Labor Effects of Adult Mortality in Tanzanian Households

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Due to the HIV/AIDS epidemic, sub-Saharan populations are challenged with increasing adult mortality rates that have potentially profound economic implications. Yet, little is known about the impact of adult deaths in African households. Using panel data from Tanzania, this paper will explore how prime-age adult mortality impacts the time allocation of surviving household members and the portfolio of household farming activities. Analysis of farm and chore hours across demographic groups generally found small and insignificant changes in labor supply of individuals in households experiencing a prime-age adult death. While some farm activities are temporarily scaled back and wage employment falls after a male death, households did not shift cultivation towards subsistence food farming and did not appear to have reduced their diversification over income sources more than six months after a death.

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I. Introduction

Despite the possibility of declines in the number of new Human Immunodeficiency Virus (HIV) infections in some parts of Africa, deaths from AIDS in Africa will continue to rise well into the future (UNAIDS/WHO, 2001; Bongaarts, 1996). While there are other more prevalent diseases in Africa, the characteristics of HIV/AIDS suggest that its economic and demographic impact will be profound. In the absence of the AIDS epidemic, prime-age deaths are relatively rare in Africa. In an area with high levels of HIV infection, prime-age mortality rates can double, triple or even quadruple (World Bank, 1993). Moreover, HIV/AIDS is not restricted to poorer populations. Unlike other major diseases in Africa, HIV/AIDS is prevalent among the better educated and higher income Africans in urban areas, with some evidence indicating higher rates among these groups (see World Bank, 1997). Although HIV/AIDS is typically considered to be primarily an urban epidemic, there has been increasing concern about the implications of HIV for food security, since rates in rural areas may be rising (FAO, 2001; National Research Council, 1996).

Barnett *et al*. (1995) assert that in areas where the major sector is agriculture the main burden of the impact of HIV/AIDS falls on the labor economy of the household, but little empirical evidence exists of this effect. Drawing on a panel data set from the Kagera region of Tanzania, the Kagera Health and Development Survey (KHDS), this paper estimates the impact of prime-age deaths on the set of activities and time allocation of individuals among surviving household members.

The potential reallocation of time by individuals and changes in household activities are of interest for several reasons. Adjustments in labor supply may give insight into the mechanisms that households use to smooth consumption in the event of the death of an adult member. While some research has shown that households in rural areas are able to partially smooth consumption in the

face of weather and other income-related shocks, the channels by which they smooth are not well researched (see, for example, Townsend, 1994). There is some evidence that time allocation in rural households is responsive to idiosyncratic and aggregate (village-level) income shocks (Fafchamps, 1993; Jacoby and Skoufias, 1995; Kochar, 1999; Rose, 1999). Some have analyzed adjustments in time allocation in response to illness shocks and health status among other household members (Pitt and Rosenzweig, 1990; Kochar, 1995). Own-illness, either chronic or acute, will also impact an individual's own time allocation decisions (Pitt and Rosenzweig, 1986; Pitt *et al*. 1990). Farm households may, in fact, be more vulnerable to demographic shocks than to crop income shocks (Kochar, 1995).

There are some key features that distinguish prime-age adult mortality from economic shocks in the studied cited above. First, morbidity diminishes labor capacity over the duration of illness, whereas a death results in the *permanent* loss of an individual. This implies that households will need to adjust to the long-term loss of this individual's labor and related income, in addition to the loss of management skills and acquired human capital investments. Second, in the case of higher mortality due to AIDS, the deaths are preceded by *severe* debilitating illness resulting in limitations in activities of daily living. Moreover, these deaths are concentrated among prime-age workers, who are typically the most economically productive household members. Finally, adult mortality due to illness may be anticipated to some extent by the household. Thus, households may adopt *ex ante* strategies to cope with an impending adult death, alternatively thought of as *ex post* illness response. These characteristics of prime-age mortality suggest that we cannot necessarily equate it with other sorts of economic shocks facing agricultural households, such as variation in weather or temporary illness.

Less analysis has examined the potential differential effects of income shocks on individuals which may be an important factor in the design and implementation of policies (Quisumbing, 1996). If time allocation is adjusted to buffer households from the shock of an adult death, household-level outcomes may mask differential outcomes across household members. That is, the burden of adjustment may be concentrated among certain group (surviving prime-age adults, children, the elderly, etc...).

Understanding the interaction between individual labor participation rates of survivors and prime-age adult mortality will be informative in the application of macroeconomic simulations used to estimate the impact of the HIV/AIDS epidemic on economic growth (e.g. Robalino et al., 2002; Cuddington, 1993a; Cuddington and Hancock, 1994; Cuddington, 1993b; Kambou *et. al* 1992; Over, 1992).[1] Cuddington (1993a) proposes that this type of analysis can be used to evaluate the economic outcomes associated with different health sector interventions. Analysis of individual and household behavior can, in turn, inform those undertaking these types of simulations. These studies depend critically on the labor productivity and savings loss parameters assumed which capture the fraction of worker productivity and savings lost due to an AIDS-related illness, although there is a lack of micro estimates of these key paramters.

Finally, if high rates of adult mortality result in farm labor shortages that cannot be easily made up for by hiring in labor, then we may observe a decrease in crop production, as speculated by some (FAO, 2001; World Bank, 1992; Brown *et al*., 1994). The contention is that diminished labor quantity and/or quality will increase the incidence and depth of household poverty and, thereby, food insecurity; the implications of the AIDS epidemic for food security across Africa are

[1] As concluded by the World Bank (1997), the available evidence suggests that the net impact of AIDS on GDP growth rates per capita will be small, although some studies find large reductions in GDP growth rates. The cross-country analysis by Bloom and Mahal (1997) finds an insignificant effect of the epidemic on GDP growth. The authors stress the need to explore their result "in terms of labor supply and relative shifts in labor supply...caused by AIDS morbidity and mortality."

potentially huge where labor power is crucial to agricultural production. Moreover, agricultural production in Sub-Saharan Africa shapes the availability and price of food for urban markets and is a major export good. At the same time, changes in labor activities may be associated with changes in diversification over income sources. For agricultural households, diversification can provide security against the volatile income stream associated with agriculture (see Reardon, 1997).[2] The economic viability of households may be compromised if, for example, households must shift participation of household members away from off-farm activities or cash crops to subsistence farming.

