death history survey (RLDS); and 4) the Household Living Standards Survey (EICV)³. All four surveys used nationally representative samples for rural residents and the samples overlapped for 1395 rural households, allowing sharing of variables from the same households across the studies.^{4,5} The latter three surveys obtained information at a household-member level as well.

² See Gillespie 1989 for labor allocation by crop by gender.

³ Known by its French acronym, EICV, which stands for Enquête Intégrale sur les Conditions de Vie des ménages. For more information, see MINECOFIN, 2002.

⁴ For more information on the FSRP/DSA production and land use surveys, see Mpyisi, Edson, Emmanuel Shingiro, and Jean-Baptiste Nyarwaya. *Statistiques Agricoles: Production Agricoles, Elevage, Superficies et Utilisation des Terres, Année Agricole 2000*. Ministry of Agriculture, Animal Resources, and Forestry, Food Security Research Project and Division of Agricultural Statistics. Document No. 4F. Kigali, 2001 available at <http://www.aec.msu.edu/agecon/fs2/rwanda/anneeagricole.pdf>; and Mpyisi, Edson, Emmanuel Shingiro, and Jean-Baptiste Nyarwaya. *Statistiques Agricoles: Production Agricoles, Elevage, Superficies et Utilisation des Terres, Année Agricole 2001*. Both production reports are available at the following website: <http://www.aec.msu.edu/agecon/fs2/rwanda/index.htm>. Ministry of Agriculture, Animal Resources, and Forestry, Food Security Research Project and Division of Agricultural Statistics. Document No. 5F. Kigali, 2002. For the EICV survey, see MINECOFIN (Ministry of Finance and Economic Planning). *A Profile of Poverty in Rwanda: A Report Based on the Results of the Household Living Standards Survey*; English Version; Ministry of Finance and Economic Planning; Kigali, Rwanda, February 2002 available at <http://www.minecofin.gov.rw/>.

⁵ See <http://www.aec.msu.edu/agecon/fs2/rwanda/index.htm> for the Survey Instrument for the recent FSRP/DSA survey.

Basic cropping information was collected through seasonal visits for three years with 1584 households nationally. The RLDS re-visited the same households with a single-visit survey asking about the prior four years of history of mortality and recent morbidity of each household member, effects of both morbidity and mortality and strategies to respond to the effects on agricultural and livestock activities, as well as non-farm income activities. The EICV survey used multiple household visits to collect information on household income and expenditures, which are used here to develop poverty indicators for each household.

Combining the supplementary information on morbidity and mortality with the FSRP/DSA production and land use data, FSRP/DSA demographic data, and EICV general socio-economic data provides an unusual opportunity to improve our understanding of how rural households in Rwanda respond to illness and death. In particular, we hope to better understand the effects on household labor allocation across different activities (cropping, livestock, and non-farm) and the impact on household income and food security.

Of the 1584 households initially interviewed in the FSRP/DSA Demographic survey in February 2001, interviewers were able to re-interview 1520 in the 2002 RLDS,⁶ a retention rate of 96%. There were 64 households not retained in the sample. After talking to neighbors and relatives, interviewers indicated that, of the 64 households, 45 households had moved away for a variety of reasons (looking for more fertile land, jobs, or other non-specified reasons), 6 households had deaths in the household⁷, 3 households had illnesses/disability reportedly unrelated to HIV/AIDS, one household was uncooperative, and in one household, the female head re-married into a new family. There were 8 households for which no further information is available on why they were not re-interviewed.

Of the 45 households who moved away for non-specified reasons, we believe that death was not the main factor. In general, there is high mobility in rural Rwandan families, mobility that may in part be responsible for rising rural prevalence of HIV/AIDS. The year 2001 saw a dramatic increase in the number of household members leaving relative to the previous 3 years, and 2002 looks to be similar, given the 3 months of data. Most respondents indicated the migration/loss of a given member was to find a job or for reasons other than death or illness. For women, marriage was a major reason for leaving in 2001, but for the first three months of 2002, finding a job and other reasons were just as important for women as for men. Among PA new arrivals, approximately 20% moved for job related reasons,⁸ while 18% came because of marriage and 14% did not specify the reason. Only about 11% of new PA arrivals were related to death or illness.⁹

With a retention rate of 96%, we believe the remaining households will provide a good basis on which to assess the impact of mortality and morbidity in rural Rwanda. However, since some of the households that are no longer in the sample dissolved or moved due to death and/or chronic illness of a member, there is an attrition bias that will lead us to underestimate the negative effects. The households with death or chronic illness still in the sample may be those households that have been able to use strategies to keep the household in place, with the worst outcomes occurring in households that have dissolved.

⁶ The EICV overlap is 1395 households. We do not account for the sample attrition for the EICV survey.

⁷ One of these deaths was an elderly person and is therefore unrelated to the prime age effects that this study attempts to address. We were unable to locate remaining household members in the area for these 6 households.

⁸ 14.4% moved to look for or take a job, while 5.7% moved back to the household from a job.

⁹ About of 4.6% of new prime age adults arrived because of death in another household, 5.2% due to death in this household, 1.1% of incoming adults are orphans, while 1.2 % moved in due to illness of himself or herself or someone else.

The RLDS research design drew on similar work by Michigan State University undertaken in Kenya, Zambia, and Mozambique. In each country, the research was developed with local researchers and thus the survey design varied, as did the availability of complementary data on the households. In Rwanda, the basic research design was adapted with the assistance of local health experts, whose skills complemented the agricultural background of the FSRP/DSA survey and professional staff.

Research in Rwanda indicates that there is likely to be under-reporting of HIV/AIDS as the cause of death (Hess 2002). Since there are several opportunistic diseases that occur more frequently with weakened immune systems, it is often difficult to know the cause of death without blood testing and medical autopsy. To avoid invasive and relatively high cost procedures, this research used a modified verbal autopsy or diagnosis, in which household members were asked about the deceased person and the basic cause of death (murder, accident, illness, other).¹⁰ For members who were identified to have died from sickness or disease or were currently chronically ill, respondents were asked to indicate the presence of four key symptoms, generally associated with HIV/AIDS: 1) chronic diarrhea; 2) chronic fever; 3) substantial weight loss; and 4) skin rash. These four symptoms have been shown to strongly correlate with HIV/AIDS, as opposed to other illnesses, when three or four of them are present (Ainsworth and Semali 1998). For additional information, the length of illness was asked, as well as the basic demographic characteristics of the member, including age, occupation, level of education and relationship to household head. In this research we specifically focus on 'prime-age adults' defined as those between 15 and 60 years of age.¹¹

The present work is mainly descriptive, based on comparisons of the means and medians. Further work modeling the possible relationships will be completed to better understand differences in populations and how actions of the households are affecting their livelihoods compared to the general population. In addition, while the income data are still being cleaned and organized from the EICV, we use the expenditure data as a proxy for income.

IV. Documenting The Changing Composition Of Households

To understand what changes there were in the households, interviewers asked each household to:

- (1) Identify all individuals who were members of the household at some time during the previous four years, but were no longer part of the household at the time of the 2002 interview and specify the reason for the departure (e.g., marriage, migration, death);¹²
- (2) Identify all individuals who had joined (or rejoined) the household since January 2001 (the time of the initial FSRP/DSA demography survey);
- (3) Identify all individuals in household who are alive but who have been ill for at least 3 of the 12 months prior to the 2002 interview.

¹⁰ Recent research in South Africa (Shisana and Sibayi 2002) used HIV testing based on mouth tissue samples, a less invasive method, but still one requiring the intervention of health care professionals and thus more costly. Verbal autopsy method has been used to derive algorithms for cause of death in other research (Quigley et al., 2000)

¹¹ The age range 15 to 59 years corresponds to the Demographic and Health Survey (DHS) inclusion of males in Rwanda ((Rwanda, 2001 #8). In the MSU study in Kenya (Yamano and Jayne 2002), prime age adults were defined somewhat differently: 20 to 54 years for men and 15 to 49 years for women, based on sexual activity and AIDS prevalence data. Yamano and Jayne also estimated results using a 15 to 59 age range for both men and women.

¹² The longer time span on this first question was used in an effort to ensure a large enough sample of households having suffered a loss through death to provide meaningful results for the section of the survey dealing with impacts and strategies of deaths.

Unlike many countries in SSA, Rwandan household structure tends to be based on nuclear families consisting of father, mother, and unmarried children (ranging in age from birth through young adult). Hence, the loss of prime-age adult labor due to death and/or chronic illness can have important consequences for household income and food security, particularly in households where none of the children have reached an age where they are capable of handling a full adult work load. In this sample, households in 2002 had an average of 3.0 prime-age adults, so that losing one prime-age adult means losing one-third of the most active labor available to the household.

Looking at the previous 15 months (Feb 2001 to April 2002), the majority of households (66%) did not have a change in the number of prime-age adults, but 29% lost at least one PA adult and 9% gained at least one prime-age adult. Marriage and looking for a job were the main reasons for departure, along with death, while marriage and looking for a job were the main reasons for arrival of new adult members.

Shifting to the view of the past four years, and setting aside the 64 households who departed the sample, 15% of the households suffered a death in the household across all age groups (Table 1). A total of 6% of the households had a prime-age adult death in the period covered.¹³ Another 8% of households had a prime-age adult suffering from a serious illness during 2001/02. There are households in which two or more PA adults were either chronically ill or died due to disease/illness. Very few households (0.4%) had both a death (in the past four years) and a current chronically ill prime-age adult. Only one case in our sample of 1520 was a household with two prime-age adult deaths related to sickness and disease. Thus, we do not observe the possible households losing both male and female partners in the period covered, although some of those households leaving the sample may have lost both spouses, leading to household dissolution.

There are six households in the sample with a PA adult death and a chronically ill PA adult, and in five of those cases the death was due to illness (Table 1). There are another 11 households in which a PA adult death occurs with a PA adult arrival in the previous 15 months. In eight of those households, the death was due to illness.

¹³ Gillespie (1989), using WHO estimates on mortality rates with HIV/AIDS, estimated that about 8% of farm households were likely to have an HIV/AIDS related death during the 1990-1995 period (5 years). While not all adult deaths due to illness can be attributed to HIV/AIDS in our sample, finding 6% of households with an adult death in a four-year period corresponds well to those earlier estimates.