We anticipate that labor supply will serve as a response mechanism to deaths or other idiosyncratic shocks in households in part because there are very limited options for risk coping and management in this region (see Dercon, 1996, regarding risk management in Tanzania). Regions like Kagera lack formal credit and insurance markets, and have limited options for savings and asset accumulation. While informal institutions and arrangements among households may partially accommodate households, labor serves as the pivotal resource to all households.

A handful of studies have examined the impact of prime-age deaths on labor (primarily due to HIV/AIDS) at the household and individual levels. The lack of studies of the impact of an adult death at the household level or across individuals stems mainly from the lack of data. Gillespie (1989a, b) evaluates the impact of AIDS on farming systems in Rwanda using data on household labor supply by gender to crops across seasons. His analysis does not allow for changes in labor allocated by gender or the potential for hired labor (or even other farm inputs) to accommodate labor shortages. Cleave (1974), however, surveys a large number of studies of African farmers and finds that traditional allocations of work between sexes are modified in

[2] See the study by Collier *et al.* (1990) for a description of the degree of diversification over economic activities by households in

response to labor shortages. Barnett and Blaikie (1992), using a detailed field study, present mixed anecdotal evidence about the farming systems and activities of 129 households in the Rakai district of Uganda in response to an AIDS death; they find no significant change in agricultural production in the district. Barnett *et al*. (1995) and Barnett (1994) analyze data from rapid assessment surveys of households in Uganda and communities in Tanzania and Zambia. They find some discernible evidence of impact in only one community in Uganda where they note a shift over the period of 1989-1993 to subsistence crops most pronounced for poorer households. In the Tanzanian communities, these studies found little evidence of an impact of morbidity and mortality due to the epidemic. Yamano and Jayne (2002) examine crops farmed (acres and output) among rural households in Kenya and find no change in net or gross output after an adult death (total and per acre), although they do find a significant decline in acres of high-value crops farmed.

Tibaijuka (1997) draws on data collected in 1989 from households in one village in the Kagera region of Tanzania. Of the 220 households surveyed in this village, her study focuses on the small sample of households (10) that reported an AIDS death which was confirmed in a hospital since 1985. Pitayanon *et al.* (1997) study a sample of households in Thailand that had either an HIV/AIDS related death, a non-HIV/AIDS related death, or no death in the past 1-2 years. They assess the impact of HIV/AIDS related deaths on the household labor supply as substantial. However, they have vague measures of this effect and no information collected from households before the death occurred.

This study uses a detailed panel data set to focus on one specific area of potential impact, time allocation. The paper is organized as follows. The next section presents a basic model of time allocation and introduces the event of an adult death into this framework. Empirical specifications

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rural Tanzania.

are described in Section III. Section VI describes the Kagera Health and Development Survey (KHDS) and empirical results are presented in Section V. Section VI concludes.

II. Theoretical Framework

There is a large literature on the theory and determinants of labor supply, as well as empirical evidence bearing on the economics of time use in developing economies (see Becker, 1965; also see Juster and Stafford, 1991, for a review of this literature). Some of this research focuses on total or off-farm labor supply and response to wage rates or shadow wages in farming (Rosenzweig, 1980; Jacoby, 1993). Other work has examined time allocation across activities in agricultural households (such as Evenson *et al*., 1980; Khandker, 1988; Mueller, 1984; Skoufias, 1993). In these models, the solution to the utility maximization problem yields the conventional result that the reduced-form time-demand function for individual *i* in activity *j* will be a function of prices, wages, total time available and unearned income. Additionally, individual and household-level unobservables enter this equation:

$$T^j_i = T^j_i(p_m, p_a, w_i, T_{hh}, Y_{hh}, \upsilon_i, \upsilon_{hh}; Z) \quad (1)$$

where T is time in activity j, p_m is a vector of prices for market goods, p_a is a vector of prices for home-grown commodities, w is the wage rate, T is total stock of time, and Y is non-labor income, conditional on Z, a set of taste/preference shifters. Unobservable individual and household-level specific variables are captured in υ_i and υ_{hh}.[3]

We can extend this equation to incorporate mortality of household members by considering its effect through full income. The preceding illness and subsequent death of a household member will affect the allocation of time of remaining members through several pathways: the total time

[3] Unobservables could affect an individual's time allocation through a health production function but could also feasibly have other affects. For example, household-level unobservables could enter in farm production and individual-specific endowment may affect effective labor, conditional on health. Market wage offers may also respond to unobservables.

available in the household, the effective time of household members, expenditures and asset stock.[4]

An adult death changes the total stock of household time available for allocation (T) in two ways. First, the total time of the deceased is gone. Second, among individual survivors, the death also implies constraints on time use in the short-run. For example, we normally associate deaths with customs such as funerals and mourning, which includes social customs mandating periods of mourning where mourners cease participation in economic activities. A death due to illness such as AIDS may imply demands on non-afflicted members' time such as caring for the afflicted person and assistance in seeking medical care prior to death.

In addition to changing the stock of total time, we expect that the illness that precedes death will affect the effective time of the dying household member through health status.[5] Moreover, the quality of labor inputs of other members may be diminished if they contract illnesses themselves from the presence of infections and diseases. Health status of afflicted and non-afflicted adults can also impact wage offers if employers perceive declines in effective labor.

An adult death usually mandates expenditures on terminal medical care and funerals which can be a significant portion of household cash income (National Research Council, 1996, Konde-Lule *et al.* 1995). Cost of burial and mourning ceremonies can be quite high when social norms mandate that households pay for food, lodging and, perhaps, transportation of mourners. These expenditures result in a reduction of full income, and, thereby, may affect time allocation.

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[4] This treats the event of death as an exogenous shock to the household *conditional* on contracting HIV. It should be noted that even in cases of a fatal disease, such as AIDS, life can be prolonged depending on health inputs. For example, higher levels of health care and more advanced medications are reasons cited for significantly longer durations of AIDS in HIV/AIDS patients in the U.S. than in African countries (see, for example, Ryder and Mugerwa, 1994). To this end, households can potentially influence the *timing* of death. In the region studied in this analysis, these high-cost health care and advanced medication options are not available to households so it is presumed that the degree to which households can prolong life for household members afflicted with "full-blown" AIDS is minimal. Furthermore, given the low level of testing for HIV in Africa, especially in rural areas, health care intended to delay the onset of AIDS is not considered.

[5] The extent to which individuals suffer physical disability or limited activities will depend upon the specific illness with which they are afflicted. O'Dell *et al.* (1996) study physical function among a sample of American adults with AIDS and find mild to moderate disability in instrumental activities of daily living (such as grip and reach) although severe disability is rare.

In addition to the expenditure associated with death, assets such as land rights and other property held by the individuals may be inherited by individuals outside the household after a death. Women may be especially vulnerable to the loss of a spouse and, consequently, ownership of productive or otherwise valuable assets and legal title over land.

Finally, the event of deaths of non-resident relatives may also influence full-income through non-labor income. These deaths may be associated with financial and labor shocks to households with no household member deaths if there exist reciprocity arrangements across households in the form of, for example, remittances. At the same time, households may contribute to medical and funeral expenses for deaths in their extended family and thereby expenditures associated with deaths may be incurred in households in which no death had occurred.

As well, we can consider the full-income effect of an adult death to include an impact on farm profits if we drop the assumption that effective hired labor and family labor are not perfect substitutes (see Singh et al., 1986, for more discussion of separability in agricultural household models). If farm production and consumption decisions are not separable, then farm profit will also depend on household composition and the health status of household members. The death of an adult member also implies the loss of some of the managerial capacity or stock of experience available to the households in farming (see Rosenzweig and Wolpin, 1985). If no market exists for these farm inputs, then separability also fails and, consequently, farm productivity and profits can be negatively affected by an adult death in the household.

We expect that the characteristics of an adult death (such as cause of death, and gender and position in the household of the deceased) should affect the household's response. If prime-age deaths are caused by illness, as in the case of HIV/AIDS, to some extent households may anticipate the death and adopt coping strategies preceding the event, such as recruiting new residents before

death but after the illness onset. After the death, household responses may depend of the time since the event for a number of reasons. For example, if households cope with a death by initially selling non-productive assets, then time allocation may be unaffected by a death only up to the point where households exhaust this wealth. If other households temporarily aid households experiencing an adult death, then, again we see more muted responses closer to the event. On the other hand, *ex post* time allocation responses might be larger in the period closest to the death if, for instance, replacement labor is not readily available.

III. Empirical Specification

Time Allocation

Using panel data (described in the next section), from equation (1), time allocated to activity j by individual i in period t is modeled in the reduced form as follows:

$$T^{j}_{it} = \beta_0 + \beta_1 V_{ht} + \beta_2 X_{it} + \beta_3 Z_{ht} + \beta_4 D_{ht} + \upsilon_i + \upsilon_{hh} + \varepsilon_{it} \quad (2)$$

V is a vector of dummy variables indicating village and interview round which will capture all village-level characteristics (such as wage rates, prices, and infrastructure). V also includes dummy variables for the month and year of interview for seasonal effects and overall changes in regional prices across years.

X is a vector of individual characteristics including age, education, and headship.[6] The vector Z includes household production characteristics (components of full-income), which include characteristics of the household head (age, sex, and education) and a measure of assets (inherited land). Household composition variables, which are believed to be endogenous, will be excluded from the set of regressors. The age and sex composition among surviving individuals within the

[6] For children and young adults (15-19 years), education and headship are not included because these individuals are still in school and very few are household heads. For these samples, parental information is included describing orphan status, presence of parents in the household, and status as child of the household head.

households is posited to be influenced by the occurrence of adult deaths and other covariates (Rosenzweig, 1988).[7]

D is a set of variables describing deaths, explained in detail below. The terms υ_i and υ_{hh} are individual and household time-invariant unobservables, respectively.[8] The error component ε_{it} is assumed to be independently and identically distributed with mean 0 and variance σ^2_ε.

D is a vector of variables describing the future and past deaths of adults 15-50 years who are household members. Variables describing future deaths capture two simultaneous occurrences. Future death variables should identify households with very ill household members, which may influence time allocation -- regardless of the household's expectation or knowledge of the impending death (*ex post* illness response). At the same time, households may be adjusting activities, not only to account for a potentially ill household member, but in preparation for an anticipated death (*ex ante* death response). The future death variables, therefore, identify an *ex ante* death coping strategy and an *ex post* illness response. If it is the case that households cannot (or do not) accurately anticipate deaths, then the future deaths variables will capture only the latter effect. Past death variables describe *ex post* responses to factors such as income shocks associated with funeral expenses and shocks to potential stock of labor in the household.

The shock of an adult death has several dimensions that need to be captured: the discrete event itself, the time to and from the event and characteristics of the deceased. Several alternative depictions of this impact were explored and the results of one of these are presented.[9]

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[7] Other analysis of household composition in the KHDS sample showed a high level of turnover of household members of all ages and revealed a significant impact before and after the death of a member on the probability of another adult joining or leaving the household (Ainsworth *et al.*, 1995).

[8] One restriction of this time demand function is that the cross-effects of unobserved endowments are the same for all types of members as long as they result in the same household average unobservable. Consider the unobservable to capture health endowment. The restriction then considers a low health endowment of an adult woman to have the same effect as a low health endowment of a male child so long as they result in the same household average endowment. Alternative, υ_{hh}, could be divided into several household endowments for different age and sex groups.

The set of D variables identify households in which at least one person died while residing in the household. This includes individuals who joined the household and died shortly thereafter. Ideally, we would like to separate deaths of household members into those that were long-term members and the new arrivals, but small cell sizes in this larger, more descriptive set of death variables restrict us to grouping them together. Whereas some individuals move into the household shortly before death, it is also possible that some non-member relative deaths are individuals who recently exited the household, although these cases cannot be identified in the data used.

A set of variables are included to identify any male or female prime-age (15-50) death in the household in the future and past within 12 months of the interview date.[10] This interval is subsequently subdivided into two periods to infer differences of the impact of death depending on distance of death from the interview date: 0-6 months and 7-12 months from interview date.[11] Each dummy variable is 1 if such a death occurred and 0 otherwise.

Only the most recent death for each category is identified and so the dummy variables do not take into account multiple deaths within a household over the specified time interval. This is rarely observed given the classification of deaths by sex, limitation to deaths of household members, and truncation of deaths prior to 12 months preceding the first interview in the panel. Moreover, since most households only experience one death during the panel, the set of D variables

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[9] The various alternative specifications examined included, for example, variations in an Almon polynomial in the months since/to an adult death (see Greene, 1990) and dummy variables for less aggregated monthly groupings (such as single month intervals and 3 month intervals). Characteristics such as education of the deceased could also be introduced. The small number of deaths, especially once prime-age deaths are segregated by sex, makes obtaining results from a more descriptive set of variables increasingly difficult.