Table 1: Number of Households with New Arrivals, Death and Illness Overall and by Age of Affected Household Member

Households with changes in composition, as indicated	Households in sample	% of households nationally¹
A. New Arrivals (all age groups) for previous 15 months	462	30%
Newborn/Infant (under 5 years old)	267	18%
Children (5 to 14 years old)	115	7%
Prime Age (15 to 60 years)	149	9%
Elderly (61 + years)	7	0.4%
B. Death (all age groups) for past four years	222	15%
Newborn/Infant (under 5 years old)	80	6%
Children (5 to 14 years old)	34	3%
Prime Age (15 to 60 years)	96	6%
Elderly (61 + years)	40	3%
C. Departure for reasons other than death (all age groups) for past four years	449	29%
Newborn/Infant (under 5 years old)	32	2%
Children (5 to 14 years old)	100	6%
Prime Age (15 to 60 years)	377	25%
Elderly (61 + years)	3	0.1%
D. Illness (all age groups) for at least three out of past twelve months	152	11%
Newborn/Infant (under 5 years old)	11	1%
Children (5 to 14 years old)	14	1%
Prime Age (15 to 60 years)	103	8%
Elderly (61 + years)	28	2%
E. Combination of prime age adult death and prime age adult illness in the same household	6	0.4%
F. Combination of prime age adult death and prime age adult arrival in the same household	11	0.7%
G. Households with 2 prime age adults with illness	9	0.5%

Notes: ¹ There were 1520 households in the nationally representative sample for the rural sector. Population estimates of percentages of households are based on the weighted sample.

Source: FSRP/DSA Rural labor and deaths survey, 2002 and FSRP/DSA Demographics Survey, 2001.

V. Demographics of the Prime-age Adults who Died and Adults who are Chronically Ill

Evaluating the basic characteristics of the people who are deceased or are chronically ill shows that they are somewhat similar to other adults in the sample, regarding education level and primary activity in agriculture. Higher prevalence of chronic illness and death due to illness appears to occur in older adults (Table 2), with the average age of men in the general population at 28 years old, while PA adult males with chronic illness and death due to illness have average ages of 36 and 40 respectively for illness and death. Women who have died from illness are on average 5 years younger than the men, although similar mean age is found for male and female adults with illness. The majority of PA adults, both men and women, have never completed primary school. Deceased ill PA adults have lower primary school completion rates than the general population.

Illness deaths are expected to have implications for production prior to the death of the person. The average period of inactivity, for those ill prior to death, is 23 of the past 48 months. The median is 12 months. The higher average figure is due to a high frequency of persons with lengthy periods of inactivity. In particular, 7 persons are reported as inactive for 48 months prior to death. Persons in the household who have been ill for the past 12 months, have an average period of inactivity of 5 months and a median of 4 months. Some illness spells are incomplete but these figures demonstrate that a large part of the year's labor is lost due to illness for these adults. The death cases give possible implications of the impact for households with ill members, since care must be given over these long periods, increasing the total loss of agricultural and off-farm labor in the household.

While equal numbers of PA men and women died due to illness, among members who are currently chronically ill, there are significantly more women (72%). Maternity-related illness may explain some of this, but there could be a relationship with HIV/AIDS prevalence in spouses. Given the long period between HIV infection and the appearance of AIDS symptoms, the high percentage of women may reflect the wave effect, and will be discussed again when the verbal autopsy results are presented.

Most of the prime-age adults who died due to illness were either heads of households, their spouses, or adult children of the head. The geographic distribution of the prime-age-deaths due to illness and chronic sickness are valuable for helping to determine where morbidity and mortality problems are already present as well as where they may be increasing, and thus interventions may be needed (Table 3). For the prime-age deaths, Gisenyi stands out, both for deaths due to murder and deaths due to illness (Figure 1 and Table 3). The survey identified high rates of murder in both Gisenyi and Ruhengeri, but out of 17 deaths due to murder, 88% occurred in 1998 during times of greater political insecurity.

Deaths due to illness however are increasing over time in our sample. Butare, for example, had a high number of adult deaths due to illness, mostly occurring in the past two years. Byumba had high numbers for adults living with chronic illness (Figure 2 and Table 3). Byumba only has 10% of the national population, but it had 34% of all households affected by adult chronic illness. Kibungo and Gikongoro also have high rates of chronic illness.

Table 2: Characteristics of Deceased and Ill Prime-age Adults

Characteristics of prime-age adults ¹	General population of prime-age adults			People who died from illness			People who are/have been chronically sick ²		
	(1)			(2)			(3)		
	All	Men	Women	All	Men	Women	All	Men	Women
Average age	29 years	28 years	29 years	37 years	40 years	35 years	36 years	36 years	36 years
Never attended school or Incomplete primary school education	74%	71%	76%	79%	80%	78%	74%	73%	75%
Period unable to work: ³									
Average	n.a.	n.a.	n.a.	23 mths	28 mths	21 mths	5 mths	5 mths	5 mths
Median	n.a.	n.a.	n.a.	12 mths	24 mths	12 mths	4 mths	4 mths	4mths
New member to household	172 (4%)	65 (3.5%)	107 (4.5%)	0 (0%)	0 (0%)	0 (0%)	2 (2%)	1 (3%)	1 (1%)
Member is HH head or spouse	2034 (48%)	834 (45%)	1200 (51%)	39 (54%)	24 (67%)	15 (42%)	88 (76%)	22 (67%)	66 (80%)
Primary activity in agriculture	3202 (76%)	1310 (71%)	1892 (80%)	48 (79%)	25 (78%)	32 (79%)	89 (77%)	22 (67%)	76 (81%)
Primary income earning activity other than agriculture	209 (5%)	163 (9%)	46 (2%)	8 (13%)	6 (19%)	2 (7%)	4 (3%)	4 (12%)	0 (0%)
Number of cases	4223	1865	2358	73	36	37	116	33	83

Source: FSRP/DSA Rural Labor and Death Survey, 2002 and FSRP/DSA Demographics Survey, 2001.

¹ Includes PA adults who left after January 1998 for reasons other than illness. Figures are based on valid responses. Unless noted the full sample had valid data.

² The sample includes 112 current household prime-age adults, who have been ill in the past 12 months and 4 members who left the household due to illness in the past 12 months.

³ Figures refer to the past 48 months for deaths and the last 12 months for chronic illness.

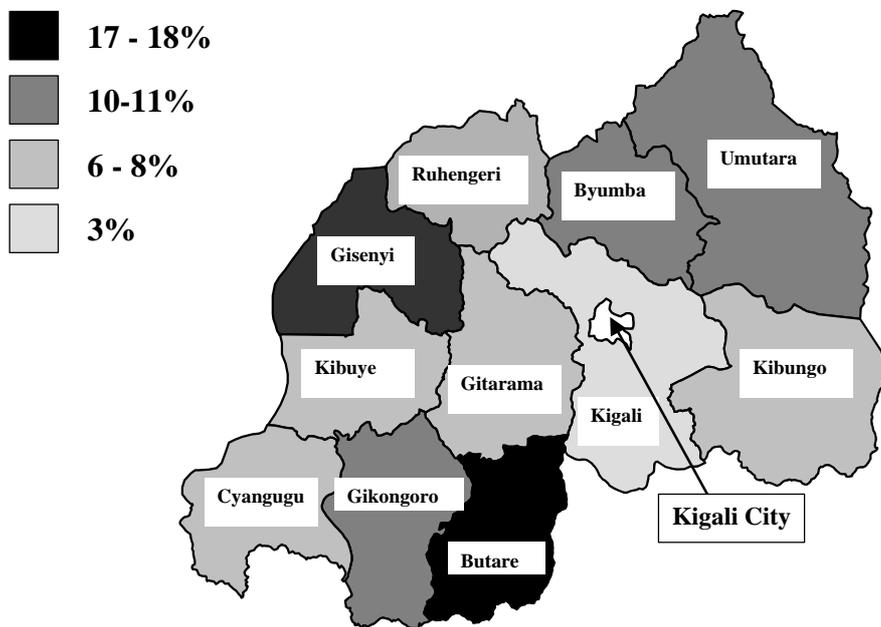
Table 3: Provincial Prevalence of Prime Age Adult Death (by cause of death) and Prime Age Adult Chronic Illness

Province	Cause of Death						Prime Age Adult Chronic Illness		All Adults		
	Accident/Other		Murder		Disease/sickness		All causes				
	Count	% w/in Accident/Other ¹	Count	% w/in Murder ¹	Count	% w/in Illness ¹	Count	% over all Causes ¹	Count	% of Sample	% Nat'l population total
Butare					12	16	12	12	6	5.4	6
Byumba	1	14			7	10	8	8	38	33.9	34
Cyangugu	1	14	1	5	6	8	8	8	7	6.3	5
Gikongoro					7	10	7	7	15	13.4	9
Gisenyi	1	14	13	68	13	18	27	27	4	3.6	5
Gitarama					6	8	6	6	4	3.6	2
Kibungo	1	14			4	5	5	5	19	17.0	17
Kibuye	1	14	1	5	4	5	6	6	1	0.9	0
Kigali Rural					2	3	2	2	13	11.6	17
Ruhengeri			4	21	4	5	8	8	2	1.8	2
Umutara	2	29			8	11	10	10	3	2.7	2
Total	7	100	19	100	73	100	99	100	112	100	100

¹ Percentages based on sample numbers (may not add to 100 due to rounding). There are three households with 2 adult prime age deaths, so there are 99 cases of prime age adult deaths, but only 96 households involved.

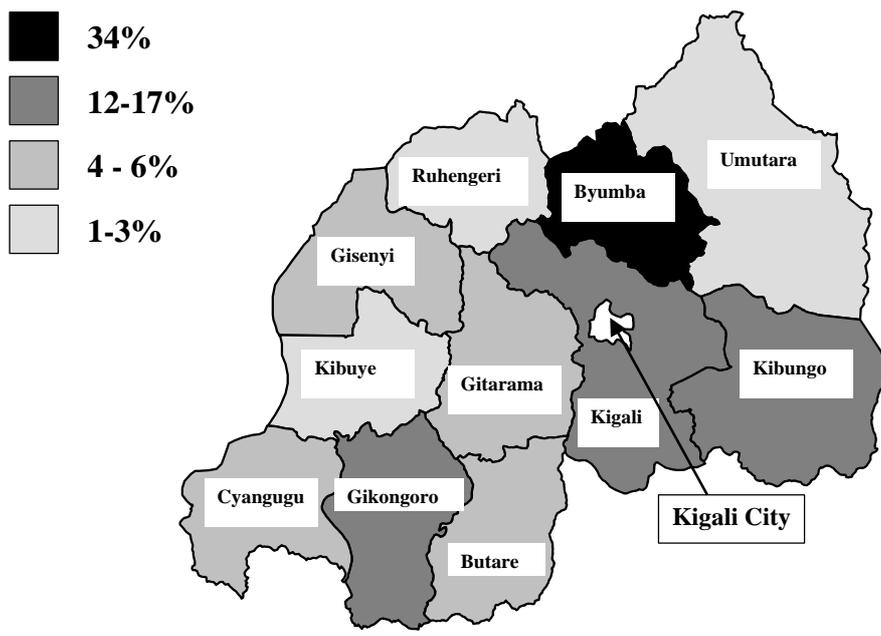
Source: FSRP/DSA Rural Labor and Death Survey, 2002.