[10] Thus, the control group is not households that do not experience a death, but rather those that had no death within a year. Indicator variables for the number of future interviews (and, therefore, censoring on the variables for future deaths) are included.

[11] Few deaths occurred within 2 weeks of the interview date, where we would expect to observe periods of mourning and other funeral activities. Thus it is presumed that this approach of categorizing deaths in periods covering 0-6, 7-12, and 0-12 months in the past will not be capturing these types of short-run activities associated with deaths.

can be thought of as a specific parameterization of one variable measuring a death, whether it be male or female, past or future.[12]

Household-Level Activities

As an extension to analysis of individual hours, the farming of specific crops is also examined. Although these estimations cannot reveal information about output or yields, they may indicate the extent to which farming of food and cash crops shifts as a consequence of an adult death. These estimations include the same set of household characteristics as the individual time allocation regressions for equation (2): characteristics of the household head (age, sex and education), acres of inherited land, and month and year of interview. Dummy variables indicating village and round of interview, month, and year should capture spatial and temporal variation in, for example, weather and prices that may influence farming decisions.

Estimation Methods

The analysis of time allocation is confounded by at least two econometric issues. The first is the potential omitted variable bias and the endogeneity of deaths. There are (at least) three ways that deaths could be viewed as endogenous. First, the death of an adult in the household is itself a function of household unobservables (υ_{hh}) and the non-survivors' individual unobservable component. Thus, through the omitted time-invariant variable, υ_{hh}, death is endogenous and OLS results will be biased. If all deaths were caused by *fatal* illnesses *randomly* distributed in a population, then we would not suspect the set of death variables to be correlated with households unobservable characteristics. The presumption is that a significant portion of deaths are caused by AIDS, a disease typically contracted through distinct patterns of behavior (see, for example,

[12] This interpretation can be juxtaposed against one which would apply in the case of having multiple deaths for households. In that case, the interpretation in complicated since, for example, a coefficient on past deaths measures the effect of a past death on hours conditional on a future death.

Philipson and Posner, 1995). Conditional on household unobservables, in this example, the individual-specific unobservables of *survivors* would not seemingly be correlated with the variables describing deaths of others which are a function of household and the *non-survivor's* individual effects. In this example, fixed effects regressions at the individual level will remove the bias of this time-invariant household unobservable.

However, we can propose an alternative example in which the survivor's individual unobservables could result in the endogeneity of mortality. Consider the possibility that an illness sickens a healthy person and thereby affects that person's labor supply. That same illness could hasten the death of another household member already affected by AIDS. To the extent that this negative health shock is time-invariant (at least over the course of this panel data set, approximately 21 months), controlling for individual heterogeneity using fixed effects will address this potential bias. If illness status is a time-varying unobservable, but linked to a community-effect (such as level of contagion or sickness in the village), then the set of village-time indicators will address the endogeneity. Otherwise, time-varying unoberservables of this nature can lead to biased results at least for the measure of future deaths and this caveat should be kept in mind when considering the findings on future deaths.[13] A similar example could be constructed for a time-specific shock that effects time allocation and, in turn, reduces time spent caring for a sick household member which thereby perhaps hastens the death. Again, the set of future death variables in a fixed effects estimation may be biased in this scenario.

The second source of endogeneity is through choice of residence. The event of a death is a reflection of household composition, which can be endogenous. To the extent that individuals chose to live in households in response to illness or recent death, the event of death in their

household is endogenous. This is further evidenced by two findings in the KHDS data. First, there is a high degree of change in household composition over time and, second, about one-third of all adult deaths in the data are among people who move into the household within six months of dying. One approach to potentially address this problem is to broaden the measure of mortality to encompass the death of any close non-resident relative in addition to deaths among household members. Using fixed-effects should remove bias on past deaths, however. In this case, by definition, the negative health shock would be time-invariant in order to affect both current time allocation and the past deaths of others. These measures were examined but are not presented below since these variables were not significantly associated with changes in participation or hours. This point is revisited in the conclusions.

A second econometric issue is the censoring of hours at zero. This is of greater concern in the analysis of wage employment and non-farm self-employment where a large share of the sample does not participate. For these analyses, participation decisions are estimated using probit estimation. These probit equations are estimated with Huber-adjusted standard errors for clustering at the household level. Thus, these estimates will not be purged of the edogeneity problems noted above.

III. Data

Data Setting and the Kagera Health and Development Survey

The data for this study are drawn from a research project conducted by the World Bank and the University of Dar es Salaam in the region of Kagera in northwest Tanzania. Tanzania and a host of other countries generally clustered near Lake Victoria (for example, Uganda, Kenya, Rwanda, Malawi and Burundi) are some of the most seriously HIV/AIDS affected countries in the

[13] Using fixed-effects should remove bias on past deaths, however. In this case, by definition, the negative health shock would

world. Kagera is estimated to be one of the regions in Tanzania most affected by the HIV/AIDS epidemic (World Bank, 1992).[14]

The Kagera Health and Development Survey (KHDS) surveyed over 800 households in the Kagera region up to four times from 1991-1994 with an average interval between surveys of 6-7 months. For further description of the project and data see Ainsworth *et al*. (1992) and World Bank (1993). The sample is a random stratified set of households where households thought to have a high risk of an adult death were over-sampled.[15] Households are drawn from 51 communities, mostly villages, across the six districts of Kagera. The KHDS has information on numerous individual and household characteristics, including detailed data on past deaths of household members and non-resident relatives. Data on time allocation over the last seven days for several activities were collected for household members seven years and older.

Individual Time Allocation Patterns

Table 1 presents the means for time use and prevalence of prime-age deaths in households. The sample excludes persons who were observed during the survey and subsequently die during the panel in order to avoid confounding the impact of an individual's future death or current illness on their *own* current time use with the impact of a past or future adult death on *other's* time use.

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be time-invariant in order to affect both current time allocation and the past deaths of others.

[14] In Africa, HIV/AIDS is primarily contracted through heterosexual contact. For more discussion about the nature of the epidemic in Kagera, see Killewo *et al.* (1990) and Killewo *et al.* (1994). One could argue that to best estimate the impact of adult mortality you would want to examine households in an area with a low incidence of HIV/AIDS so that the event is unanticipated for all households. Despite the fact that HIV levels are very high in Kagera, the probability of a prime-age adult death at the time of this survey was small. If households do anticipate the event of a prime-age adult death even before the onset of illness we may see more muted responses in time allocation than we would otherwise observe if the event (death and the preceding illness) was unanticipated. This raises an alternative issue which this study does not focus on: household responses to the perception of *risk* of an adult death and risk-sharing activities in which households may participate.

[15] The stratification of households based on high or low risk of death was based on an enumeration survey of all households in the 51 communities. This enumeration survey elicited information about sick prime-age adults and recent past deaths. The fixed-effects approach addresses the stratified choice-based sampling employed to construct the sample where households that had already experienced a death or had sick adults were more likely to be surveyed.

Overall, 70 percent of the sample reported working last week in one of the three areas of economic activity: wage-employment, non-farm self-employment, and farming. At least two-thirds of the entire sample had farmed in the last seven days. As an indicator of participation in agricultural activities, this figure provides a lower bound, given that wage employment includes farming or working in other agricultural activities for others.[16] Only a small fraction of adults, predominantly men, did not participate in farming in the past year.

Agriculture in sub-Saharan Africa, as in other developing regions, typically displays a gender division of labor in agricultural tasks and across crops. In the KHDS sample we find that a significantly higher percent of prime-age women reported farming the main food crops in the last seven days than prime-age men. Farming of the main tree crops (bananas and coffee) and sugar cane in the last week was not reported more often by men. Tibaijuka's (1984) earlier 1982-1983 survey of Kagera finds a similar pattern of the gender division of labor, where women have a high level of involvement in all farm activities except livestock rearing.

Average weekly hours in farming among the KHDS sample are low compared with Western standards. Individual farm hours *per day worked* in the last week averaged just over 4 hours among prime-age men and women. Daily average hours for *all* persons for the last week are lower, under 3 hours for prime-age adults. Low average daily hours alone are not necessarily evidence of underemployment. Cleave (1974) surveys a large numbers of studies of agriculture in Sub-Saharan Africa and notes that seasonal peak times may be associated with much higher time spent on agriculture and competing demands for time in non-agricultural activities also need to be

[16] Kagera is predominantly made up of small-holder coffee-banana farms and observes two cropping seasons, although tree crops and cassava have fairly continuous cultivation over the year. It is, however, not homogenous with respect to the farming systems. There are considerable differences across zones with cotton and cattle being more common in the southern districts. While bananas are typically considered a food crop, they are becoming increasingly commercialized. Almost all the households in the sample from the KHDS had some land holdings (93 percent).

considered. In Kagera, however, seasonal labor demands are less pronounced for farms due to the presence of permanent banana and coffee trees.

Household Activities

The households sampled by the KHDS have strong ties to agriculture. In the first interview, three-quarters of households report having at least one adult member engaged in farming in the last seven days; this figure is 98 percent for the past year. At the same time, a large share of households had household members engaged in other income-generating activities. Only nine percent reported farming as the only income source.

Few households in the sample use any farm inputs besides unpaid family labor. In each round of the survey, roughly one-quarter to one-third of households reported hiring labor in the last 6-12 months. Hired labor is mainly employed in the strenuous task of clearing land for establishment of perennial crops (Tibaijuka, 1984). With the exception of manure (which was used but typically not purchased), very few farms in the KHDS sample used other non-labor farm inputs such as pesticide or fertilizer in farm production.

Reporting of Prime-Age Deaths

Households report deaths for two groups of people: household members and non-resident relatives. The definition of household membership of the deceased was left to the respondent for those deaths reported in the first interview. During the panel, the deceased was considered a household member if he/she had qualified as a member in the previous interview *or* had been residing in the household at the time of death. So, some people who moved into the household just prior to death were considered to be household members.

Almost all adult deaths (at least 95 percent) were attributed to illness, rather than accident or injury, childbirth, suicide or homicide. The average length of illness was 12 months. Cause

of death was reported by households and, if diagnosed, confirmed by a medical practitioner. About half of deaths were reported to be caused by AIDS; another third were cited as unspecified or unknown illness. Without reliable diagnosis by medical practitioners (or, more specifically, laboratory-confirmed diagnosis), it is difficult, if not impossible, to infer the true proportion of adult deaths due to HIV/AIDS. Households may incorrectly identify the cause of death because of lack of information, misconceptions, and stigma surrounding HIV/AIDS. In any case, this study is concerned with the event of an adult death, and not isolating deaths due to AIDS from other illnesses that afflict prime-age adults.[17]

About a third of adult deaths during the panel (between the first and fourth interviews) are individuals who joined the household between interviews. Thus, they resided in the household for less than seven months before death which may indicate that these individuals entered the household specifically because they were seriously ill. Some of the reasons these individuals relocate can include seeking terminal care, saving the family the cost of shipping a body, and the desire of seriously ill persons to die in their home areas. This raises the concern that the event of an adult death in a household is not exogenous if fatally ill individuals are selecting households in which they will die. It is the case that all of these persons were related to someone in the household and most were close relatives, primarily with a parent in the household and in some cases also siblings or a spouse. Nevertheless, small cell sizes restrict being able to disaggregate adult deaths to more narrow characteristics.

V. Results

[17] While the identification of the specific cause of death is not imperative, it is important that, in most cases, cause of death is not considered to be due to potentially curable illnesses. Otherwise, after contracting the illness, the subsequent outcome (death) would be endogenous to household and individual care decisions.

For estimation of individual time allocation equations, the sample has been divided into six groups: children (7-14), young women (15-19), young men (15-19), adult women (20-50), adult men (20-50) and older adults (51+ years). Young adults are separated from other prime-age adults (20-50) mainly because school participation is still a decision for these individuals. Results for response of hours in farming as well as chore hours to past and future deaths are presented in Table 2 for any death in the past/future 0-12 months. (Annex Table 1 present results for deaths in the past/future 0-6 and 7-12 months). In all cases, the Breusch-Pagan test is rejected suggesting that heterogeneity is present. In most instances, the Wu-Hausman test of the individual fixed versus random effects specification did not reject the null hypotheses that the individual unobservables are uncorrelated with the set of explanatory variables. The Wu-Hausman test on the subset of variables describing the deaths of household members is rejected in most cases, but not necessarily in every instance where the overall Wu-Hausman test is insignificant. For brevity, only the individual fixed effects estimates are presented.

Farm and Chore Hours

There is no evidence that surviving members work more hours per week on the farm as a consequence of an adult death in the past or future year. That is, almost all estimates for level of farming hours in Table 2 are small (under 3 hours) and statistically insignificant. Prime age adults do not work more hours before or after an adult death. Among women 15-19 years, a future female adult death is associated with nearly six hours less per week in farming. Farming hours are lower for children in households with a past male death.