Figure 1: Rural Deaths Due to Illness, Percent of National Total, by Province



Source: FSRP/DSA Rural Labor and Death Survey, 2002

Figure 2: Rural Adult Chronic Illness, Percent of National Total, by Province



Source: FSRP/DSA Rural Labor and Death Survey, 2002

Thus a pattern of prime-age deaths due to illness in certain locations, and prime-age chronic illness in other locations may be present.¹⁴ If follow up work can confirm this pattern, it is important to understand the dynamics that generate such results, possibly related to the wave effects of the HIV/AIDS epidemic identified by other researchers (Barnett 1999).

V. Rates Of Adult Mortality

In evaluating the adult deaths over this period, it is useful to translate the numbers into a mortality rate, as has been done in other research (e.g. Urassa et al 2001 for Tanzania and Yamano and Jayne 2002 for Kenya). Research in Tanzania provides a method and basis for comparison with the FSRP/DSA sample, although the methodologies are not identical. For comparability, we use the same age groups that the Tanzania and Kenya use (See Table 4) and estimate the rates based on deaths per 1,000 person years. We find that in our Rwanda sample for the 1998-2002 period, there were 67 adult deaths between the ages of 15-44 (the Tanzania study cutoff for prime-age) and an estimated total of 2990 person-years (for people 15-44). That translates to a prime-age mortality rate of 5.60 per 1000 person-years.¹⁵ In Tanzania, authors presented a mortality rate of 3.7 per 1000 person-years for a population that was HIV negative and 73.1 for the HIV positive population. The Rwanda mortality rate is estimated with both HIV positive and negative populations, thus it is expected that it would be higher than the Kisesa Tanzania HIV negative population, but clearly lower than the HIV positive population.¹⁶

VII. Insights From Limited Verbal Autopsy Questions

As indicated in the description of methodology, after identifying deceased household members affected by illness (as contrasted to accidents or murder) remaining household members were asked about four basic symptoms of illness, both for those people who died due to illness, and for those in the household with a chronic illness. While we cannot make the direct assumption that this information confirms that households are affected by HIV/AIDS, when this tool is used in combination with prime-age related variables and length of illness, it helps to identify households with a high likelihood of having been (or being) directly affected by HIV/AIDS. Malaria, tuberculosis, and other opportunistic diseases complicate the interpretation of the results, but regardless, chronic illness has profound effects on Rwandan households.

In the case of prime-age adults who died of disease (73 cases with information), 25% of the respondents reported none of the 4 symptoms according to household members (Figure 3).¹⁷ One in five had three or four symptoms indicated, thus a strong possibility of HIV/AIDS being involved (Table 5). The cases with three to four symptoms were widely spread

¹⁴ Current work by TRAC with assistance from the Centers for Disease Control in sentinel health sites throughout the country will determine new HIV/AIDS prevalence estimates for the country.

¹⁵ This figure is preliminary and possibly an underestimation of the rate, as the estimation of person years will be adjusted to account for departures. A crude adult rate using the FSRP/DSA data is 8.8 deaths per 1000 persons per year, well below the crude adult death rate for Rwanda of 22 found in UNAIDS 2002.

¹⁶ In general, you might expect adult mortality rates in Rwanda to be higher than Kenya, as given the lower adult life expectancy of Rwandans. An equivalent measure of adult mortality rate over the non-HIV population would be higher in Rwanda than that rate in Kenya. We cannot estimate that. The rates for Kisesa are not national rates, but rather of one ward where HIV/AIDS prevalence is high and thus the higher mortality rates.

¹⁷ Since these are very sensitive issues and can be difficult, it is possible that the true occurrence of the symptoms is higher than observed.

Table 4 Mortality Rates by Age Group and Gender for Tanzania, Kenya and Rwanda

Sex	Age Group	Mortality Rate per 1,000 person years ¹		
		Kisesa, Tanzania ²	Kenya ²	Rwanda ²
Men				
	0 to 4	35.6	-	12.0
	5 to 14	2.6	-	3.8
	15 to 24	5.3	2.6	4.6
	25 to 34	12.2	3.8	5.3
	35 to 44	17.1	14.6	13.2
	45 to 59	20.1	-	19.4
	60 +	62.2	-	34.8
Women				
	15 to 44			7.1
	0 to 4	33.7	-	10.8
	5 to 14	2.7	-	3.0
	15 to 24	5.1	2.1	3.9
	25 to 34	11.4	6.7	6.2
	35 to 44	14.8	7.6	5.7
	45 to 59	18.1	-	8.1
	60 +	59.6	-	27.9
	15 to 44			5.0

Sources:

Urassa, et al. 2001; Yamano and Jayne, 2002;
FSRP/DSA Rural Death and Labor Survey, 2002;

¹ Person years are estimated on the basis of expected household residency period.

² Tanzania survey based on rural population of Kisesa ward;

Kenya survey based on national rural sample, excluding nomadic regions;
Rwanda based on a nationally representative rural sample.

throughout the country, so no one geographic region stands out. The same proportion of men and women who have died of illness were said to have shown three or four symptoms. Weight loss and fever was the most common combination of symptoms, with either diarrhea or skin rash when three symptoms were present.

Among prime-age adults who are chronically sick, over half were said to have had two of the symptoms, with the combination of fever and diarrhea being the most common in both men and women (Table 6). Most of the chronically ill adults with 3-4 symptoms were in Byumba (47% of the 34 cases), with Kibungo (24% of cases) and Cyangugu (12% of cases) also having people with three to four symptoms. Weight loss and chronic fever are the two most common symptoms, and they generally went together.

There are four cases (3%) of chronically ill adults who have been unable to work for the last 12 months who have none of the symptoms, indicating the possibility of long-term physical or mental impairments, probably unrelated to HIV/AIDS and other communicable diseases. Most of the people (85% of cases) have been ill 12 to 20 weeks.

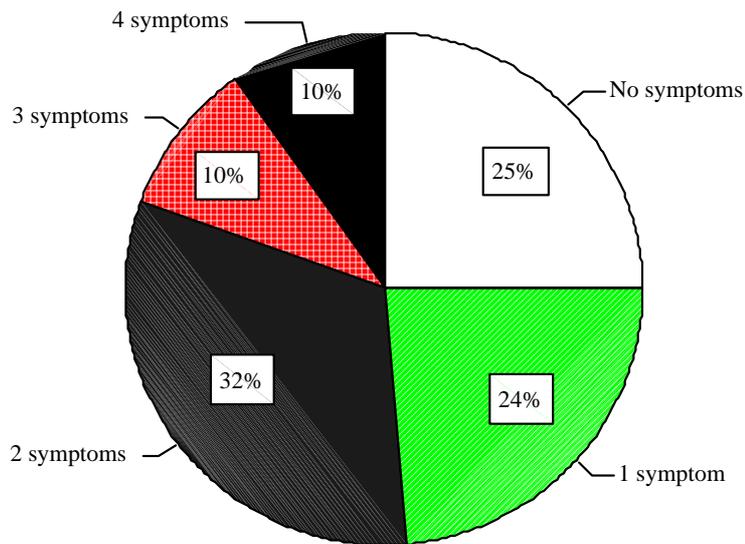
Table 5:

Symptom combinations for prime age adults who have died due to illness					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 No symptoms	18	24.7	25.0	25.0
	1 1 symptom	17	23.3	23.6	48.6
	2 Weight loss and fever	16	21.9	22.2	70.8
	3 Weight loss, diarrhea	3	4.1	4.2	75.0
	4 Weight loss, skin rash	3	4.1	4.2	79.2
	5 Other combo of 2	1	1.4	1.4	80.6
	6 Weight loss, diarrhea, fever	2	2.7	2.8	83.3
	7 Weight loss, skin rash, fever	5	6.8	6.9	90.3
	8 All 4 symptoms	7	9.6	9.7	100.0
	Total	72	98.6	100.0	
Missing	System	1	1.4		
Total		73	100.0		

Table 6:

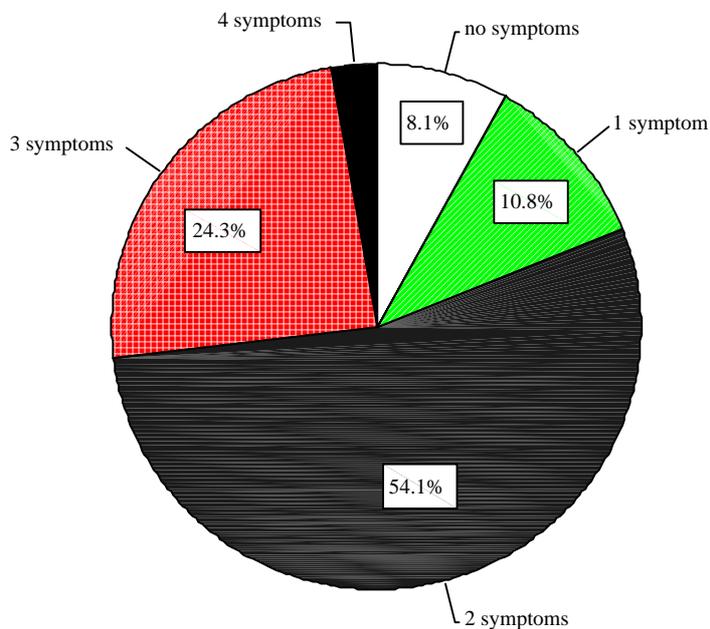
Symptoms for prime age adults who are chronically ill					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00 No symptoms	9	8.0	8.1	8.1
	1.00 1 symptom	12	10.7	10.8	18.9
	2.00 Weight loss and fever	55	49.1	49.5	68.5
	3.00 Weight loss, diarrhea	3	2.7	2.7	71.2
	4.00 Weight loss, skin rash	2	1.8	1.8	73.0
	6.00 Weight loss, diarrhea, fever	8	7.1	7.2	80.2
	7.00 Weight loss, skin rash, fever	19	17.0	17.1	97.3
	8.00 All 4 symptoms	3	2.7	2.7	100.0
	Total	111	99.1	100.0	
Missing	System	1	.9		
Total		112	100.0		

Figure 3: Number Of Symptoms Identified For Prime Age Adults Who Died Due To Illness:



Source: FSRP/DSA RLDS data, 2002.

Figure 4: Number Of Symptoms Identified For Prime Age Adults Who Are Chronically Ill



Source: FSRP/DSA RLDS data, 2002.

VI. Assessing Differences Among Households

In the genocide period of 1994 and the periods of unrest both before and after, many households suffered death shocks. Current poverty rates in Rwanda are also very high, with 73% of the rural population estimated to be living below the poverty line in 2001 (MINECOFIN, 2002). A key question is whether or not households affected by death, especially prime-age death, or prime-age chronic illness are different from other households in terms of poverty or other characteristics.