When the 0-12 month period is divided into two segments, we observe some significant differences in weekly hours across individuals in households with or without an adult death (Annex Table 1). Women 20-50 and men 15-19 in households with a male death occurring sometime in

the future six months work 6-7 hours more in farming activities over the last week compared to their counterparts in households with no death. Female deaths within 0-6 months are associated with seven fewer hours among young women and future deaths 7-12 months were associated with fewer hours for men 15-19. Children and people over 50 years in households with a male death in the future 7-12 months had lower hours in farming.

Results for hours in non-farm household activities are also included in Table 1 and Annex Table 1. The category of chores includes specific general chore activities as well as caring for ill household members. These activities make up a large portion of weekly non-leisure hours, particularly for women, although caring-for-ill hours are a relatively small portion (for example, 6 percent of chore hours for primary care-givers, women 20-50, was spent caring for ill household members). In addition to the loss of potential labor for household chore activities (similar to the loss for farming), a fatally ill resident requiring care by others places a new demand on surviving household members. The extent to which these demands on labor constrain individuals can explain the lack of increase in farming hours. We might not see increases in farm hours if survivors have to spend more time in household chore activities as well as caring for an ill member in the months preceding death.

Men 20-50 are the only group that showed significantly different hours in chore activities for a death within 12 months, with nearly six more hours per week associated with future male deaths. This is surprising given the perception that females are primary caregivers. When months are divided into two periods (Annex Table 1), a male death in the future 7-12 months is associated with higher chore hours for adult men and lower hours for adult women. Hours in chores are lower and comparable in magnitude for women 15-19 and those over 50 years in households with a recent past female death. Given the inclusion of caring for the ill in the measure of housework

hours, we would have expected closer future deaths (within 0-6 months) to have a larger impact than deaths farther from the interview date. Female deaths in the past 7-12 months were associated with higher chore hours for prime-age women.

A household's ability to cope with an adult death may be dependent on the household's level of wealth. Wealthier households will have more assets and, perhaps, greater access to credit, both of which will affect the extent of time allocation adjustments. For instance, some households will be better able to finance medical and funeral costs through sale of assets. Likewise, such households may be better able to hire replacement labor for an ill or deceased household member. Results based on separated samples of households into two groups based on median expenditure per capita, found that, generally, individual farm and chore hours were not significantly associated with adult deaths in either group of households.

Non-farm Self-employment and Wage Employment

Changes in wage employment and non-farm self-employment are important because these activities are the main sources of cash income to these households. As mentioned above, notwithstanding the possible loss of income after an adult death, adult deaths are associated with large, immediate expenditures for both medical expenses and funeral activities. Due to low levels of participation among most samples, only adult males 20-50 were examined. Participation in wage employment is nearly three-times that of non-farm self-employment (30 percent to about 10 percent). These results are presented in Table 3.

Men in households with a female or male death were significantly less likely to report participation in wage employment within six months of a *future* death. For past deaths, there was no difference in participation for men in households with or without a death. The magnitude of decreased participation was large for both male and female deaths, at least 50 percent of the mean

level of participation. In fact, the magnitude of deceased participation probability was similar for male and female deaths (around 20 percentage points decrease). Non-farm self-employment participation showed no significant changes associated with male or female deaths.

Activities that pull individuals out of the household, such as wage employment, may be more difficult to sustain in times when the household has a fatally sick resident. Individuals in households with an ill female may incur additional household responsibilities, including caring for children, drawing them out of non-farm employment even if hours in farming or chore activities do not increase in response to future deaths. Considering the importance of diversification of income sources for agricultural households where the main activity, farming, has a high level of risk we tentatively find that one crude measure of diversification (participation in wage employment) is not compromised by past prime-age adult deaths, but is reduced in the short-run preceding an adult death.

Farming Activities of Households

Notwithstanding a small number of significant differences in farm hours among households with and without death, the results find little association between prime-age deaths and adjustments in farming hours. This may imply that overall farm hours and output have fallen, or that labor on Kagera farms is underemployed in which case output can be maintained despite the decrease in total hours (along the lines of the labor-surplus model proposed by Lewis, 1954). The possibility that output has declined has serious implications for food security for Kagera households where food consumption is the dominant category of household expenditure and the majority of food consumption is from home-produced items. Alternatively, households might increase hired labor to maintain output. Households might even use non-hired labor. In the short-run, it may be the case that individuals residing in other households are supplying labor to households with a prime-

age death. Over time, households may even acquire new members to increase the stock of labor. These possibilities suggests that linkages across households and within villages not only in terms of cash or in-kind remittances but also with respect to the movement of individuals (in the short or long term) are potentially important methods for coping with an economic shock such as an adult death. These issues also point out the complexities of assessing the labor endowment available to households. If labor resources of households transcend the composition of the household unit then policy makers may not be able to effectively assess relative vulnerability of households to the AIDS epidemic in terms of labor endowment (see Barnett *et al*., 1995).

If it is the case that total labor hours devoted to the farm do fall after a prime-age death, then we expect to see output and perhaps yields from farms fall, unless the marginal productivity of the deceased member was very low (i.e. there is under-employment on-farm or underutilization of labor). Unconditional on numerous factors such as poor health, average hours do not appear to be constrained in the KHDS. It is interesting to note that lower farm output (not per capita output) is not *necessarily* a negative outcome given that these households also have one less member to feed and shelter. However, even if this were true, decreased production of certain crops may be of concern to the national economy.

Table 4 presents results for the probability of any household member being engaged in farming of three crop types in the last seven days. Households with a male death in the past 0-6 months showed decreased participation in coffee farming. This suggests that, at least in the months immediately following a male death, cash cropping may be curtailed in favor of food crops. Participation in coffee and banana crops is not lower for households experiencing an adult death 7-12 months in the past. This is consistent with other evidence (Ainsworth *et al*., 1995) that male deaths are associated with new adults joining the household over a six month period, thereby re-

establishing farming of trees within seven months of the death. Probability of any time spent farming coffee is lower among households with a male death in the future 7-12 months.

Households with a more distant past male death did have significantly lower activity in farming of maize, cassava, and beans. This decline is consistent with the reduction in the number of persons for which these subsistence, non-commercialized foods are being grown, although they cannot tell us about outcomes on a per capita level. If per capita production does not decline, then this is contrary to the perception that an adult death will result in a labor crisis and in increased production of subsistence crops relative to export crops (see, for example, National Research Council, 1996). To what extent these result holds in the long term is not certain. Barnett *et al*. (1995) found evidence from Uganda that households shifted farming away from cash crops over a four year period. In their study of rural households in Kenya, Yamano and Jayne (2002) find evidence of shifting of cultivation from high-value crops towards cereals over a three-year period following an adult death.

VII. Conclusion

Despite much concern about the impact of the AIDS epidemic on households in developing countries, little empirical research has addressed this topic at the household level. This study examines one area of the potential impact of a prime-age adult death: adjustments in time allocation and household activities. Using a panel data set from Tanzania, participation in activities across different demographic groups and at the household level was examined.

Analysis of farm and chore hours across demographic groups generally found small and insignificant changes in labor supply of individuals in households experiencing a prime-age adult death. The lack of an increase in hours for past deaths is notable for children in particular for

whom deaths are presumed to result in higher farm hours assuming there will be an acute shortage of farm labor (Barnett and Blaikie, 1992). This may reflect the point that some of the areas in the region around Lake Victoria which are most affected by the HIV/AIDS epidemic are those least vulnerable to labor shortages.

Adjustments in household composition is one explanation of this lack of increase in hours in farming of surviving household members after an adult death. Other analysis found that households with deaths were more likely to receive new co-residents (Ainsworth *et al.* 1995). This suggests that households most vulnerable to prime-age deaths may be those without access to new household members. At the same time, it challenges policymakers to consider how to infer relative vulnerability to deaths in terms of access to labor that is difficult for outsiders to observe.

To infer the impact of deaths on farming activities, the analysis examined the farming of specific crops. These results focus on household level food security as well as broader implications for the agricultural sector. Coffee and banana farming in the last seven days by any household member did decrease in the six months following a male death in the household. This is suggestive that some farm activities are temporarily scaled back as a result of male deaths. This analysis did not find that households experiencing a death shift cultivation towards subsistence food farming. In fact, participation of individuals in farming of other subsistence food crops (maize, cassava, and beans) in households with a male death in the past 7-12 months declined. Without measures of aggregate output, we cannot draw conclusions about per capita changes in output. Nevertheless, the reduction in participation of individuals in these subsistence food crops, but not tree crops, among households with a male death draws attention to the point that prime-age adult deaths are a loss of labor and cause a reduction in the number of individuals consuming food and other goods.

Households experiencing a death do not appear to have reduced their diversification over income sources. While we see significant decreases in wage employment of adult men in response to a future female or male adult death, past deaths are not associated with changes in either wage employment or non-farm self-employment. Likewise, as mentioned, coffee farming is lowered in households with a death within six months, but not for deaths after six months.

These results can be applied to macroeconomic growth estimations of the impact of AIDS in a few dimensions. They suggest that an adult death of males participating in the rural labor market may not be offset by male survivors in the household, at least as measured by participation. Cuddington's (1993a) comments in his analysis of the macroeconomic impact of AIDS in Tanzania that estimates of the associated labor supply loss for an AIDS-stricken worker and survivors *before* death and the reduction in the labor pool *after* the death are not available. The results of this analysis shed light on the affect of a future AIDS death on labor supply of non-afflicted adults. Lack of *ex ante* and *ex post* adjustments in time allocation among survivors narrows the range of reliable estimates of the fraction of labor productivity (hours) lost per AIDS case to equal to or under one.

This analysis has focused on time allocation and activities of agricultural households using a large and detailed panel data set in comparison to the few studies in this area which have, to date, been small and illustrative. To complete the picture of the impact of HIV/AIDS, though, these results ultimately need to be incorporated into results on an array of adjustments and outcomes that households in this region may undertake when confronted with an adult death. Furthermore, these results need comparison to other types of farming systems, such as areas with lower population density and without tree crops. Moreover, the results highlight short-run adjustments. Further

research is needed to assess the extent to which these findings reflect long-run impacts of adult deaths.

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Table 1: Sample Statistics

	Children 7-14	Women 15-19	Men 15-19	Women 20-50	Men 20-50	Adults 51-65
Dependent Variables						
Farm hours last 7 days	6.68	11.13	11.38	15.34	13.11	16.57
	(8.91)	(11.44)	(12.45)	(12.83)	(13.62)	(13.73)
Chore hours last 7 days	10.40	17.87	10.16	20.47	5.91	11.29
	(9.55)	(11.10)	(9.54)	(13.43)	(8.84)	(12.57)
Wage employment last 7 days					0.30	
(1 if yes, else 0)					(0.46)	
Non-farm self-employment last 7 days					0.19	
(1 if yes, else 0)					(0.39)	
Female household member death						
Past 0-12 months	0.05	0.06	0.05	0.04	0.04	0.05
	(0.21)	(0.24)	(0.23)	0.20)	(0.20)	(0.21)
Future 0-12 months	0.03	0.03	0.04	0.02	0.03	0.02
	(0.16)	(0.16)	(0.19)	(0.14)	(0.16)	(0.14)
Male household member death						
Past 0-12 months	0.03	0.03	0.04	0.03	0.03	0.04
	(0.17)	(0.18)	(0.20)	(0.17)	(0.17)	(0.19)
Future 0-12 months	0.02	0.02	0.02	0.15	0.01	0.02
	(0.14)	(0.13)	(0.25)	(0.12)	(0.11)	(0.14)
Sample size	3912	1254	1204	2596	1894	1393

Source: KHDS 1991-1994. Notes: Standard deviations are in parentheses. The category "Chore hours" consists of collection of firewood, fetching water, preparing meals, cleaning house, and caring for ill household members.