Table 7 presents mean characteristics for different types of households. The general population of the households consists of those households without PA deaths due to illness or PA adults with chronic illness. We compare these to households with male and female PA illness deaths, and to households with current PA chronic illness. The general population has an average labor supply of 4.6 adult equivalents in 2002. The households affected by PA adult death in the last 4 years and PA chronic illness in the past 12 months have higher labor supply averages. Caution must be exercised with regards to the illness figures as ill adults do not provide the implied labor supply, so the labor adult equivalents would be lower with the ill excluded. The comparison of death households to general ones does not support the conclusion that households with death are losing labor, in the period evaluated. Rather, they suggest that death households are able to maintain their labor through new members.

Average land holdings (for both total and cultivated areas) are at least as high for households with ill adults of both sexes as the general households, but households with ill females or female deaths due to illness have lower total land area per adult equivalent. Households with female deaths are the worst off when we compare average assets. They have the lowest mean values of land (total and cultivated) as well as the smallest number of cattle.

Households with illness tend to have higher expenses per adult equivalent, regardless of the sex of the ill person, although they do not indicate any health expenditures reported. A breakdown of expenditure figures shows that the same pattern holds for non-food expenditures, but not for food expenses. Households with a female death due to illness have the smallest expenditure figures of any other group.

Table 7: Household Characteristics of Selected Households in 2002

		General population HH	HH with males who died from illness	HH with males who are chronically ill	HH with females who died from illness	HH with females who are chronically ill
<i>Characteristics of households (average values)</i>						
Labor Available	adult equivalence (AE)	4.59	4.74	5.15	4.81	5.02
Total Land Area	hectares (ha)	0.89	0.81	1.10	0.76	0.95
Cultivated Land Area	hectares (ha)	0.65	0.63	0.69	0.57	0.65
Total Land Area/AE	ha/AE	0.22	0.20	0.23	0.18	0.19
Cultivated Land Area/AE	ha/AE	0.16	0.15	0.14	0.14	0.13
Number of cattle ¹		1.65	2.29	0.52	0.20	0.46
Dependency Ratio ²		1.22	1.50 (1.51)	0.63 (1.60)	1.14 (1.25)	0.87 (2.12)
Ratio of Children/Elderly ³		0.86	-	-	0	-
<i>Characteristics of household heads in 2002</i>						
Female Headed (pre-death)	% of households	30	20	23	32	28
Never attended school	% of male heads	38	43	33	27	31
	% of female heads	68	43	14	64	63
Age	Male Heads	44	35	44	43	44
	Female Heads	50	40	42	46	49
Number of households in analysis		1350	35	31	37	79
<i>Expenditure analysis</i> ⁴						
Expenses per adult equivalent		66500	54462	76851	45289	70595
Food expenditure		184678	174740	157986	146021	217498
Non-food expenditure		90187	92801	113750	53916	94485
Household health expenses		1203	4511	0	0	0
<i>Percentage of households with characteristic</i>						
Households in lower two expenditure quintiles		38	49	52	62	41
Household in extreme poverty		40	49	55	62	43
Household with a member working for wages		26	21	28	24	23
Households who get drinking water from free standing		45	46	48	50	52
Households with animals		65	67	69	56	69
Number of households in analysis		1238	33	29	34	73

¹ Based on EICV/RLDS matched sample.

² This is the ratio of children and elderly to prime age adults. In parentheses, we define ill prime age adults as dependents, shifting them to the numerator.

³ This calculation is done for households without a prime age adult.

⁴ Expenses are deflated by the EICV Cost of Living Index. See MINECOFIN 2002. EICV/RLDS matched sample.

The EICV data on expenditure quintiles and poverty follow the findings of the asset and expenditure averages. Households with a female death are more likely to be in the two lowest expenditure quintiles and extreme poverty (Table 7). Households with ill females are similar to the general households in the expenditure distribution and poverty quintiles, but those with ill males are slightly poorer on average. Households with male deaths due to illness are not as badly off those with female deaths, but they are still more likely to be among extremely poor households than the general rural household.

In 2002, Rwanda had a relatively high percentage of female-headed households (34 %), up from 22 % in 1984 (MINAGRI, 1985), pre-genocide and basically pre-HIV/AIDS. To look at the sex distribution of household heads, we evaluated the gender of the household head prior to the death in the household. Female-headed households are in the minority for all groups. However, for households with male household heads who died from illness, the head role is then taken by a female.

The mean dependency ratios (ratio of children and elderly to prime-age adults) (Table 7) indicate the number of people in the household who must rely on each adult for food security and livelihoods. The dependency ratios are slightly higher for households that have experienced a male PA death due to illness. Households with an ill prime-age adult have lower dependency ratios, but if the ill adult is classified as a dependent, the dependency ratios are 1.6 and 2.1 for male and female ill households respectively, just above the overall dependency rate of 1.2. A ratio of 1.6 means that for each adult, there are 1.6 people that must be supported. To put these numbers in perspective, in the Tanzania study the dependency ratios were 1.24 in households with an adult death (Urassa, et al 2001), similar to this work. In Mozambique, the dependency ratio varies with poverty profile of the household, such that the very poor have higher ratios of 2.5, whereas the non-poor have ratios of 1.9 (estimated from Ministério do Plano e Finanças, 1998), both much higher than the Rwanda dependency ratios.

VII. Effects On The Households And Their Strategies To Deal With Adult Death And Disease

Effects of mortality

For each adult death and each chronically ill adult, the households were asked about how the death has affected the household with regard to agricultural and livestock activities, other income generation, savings and debt, diet, and specific effects on children. The interview then focused on the strategies that the household adopted to adjust to the effects on cropping and livestock.

Evaluating separately death from illness and disease from death due to other causes is important for several reasons. As shown above, a person may be ill for months prior to death, such that the adjustment occurs over time. The shock to the household is not as abrupt as with an accident or murder, for which a household is ill prepared. Illness may give the household time to gradually shift consumption and production, to lessen the severity of effects and design more gradual adjusting/coping mechanisms. Unfortunately, though, the overall effect on the household may be severe as assets are sold and other actions taken which result in a permanent decline in livelihoods. In addition, with HIV/AIDS, the illness and death of one member may be a precursor of other deaths, threatening the survival of the household and so strategies may vary.

Table 8a: Primary Effects Noted In Households With A Prime Age Adult Who Died Due To Illness

Category	Effect noted	Sex of person who died	
		Male Col %	Female Col %
Ag-cropping/livestock effects	No effects	18	34
	Reduced farm labor	62	51
	Lost access to land	9	3
	Reduced knowledge/skills	12	6
	Effect not specified	0	3
	No money to pay workers	0	3
Other income generating effects	No effects	56	80
	Reduced non-farm enterprise income	18	9
	Reduced labor income	21	9
	Reduced remittances from family members	0	3
	Reduced income	6	0
Diet effects	No effects	47	63
	Change diet composition for the worse	53	23
	Change diet composition for the better	0	6
	Eat fewer meals	0	9
Effects on children	No effects	68	74
	Reduced formal schooling for children	9	11
	Reduced time for adults to care for children	15	3
	Speeding up transfer of ag skills to children	6	6
	Sent to live with relatives	0	6
	Reduced income to spend on children needs	3	0
	Number of cases		34

Source: FSRP/DSA Rural Labor and Death Survey, 2002.

Table 8b: Primary Effects Noted In Households With A Prime Age Adult Who Are Chronically Ill

		Sex of person who is ill	
		Male	Female
		%	%
Ag-cropping/livestock effects	No effects	23	15
	Reduced farm labor	68	84
	Lost access to land	3	1
	Reduced knowledge/skills	7	0
Other income generating effects	No effects	65	82
	Reduced non-farm enterprise income	10	12
	Reduced labor income	23	5
	Reduced income	3	1
Diet effects	No effects	39	56
	Change diet composition for the worse	42	34
	Eat fewer meals	19	10
Effects on children	No effects	72	69
	Reduced formal schooling for children	7	12
	Reduced time for adults to care for children	17	14
	Speeding up transfer of ag skills to children	0	1
	Sent to live with relatives	3	4
Number of cases		31	80

Source: FSRP/DSA Rural Labor and Death Survey, 2002

Note: Some households did to respond to these questions.

Looking at the cases where a PA adult died of illness, almost 60% of the households indicated that the main effect on agriculture was reduced farm labor, with fewer households indicating reduced farm skills (9%) and losing access to land (6%) (Table 8a). There were 25% that indicated that the death did not have an effect on cropping or livestock, but in one half of those cases, the deceased did not have agriculture as a primary activity and in other cases, the person had been inactive for at least one year.¹⁸

For households with a PA death due illness, the majority of households indicated no effects on savings and debt, children, other income generating activities, and diet (Table 8a). For those indicating effects on other income, the death of a male was more likely to have reduced other income generation, through enterprises or sales of labor. Given that the males who died were more likely to have had a non-agricultural primary income (Table 2), this is not surprising. For household savings and debt, there were households who indicated using up household savings (18% of those with a death) or indicated that their debt increased (16% of households with a death). When a household experiences both PA death from illness and current chronic illness, decline in savings and increase in debt were common effects. About one-half of the households said that they changed their diet as a response to the death, most indicating that the composition of the diet was worse. Respondents noted a range of effects on children, although only about 30% responded that their children had been affected. The effects discussed ranged from reduced formal schooling, reduced time for adults to care for children, need to speed up the transfer of agricultural skills to children, and children sent to live with relatives.¹⁹

The results varied somewhat when the prime-age death was not due to illness (Table 8b). Loss of agricultural labor was still the most important effect on cropping and livestock. For other income, reduced nonfarm enterprise income was the most common effect noted. About half of the households felt that their savings/debts had been negatively affected. Because these deaths tended to be sudden, they were less likely to say that they went into debt than when the death was due to illness. Effects on children were similar to those when there was a death due to illness.

Effects of morbidity

When asked about how the PA chronic illness affected the household over a range of aspects, the results were qualitatively similar to the responses on the effects of an adult death. There was one major exception, in that a relatively high number of households with chronic illness said that they had increased their level of debt (46% of households) or used household savings (20% of households) during the illness, indicating a draining of financial resources (Table 8b). As with a death due to illness, the most important cropping and livestock effect was to reduce labor, as indicated by 80% of the households. There were 2 households who indicated that they had lost land and another 2 households indicated the reduced knowledge or skills due to illness. About 17% of the households indicated that there were no effects, generally when the illness was long lasting or the person was not primarily in agriculture. Not surprisingly, reduced labor income and reduced non-farm enterprise income were frequently cited as the most important effect on other income generating activities. Households with chronic illness were more likely to indicate a change in diet (fewer meals, less quality) compared to

¹⁸ Future research should identify the adjustments made during the period of illness and then the adjustments after the death. The current research may underestimate the effects if adjustments were made prior to death.

¹⁹ These are difficult issues to discuss with households, and the enumerators may have wished to avoid pressing the families for responses.

households with a death due to illness. For the children, reduced time for childcare was cited as an effect of the illness by 15% of the households

Strategies for adjusting to a mortality

Households with a prime-age death were asked about the three most important strategies that they used for agricultural and livestock activities to adjust to the effects of the death.

Researchers have grouped the strategies into four main categories (Table 9): 1) labor-based strategies; 2) agricultural technology and cropping strategies; 3) child-based strategies; and 4) asset-based strategies. A few other strategies were kept as “other”. Each household might have up to three strategies stated, and households without effects on agriculture are excluded. More specific responses and how the responses were grouped can be found in Annex Table 1.

With a sudden death (murder or accident), the household was likely to use asset-based strategies, especially renting out land, in addition to the labor-based strategies. Child-based strategies were also found to be important when there is a sudden death, more so than when the death is due to disease.

As with cases of sudden death, the most important strategy group for households with a death due to illness was the labor-based group, with the majority of households trying to maintain labor time in the fields. This includes hiring in labor, sharing labor with neighbors, working more, and trying to get a member to return or bringing in a new member (Annex Table 1).

When a man dies of illness in the household, households are more likely to choose agricultural technology and cropping strategies than when a woman dies. Labor-based strategies are more important, especially when a woman dies and the household seeks new members to replace her (26% of households) when women die due to illness. Households use asset-based strategies when either a man or woman dies due to illness, although within that group, selling assets is more likely when a man dies and asking relatives for gifts or loans is more likely when a woman dies. Few households indicated that they changed the agricultural technology use (less labor intensive crops, weed crop less) with a PA adult death.

In all cases of death, the most important strategy within the agricultural technology and cropping was to cultivate less land or leave land fallow, thus reducing the demand for labor. It was also found that households with a death, male or female, developed strategies to pass on agricultural knowledge to the young (Annex Table 1), also true in cases of sudden adult death.

Strategies for adjusting to morbidity

As with households with a mortality, the households with agricultural effects of morbidity were asked about their three main strategies to deal with those effects. Since most of the chronically ill adult members are involved in agricultural activities, the effects to the crop and livestock activities can be quite strong. The most common strategy group was labor-based, particularly trying to share or hire in labor (Table 9 and Annex Table 1). The use of hired labor, though, was more common among households in which a woman was chronically ill than when a man was ill. The lack of hiring in labor when the man is ill may indicate the lack of resources available to the remaining family members to hire in labor.

Table 9: Strategies of Households in Response to Prime Age Adult Death or Chronic Illness

Strategy Group	Cases of sudden death	Men		Women who died due to illness	Men with chronic illness	Women with chronic illness
		Cases of death due to illness	Cases of who died due to illness			
Percent of households using strategy						
Labor-based strategies	53	62	55	70	72	66
Agricultural technology and cropping	33	31	41	22	36	44
Child-based strategies	27	11	9	13	8	13
Asset-based strategies	47	27	27	26	48	39
Other	7	7	9	4	0	5
Number of households with strategies for agriculture	15	45	22	23	25	62

Source: FSRP/DSA Rural Labor and Deaths Survey, 2002.

Note: Each household may have up to three strategies, so the sum may be greater than 100%.

Households used asset-based strategies more often with illness than with death, particularly when a man was chronically ill, including sales of land and livestock. These households with adult illness were also more likely to leave land fallow or cultivate less land as their major cropping-based strategy. Strategies not commonly selected were shifting to less labor-intensive crops and renting out land. Selling assets was selected as a strategy by almost half of the households when a man was ill, and by 39% when a woman was ill. One of the difficulties with selling land in Rwanda is the link between land and poverty, as found in research by Jayne et al. (2002), indicating that households using this strategy are more likely to fall further into poverty.

With adult morbidity, there were no households that indicated trying to pass on agricultural practices to the young, but children were sent away to live with relatives or were taken out of school.

Combined aspects of strategies to adjust to illness and death

This research shows that the strategies developed to deal with illness and death can be quite different. If the households with a PA illness tend to sell assets, when a death occurs there are fewer assets to provide options. This points to the need to evaluate when strategies are undertaken by households to devise ameliorating interventions. If interventions to prevent the need for asset sales occur after the death, major assets may already have gone. Children were sent away to live with relatives more often during illness than after death. Future research will need to carefully track when households adopt strategies that are likely to lead to a downward spiral of reduced production, income, and food security.

In this work, researchers focused on the strategies used by households relating to their agricultural production. While these households are primarily agricultural households, there are many strategies that may be used in addition to agriculture. Discussions with health and agriculture professionals raised various issues that may play a role in determining future directions of the epidemic as well as welfare of the households. In particular, people mentioned the possibility of women, especially young women, giving sexual favors to men in their communities in order to obtain cash or food or other “gifts”. This is called “transactional sex” by some researchers (Gillespie 2003). These rural women are not commercial sex workers, but may undertake risky behavior to provide for their families. As noted by Ngwira et al., “ ‘Commercial sex work’ may be an inadequate concept to cover the range of situations in which sex is bartered or sold” (2001, p. 13). Extended family and community networks that might have provided for families in trouble in the past may be overstretched due to war, drought, illness, and death such that individual strategies are the only remaining solution.

VIII. Observed Changes in Cropping and Land Use

When faced with stress of illness or a death, households indicated various adjustments that they make in their agricultural production. Research in the mid-1980s (Bucyedusenge et al. 1990 and Gillespie 1989) evaluated the role of men and women in agricultural cropping (decision-making as well as labor time in different activities). Given the variability of roles of men and women in different crops and livestock, we evaluate the changes based on the gender of the people who died in the household. The Kenya research (Yamano and Jayne 2002) demonstrates the need for this disaggregation in an agricultural setting with mortality and morbidity, although gender differentiation in cropping and decision-making may be quite different between Kenya and Rwanda.

To assess the short-run adjustments, we look at annual crop production changes from 2000 to 2002, across the two main seasons (A and B), comparing households that have experienced either PA adult death due to illness or chronic illness to households without such illness or death. For production, each household’s production of a crop is summed across the seasons to evaluate total production changes. In the case of both land and production, the median will be presented as the distribution of cases is highly skewed and outliers on the high side as well as truncation at zero and low sample numbers strongly influence the means of these aspects.²⁰ The numbers are also for only those households who grew the crop in both 2000 and 2002, so these numbers will not reflect the overall production trends, since new households growing a crop (or growers leaving a crop) may contribute substantially to total production.

Overall, in Rwanda, in the period 2000-2002, based on the medians, households are increasing their production of several main crops and maintaining or reducing the area cultivated (Figures 5a-c; Figures 6a-c). It should be noted that season A of 2000 (which began in September 1999) was severely affected by the drought and there were further effects through Season A 2001, depending on the region. In general 2001B and both seasons in 2002 were fairly good cropping seasons, with a few exceptions where flooding or erratic rains occurred.²¹

²⁰ Other estimators may also be used, but with small sample numbers may not be appropriate.

²¹ Concerning the area cultivated, it is possible that the early surveys in 1999-2000 suffered from under-reporting, as farmers may have linked the enumerators with government agents responsible for land redistribution. This possible under-reporting is not expected to be biased, but rather generalized. It is unlikely that total crop area has increased dramatically in Rwanda in the recent years, although bringing fallow and pasture land into cultivation is a possibility as land pressures continue.

Rwandan farm households appear to be diversifying their production more, cropping a greater variety of crops. There were increases in the numbers of farmers growing irish potatoes, sweet potatoes, cassava and peas and households with adult deaths due to illness saw more farmers particularly in irish and sweet potatoes, cassava and maize

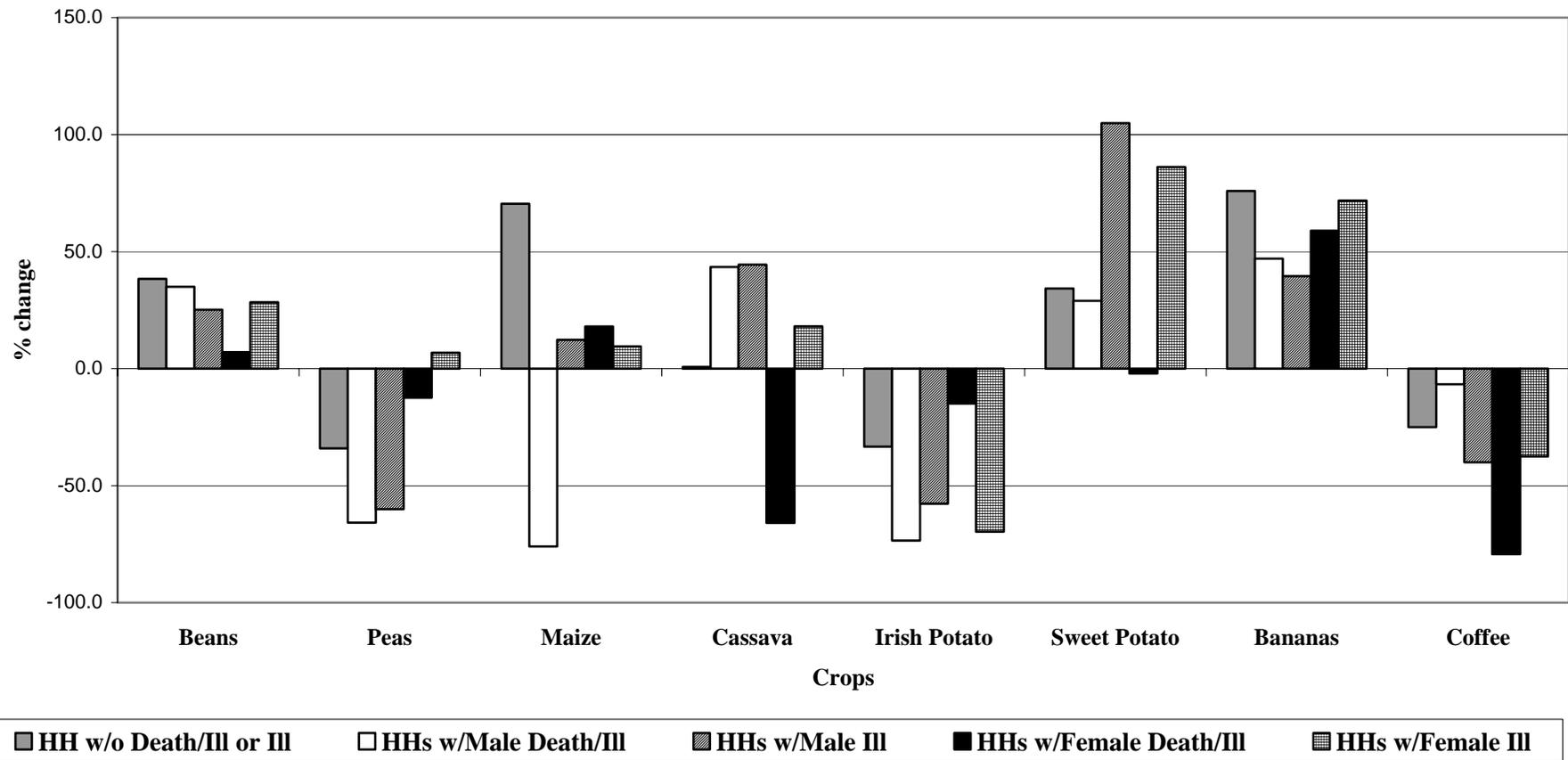
Households with morbidity and mortality were not always able to improve production of some crops as much as other households, but as shown in Figure 5a, the results are quite variable across the different types of households in the sample. Much of the HIV/AIDS literature points to a shift of cropping from labor intensive crops, such as beans and maize, to less labor intensive crops, such as cassava. For cassava, most households did not have any major increase in production between 2000 and 2002, with a median change of 0.8%. However, households with a chronically ill man or a man who died of illness had higher than median increases in harvests of cassava (about 44% increase), and crop more land in cassava, (as noted below), while households with a female death due to illness saw a decline in cassava production and area (Figure 5b). Sweet potato production increased dramatically (up 120%) for households with a chronic illness. Sweet potato production also increased for households with male deaths due to illness, at the same time that households with a woman who died due to illness saw a slight decline in sweet potato production.

Irish potatoes are one of the food crops that are also an important cash crop. There were declines in estimated household median production as well as planted area in the 2000 to 2002 period. Bucyedusenge et al. (1990) indicate that irish potatoes are a crop for which men and women share the decision-making; Gillespie's research (1989) finds that, while both men and women work on potatoes, more labor time is dedicated by women to potato cropping, such that loss of women's labor may not be compensated sufficiently by remaining members, particularly when a woman is ill.²² Only households with male mortality due to illness saw an increase in household area planted to irish potatoes, in Season A, possibly reflecting a need for cash income in these households. All other households reduced their area planted in both seasons, reflecting problems with irish potato marketing and prices for the households that cropped in both years.

Another major cash crop, coffee, saw production decline during the period 2000 to 2001, a result found across the different types of households. With low domestic prices for coffee, the farmer incentives to tend trees and harvest may be reduced for all.

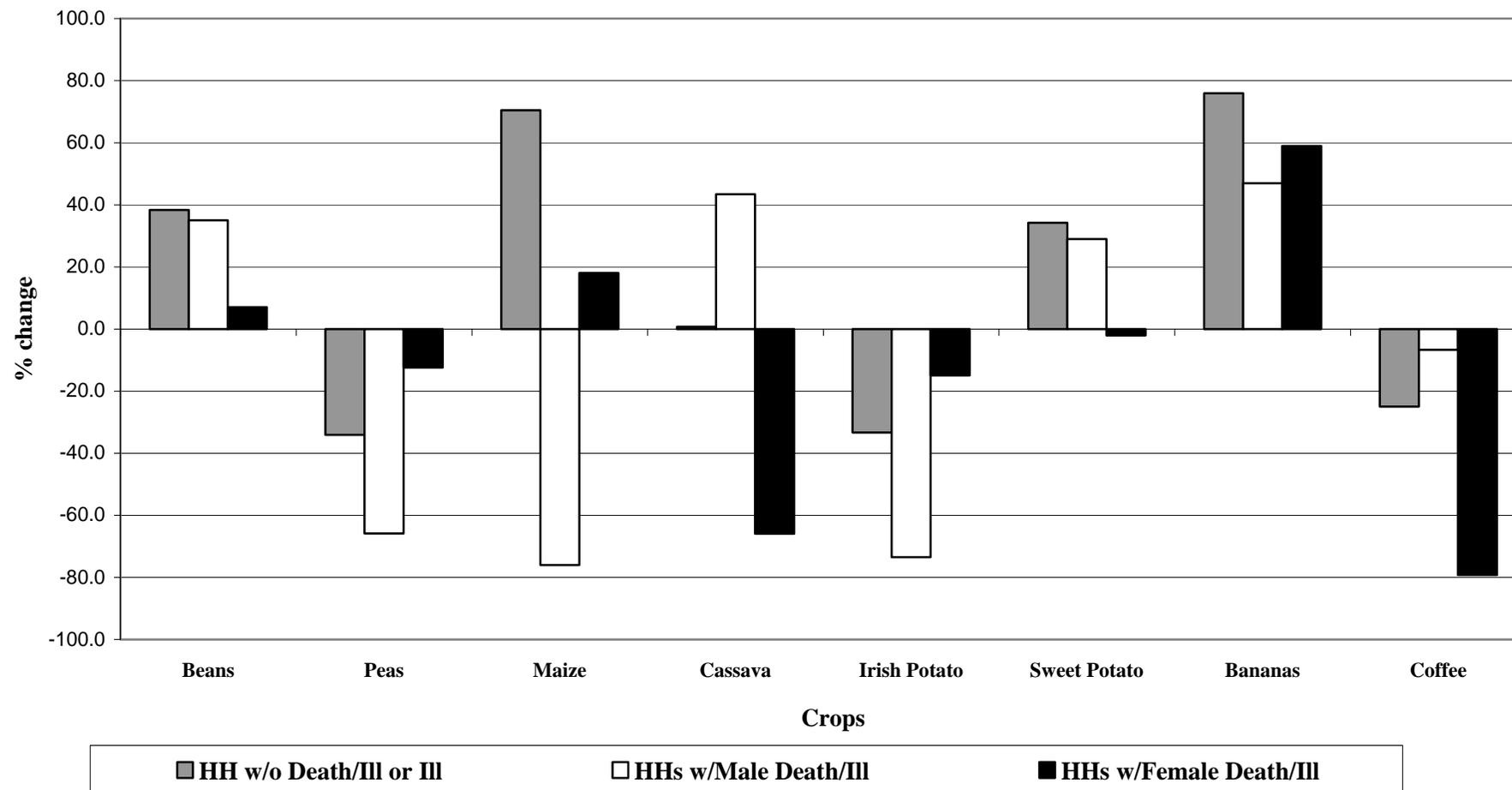
²² Gillespie predicted that a male death would affect irish potato cropping more than a female death, but that was at a time when irish potato cropping was primarily in the volcanic highlands, where labor demands on women are generally high. Irish potato production has spread outside these areas, so this result should be re-visited, given the greater variety of cropping systems.

Figure 5a: Median Percentage Changes in Crop Production, 2000 to 2002, for Households with a Prime Age Adult Death due to Illness or a Chronically Ill Adult



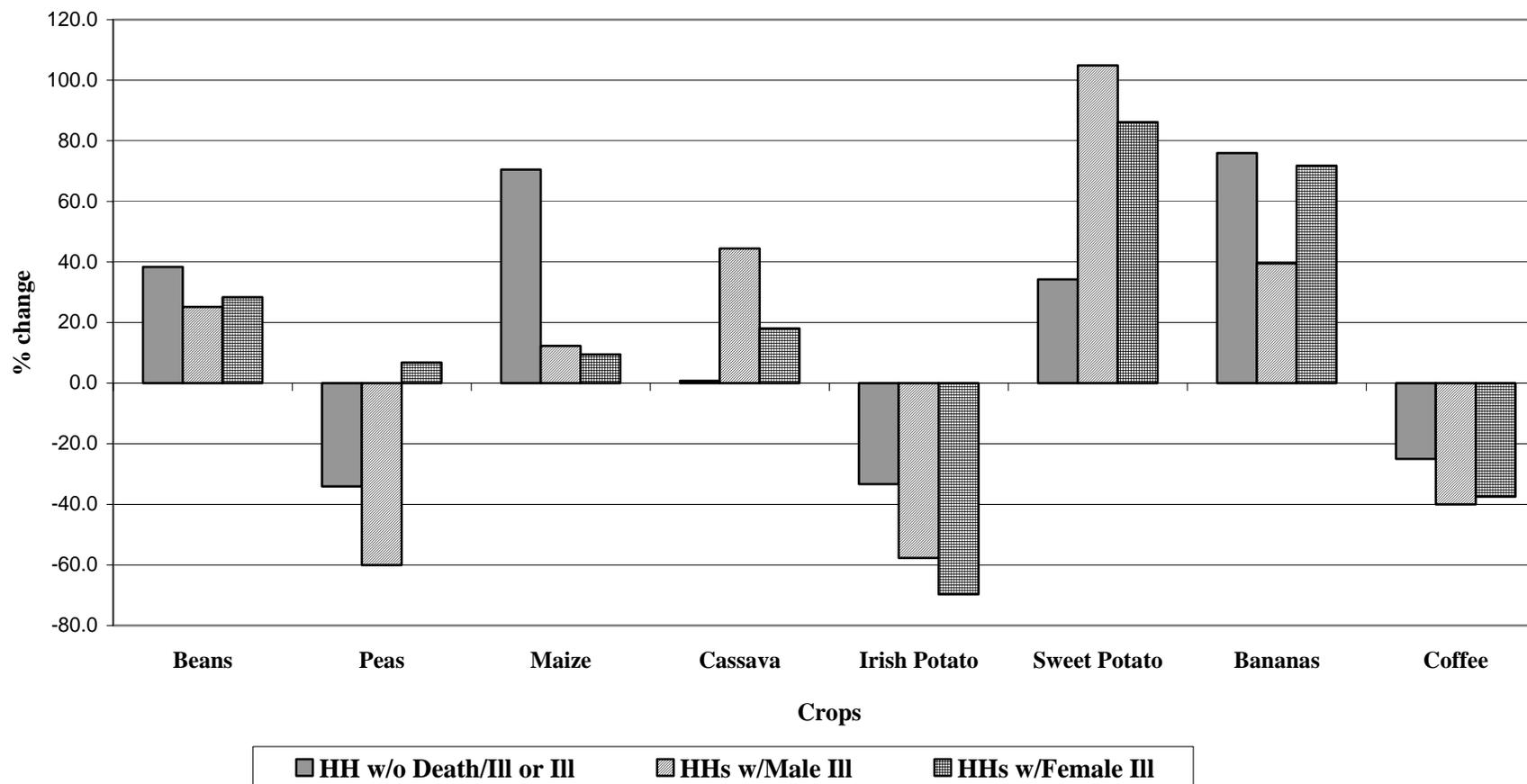
Source: FSRP/DSA Production and Land Use data, 2000 and 2002.

Figure 5b: Median Percentage Changes in Crop Production, 2000 to 2002, for Households with a Prime Age Adult Death due to Illness, Male and Female



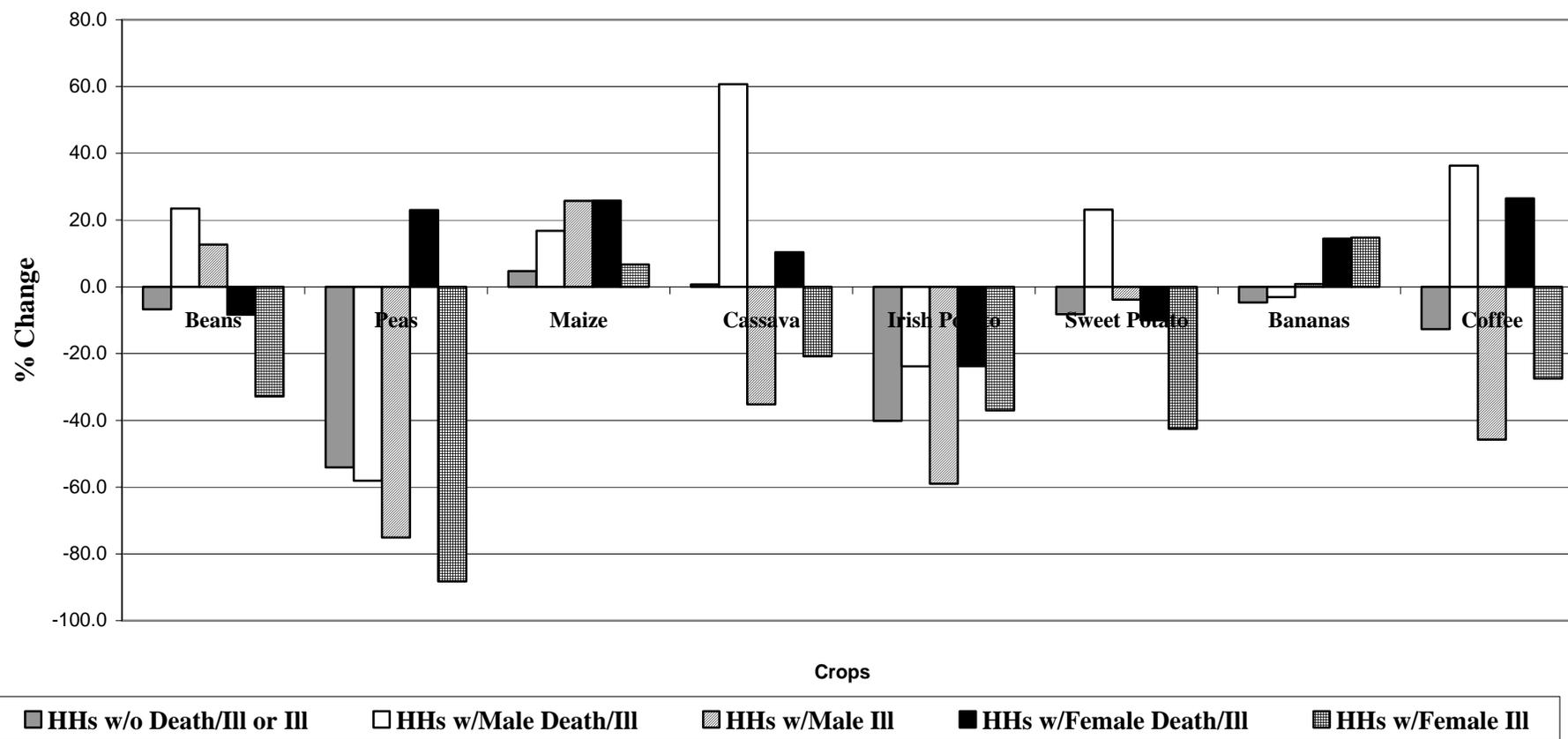
Source: FSRP/DSA Production and Land Use data, 2000 and 2002.

Figure 5c: Median Percentage Changes in Crop Production, 2000 to 2002, for Households with a Prime Age Chronically Ill Adult, Man or Woman



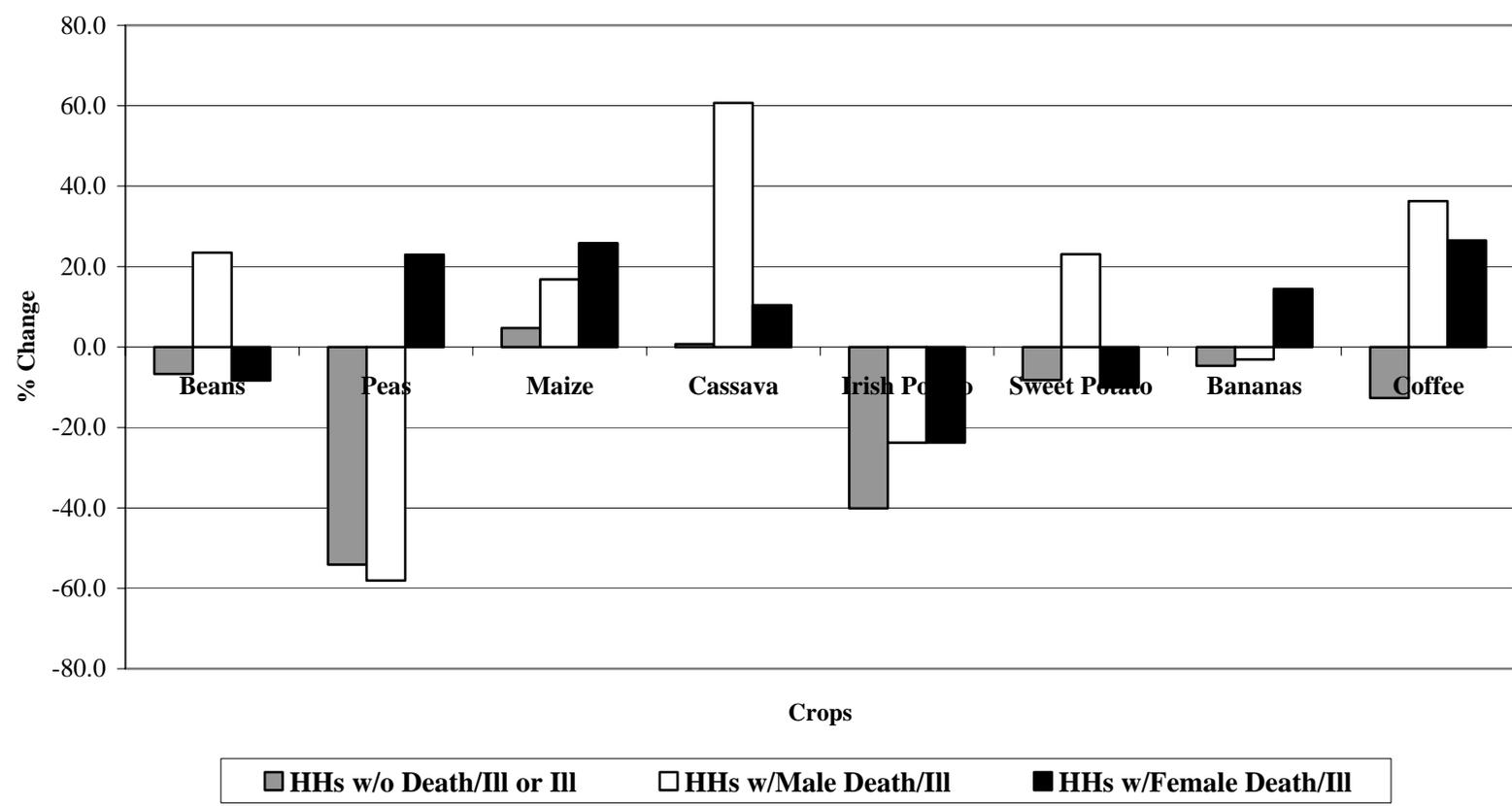
Source: FSRP/DSA Production and Land Use data, 2000 and 2002.

**Figure 6a: Median % Changes in Area Cropped from 2000 to 2002
by Type of Household**



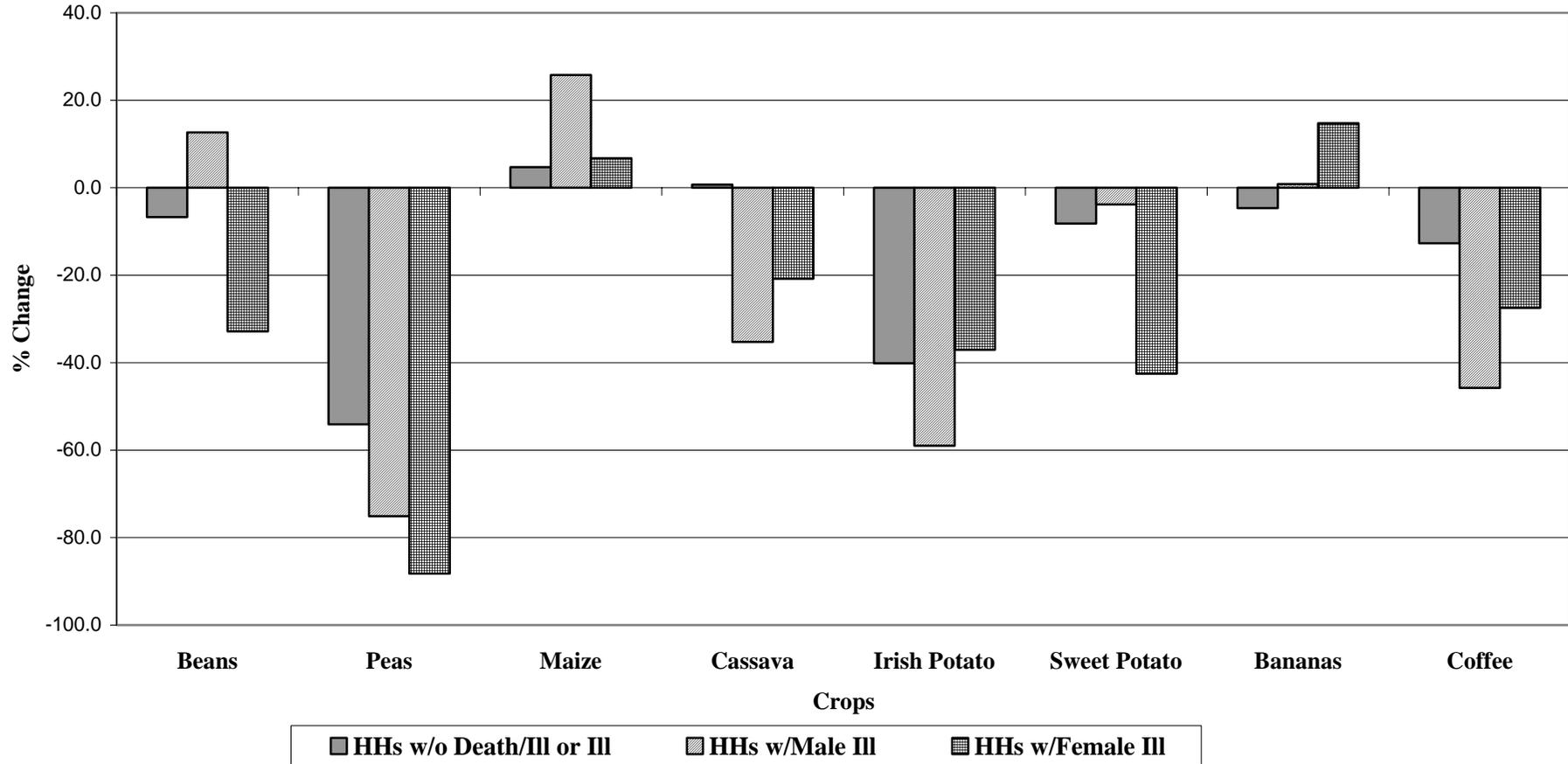
Source: FSRP/DSA Production and Land Use data, 2000 and 2002.

Figure 6b: Median % Changes in Area Cropped from 2000 to 2002 for hhs with Death due to Illness



Source: FSRP/DSA Production and Land Use data, 2000 and 2002.

Figure 6c: Median % Changes in Area Cropped from 2000 to 2002 for hhs with Chronic Illness



Source: FSRP/DSA Production and Land Use data, 2000 and 2002.

As with most households, the households with adult mortality increased their total production of bananas between 2000 and 2002, although generally there was a decline in area planted to bananas. Only households with PA illness, either male or female, increased their area planted in bananas. Beans, an important nutritional source in Rwandan diet, showed an increase in area under production for Season A in all households, especially in households with a female death.

The variability in production and area changes follows from the observed variability in effects and strategies pursued by households. The production shifts seen do not always follow what economic theory has predicted for households with death or illness. For instance, while tuber production and area increased, especially when a man died, they did not increase when women died of illness or were chronically ill (Figure 6a-c). Changes depended upon the gender of the person affected, so any strategy that looks at improving crop productivity will need to involve a range of crops, not just the tubers.

IX. Implications for Interventions

The effects and strategies to deal with illness and death stated by the households provide some insight as to the interventions that might be effective in ameliorating the longer-term decline that tends to occur in these households. While the households with morbidity and mortality lose the labor and skills of one member, the remaining members work to maintain the cropping system by drawing in labor from neighbors (based on social networks) or hiring in labor, when they have the resources. Some households bring in new members, particularly when a man loses his spouse. Survivors after a woman dies are more likely to have the resources than survivors in a household where a prime age adult male dies.

Among the strategies used by households was imparting agricultural knowledge to young people. Extension system support for activities focused on children could include school training programs, but would need to extend beyond that, since these households may withdraw their children from school. Extension programs designed for women and children may be able to reach the households that most need it, but only if the severe time constraints of women are taken into account by lessening labor demand for cooking or other household work at times when extension training is available. In households where a woman dies, the remaining members are more likely to try to bring in new members to help with the work accomplished by the person who died. This makes it less likely that a remaining male head of household will need to acquire the skills to grow what are primarily women's crops, such as sweet potato and cassava.

Agricultural technology development remains an area in which the results of this work suggest that multi-faceted approaches would be most appropriate. Focusing on subsistence, laborsaving crops may help some households, but many are looking for ways to maintain their agricultural production of the variety of crops grown. This would suggest that improving labor and land productivity of sweet potatoes, irish potatoes, maize, and cassava should all be targeted.

Bananas have long been a major source of income for Rwandan families, and the plants have good characteristics for countering soil erosion when planted densely on hillsides. Current problems with disease may be affecting the productivity of bananas, yet in general all types of households are either increasing their area in bananas or reducing area only slightly. Policy may be able to increase the productivity and income gains possible from fruit and cooking

bananas, which have much higher nutritional gains than the beer bananas. These households under stress would benefit from such increases.

The households with morbidity and mortality are disproportionately found in the lower expenditure groups in the EICV analysis. Their health care expenditures are reported as either zero or very high, such that recourse to the formal system occurs only when illness is severe. This accounts for the increasing debt and lowering savings of households with a chronically ill adult. These households are the least likely to be able to afford health care under cost recovery-based health care provision. Methods to spread out health care costs over time might lessen the impact of high health care costs.

There are households that indicated selling land, selling livestock and selling assets, as well as losing sources of off farm and labor income, particularly as a result of male PA adult death and chronic illness. For households whose income earning potential has declined, credit systems may just mean falling further into a hole, unless the credit can ensure an income generating enterprise. There were households that used the strategy of lending or renting out land, or leaving land fallow. Ensuring land tenancy rights under rental arrangements may be one way to enable households to earn from land that they have when they do not have the labor to crop it. The sample numbers in this study are too small to determine the extent to which women and children lose their access to land when the male head of household dies. For households that dissolved, this may be part of the problem. The public sector is key in establishing and enforcing clear tenure rights for survivors, such that households can retain control when they lose core household members.

As PA morbidity and mortality increase with the effects of HIV/AIDS, the social networks for labor exchange, gifts, taking care of orphans, will all be stressed. Those left in affected households will follow the individual strategies when the social strategies are not available. In particular, women-headed households, unable to rely on neighbors to help cultivate land, will see restrictions in their options. Reinforcing social networks through community programs for labor, health care, childcare, marketing may be one strategy to assist these households in particular.

X. Conclusions

Rwandan development has been undermined in recent years, and PA adult morbidity and mortality is taking its toll as well. Many households indicated relying on sharing labor with other households, but can this strategy remain effective over time? Reliance on community mechanisms to care for orphans and to deal with labor shortages may not be an option as the number of HIV/AIDS related illnesses and deaths increases. As McBride (2002) noted for Malawi, community systems for caring for orphans are overwhelmed. Hess's work in Rwanda (2002) indicates child-headed households without special assistance are already less able to provide sufficient nutrition and schooling, as social networks are strained.

HIV/AIDS is not just an urban problem in Rwanda and elsewhere in sub-Saharan Africa. For that reason, health messages need to get out to the rural areas, through radio programs or by other means. Agricultural extension agents, whether from the public sector or the NGOs, become key resources, as they have direct contacts with farm households. For that reason, they should receive basic training on HIV/AIDS transmission and living with AIDS. In addition, extension agents are one of the vulnerable groups for they travel extensively for their

work, so ensuring that they understand the basic facts of HIV/AIDS transmission and progression of the illness will help prevent them becoming vectors of the disease.

The strategies selected by households to deal with the stress of illness and death range from hiring in labor to renting out land to selling land and livestock. For those households selling assets, the future is probably one of increased poverty. Their income earning potential was lowered with the loss of human capital due to illness and death, and as a consequence, they have also had sell productive assets, including livestock and land. For those households that are attempting to keep their assets and work the land, facilitating access to labor or making existing labor more productive seem logical directions to go. Rather than focusing on less labor-intensive crops, however, the households strive to keep agricultural labor up, to keep producing crops for both home consumption and the market. This would indicate that efforts for improving labor productivity in agriculture would complement the households' other strategies. Reducing labor demand in other activities (for example, seeking water) might also be important. Such efforts might include introducing new technologies or alternative income crops or activities. Agricultural extension and training becomes important, particularly for the young and for women, since traditional ways to pass on farming and other knowledge has been compromised by the loss of adults, especially men. Since extension services in Rwanda have not reached women effectively in the past (Bucyedusenge et al. 1990), special efforts to reach women and children are necessary.

Earlier studies found that women have significantly less access to extension and agricultural training, and are less educated than their spouses and brothers. In 1990, in evaluating the disadvantages for all women-headed households, Bucyedusenge et al. suggested programs to increase access to improved seed for food crops to enable productivity improvements without higher labor demands.

Ensuring that widows and children are able to inherit land and other assets when the male head of household dies is critical to keeping the household intact and able to function. Changes in the land law have improved the legal provisions for inheritance since the mid-1980s, but loss of land with death has occurred with households that were visited.

When men die, the remaining household members, usually with a female head, tend to rely on family and neighbors to help, but as the societal stresses increase with more adult deaths, this reliance on social networks may be strained.

In the health sector, efforts at cost recovery for health services at the local level may put health care out of reach for many of the affected households, as they are more likely to be in the lower income groups. Targeting assistance for those households may be the only way to reach them with modern health care. Actions outside of agriculture could also improve a household's chance of recovering from the stress of a death or illness. As households seek to keep up agricultural production, helping to provide home health care needs for the ill could relax the labor constraint on agriculture for that household.

This research will continue to look at the affected households, as data become available and can be evaluated. EICV data on anthropometrics may yield insights into nutritional effects on children, while the income data will enable more comparisons among households. This work can be combined with the evaluation of child headed households from the CARE study as well as the national HIV/AIDS prevalence study currently underway to further understand how policy interventions in agriculture and other sectors may help to lessen or alleviate the

potentially devastating effects of morbidity and mortality in rural areas. To understand the relationships, more advanced econometric methods will be used to evaluate how morbidity and mortality among PA adults affects these households, compared to other rural households in Rwanda.

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Annex 1

Annex Table 1: Strategies of Households to deal with Prime Age Adult Death or Chronic Illness

Adjustment strategies	Percent of households indicating use of strategy ¹					
	Cases of sudden death	Cases of death due to illness	Men who died due to illness	Women who died due to illness	Men with chronic illness	Women with chronic illness
	%	%	%	%	%	%
1. Labor strategies	53	62	55	70	72	66
Get new hh member/encourage return of previous household members	6	18	9	26	0	2
Hire ag/livestock labor	31	7	0	13	24	30
Seek sharing of labor from other hh's	31	24	23	26	40	36
Less leisure/work more hours in fields	21	22	27	17	24	14
2. Agricultural technology and cropping	33	31	41	22	36	44
Cultivate less land/leave land fallow	32	22	27	17	36	41
Change crop mix to raise income	0	0	0	0	0	2
Change crop mix to less labor intensive	6	2	5	0	0	3
Weed crop less	6	7	9	4	4	5
3. Child-related strategies	27	11	9	13	8	13
Reduced schooling for children	13	2	0	4	4	8
Teach young children ag.practices	13	9	9	9	0	0
Sent children to live with relatives	0	0	0	0	8	6
4. Asset-based strategies	47	27	27	26	48	39
Rent out some land	21	9	9	9	0	3
Loan land to relatives	13	0	0	0	0	0
Ask relatives for loan or income	13	9	5	13	32	23
Eat fewer meals	6	4	9	0	0	2
Sell livestock	6	4	9	0	16	9
Sell land	0	7	9	4	12	0
Sell hh assets other than land	6	4	5	4	8	14
5. Other	7	7	9	4	0	5
Number of households responding	15	45	22	23	25	62

Source: FSRP/DSA Rural Labor and Deaths Survey, 2002.

¹ Out of households that had a strategy. Each household may have up to three strategies, if they had just one member affected.