Table 2: Impact of Adult Household Member Deaths (15-50) on Hours

PANEL A	**Women 20-50 years**		**Men 20-50 years**	
	Farm hours	**Chore hours**	**Farm hours**	**Chore hours**
Female death past 0-12 months	0.15	3.48	1.24	1.82
	(1.94)	(2.13)	(2.23)	(1.57)
Female death future 0-12 months	-1.56	-0.92	-2.24	0.13
	(2.51)	(2.76)	(2.76)	(1.95)
Male death past 0-12 months	-2.60	-2.15	1.34	-1.72
	(2.16)	(2.37)	(2.93)	(2.07)
Male death future 0-12 months	2.75	-3.56	0.86	5.71**
	(2.80)	(3.08)	(4.02)	(2.83)
P-value for joint significance:				
Female death past & future	0.76	0.13	0.37	0.42
Male death past & future	0.11	0.47	0.90	0.01
PANEL B	**Women 15-19 years**		**Men 15-19 years**	
	Farm hours	**Chore hours**	**Farm hours**	**Chore hours**
Female death past 0-12 months	-1.10	-2.39	0.61	-1.14
	(2.08)	(2.07)	(2.41)	(2.13)
Female death future 0-12 months	-5.71*	-2.56	-3.38	-1.83
	(3.04)	(3.02)	(2.78)	(2.46)
Male death past 0-12 months	-2.94	1.63	-2.12	-1.93
	(3.36)	(3.34)	(2.70)	(2.39)
Male death future 0-12 months	-0.33	2.21	5.22	1.11
	(4.27)	(4.24)	(3.60)	(3.18)
P-value for joint significance:				
Female death past & future	0.16	0.49	0.32	0.74
Male death past & future	0.56	0.86	0.08	0.50
PANEL C	**Children 7-14 years**		**Adults 51-65 years**	
	Farm hours	**Chore hours**	**Farm hours**	**Chore hours**
Female death past 0-12 months	-0.91	0.03	0.63	-2.07
	(1.01)	(1.06)	(2.58)	(2.08)
Female death future 0-12 months	-1.81	0.83	-3.69	-3.19
	(1.33)	(1.40)	(3.98)	(3.20)
Male death past 0-12 months	-3.31**	-0.44	-1.84	0.97
	(1.32)	(1.39)	(2.88)	(2.32)
Male death future 0-12 months	1.45	1.21	1.37	-0.19
	(1.62)	(1.70)	(3.92)	(3.16)
P-value for joint significance:				
Female death past & future	0.38	0.80	0.50	0.50
Male death past & future	0.00	0.55	0.60	0.87

Source: KHDS 1991-1994. Notes: Standard errors are in parentheses. * indicates statistical significance at 10% and ** at 5%. Fixed effects estimations also control for the set of time-varying individual, household, and community covariates described in the text.

Table 3: Impact of Adult Household Member Deaths (15-50) on Non-farm Self-employment and Wage-employment of Men (20-50)

	Wage-employment		Non-farm Self-employment
Female death past 0-6 months	0.004	-	-
	0.244	-	-
	[0.001]	-	-
Female death past 7-12 months	0.123	-	-
	0.263	-	-
	[0.044]	-	-
Female death past 0-12 months	-	0.051	0.155
	-	0.210	0.201
	-	[0.018]	[0.042]
Female death future 0-6 months	-0.660**	-	-
	0.295	-	-
	[-0.184]	-	-
Female death future 7-12 months	0.165	-	-
	0.349	-	-
	[0.060]	-	-
Female death future 0-12 months	-	-0.369	0.161
	-	0.264	0.276
	-	[-0.115]	[0.043]
Male death past 0-6 months	-0.153	-	-
	0.251	-	-
	[-0.051]	-	-
Male death past 7-12 months	0.248	-	-
	0.285	-	-
	[0.091]	-	-
Male death past 0-12 months	-	0.023	0.231
	-	0.219	0.266
	-	[0.008]	[0.064]
Male death future 0-6 months	-0.747**	-	-
	0.374	-	-
	[-0.200]	-	-
Male death future 7-12 months	-0.505	-	-
	0.540	-	-
	[-0.149]	-	-
Male death future 0-12 months	-	-0.638*	-0.717
	-	0.388	0.444
	-	[-0.179]	[-0.123]
P-value for joint significance:			
Female death past & future	0.106	0.293	0.730
Male death past & future	0.219	0.232	0.124
Sample Size	1793		1622

Source: KHDS 1991-1994. Notes: Probabilities are estimated using probit with standard errors in parentheses corrected for clustering at the household level; in brackets coefficients have also been converted to change in probability evaluated at the mean of all other regressors, which represents a discrete change for dummy variables from 0 to 1. Estimations also control for the set of individual, household, and community covariates described in the text. * indicates statistical significance at 10% and ** at 5%.

Table 4: Impact of Adult Household Member Deaths (15-50) on Crops Farmed by Any Household Member in Last 7 Days

	Coffee	Banana	Maize, Cassava or Beans
Female death past 0-6 months	0.127	0.121	0.205
	(0.157)	(0.171)	(0.165)
	[0.050]	[0.040]	[0.066]
Female death past 7-12 months	0.035	-0.017	0.253
	(0.216)	(0.216)	(0.201)
	[0.014]	[-0.006]	[0.080]
Female death future 0-6 months	0.336	0.285	0.251
	(0.228)	(0.242)	(0.237)
	[0.133]	[0.088]	[0.079]
Female death future 7-12 months	0.285	0.007	-0.029
	(0.291)	(0.303)	(0.312)
	[0.113]	[0.002]	[-0.010]
Male death past 0-6 months	-0.456**	-0.385	-0.161
	(0.200)	(0.204)	(0.178)
	[-0.171]	[-0.142]	[-0.057]
Male death past 7-12 months	0.210	-0.099	-0.647**
	(0.278)	(0.257)	(0.253)
	[0.084]	[-0.035]	[-0.246]
Male death future 0-6 months	-0.009	-0.353	0.289
	(0.253)	(0.261)	(0.241)
	[-0.004]	[-0.130]	[0.090]
Male death future 7-12 months	-0.755**	0.153	-0.346
	(0.365)	(0.388)	(0.366)
	[-0.263]	[0.050]	[-0.127]
P-value for joint significance:			
Female death past & future	0.502	0.738	0.291
Male death past & future	0.070	0.242	0.033
Sample Size	2643	2889	2893

Source: KHDS 1991-1994. Notes: Probabilities are estimated using probit with standard errors in parentheses corrected for clustering at the household level; in brackets coefficients have also been converted to change in probability evaluated at the mean of all other regressors, which represents a discrete change for dummy variables from 0 to 1. Estimations also control for the set of household and community covariates described in the text * indicates statistical significance at 10% and ** at 5%.

Annex Table 1: Impact of Adult Household Member Deaths (15-50) on Hours

PANEL A	**Women 20-50 years**		**Men 20-50 years**	
	Farm hours	**Chore hours**	**Farm hours**	**Chore hours**
Female death past 0-6 months	-0.45	2.62	0.74	1.96
	(2.11)	(2.31)	(2.51)	(1.77)
Female death past 7-12 months	1.26	4.88*	2.02	1.69
	(2.55)	(2.80)	(2.90)	(2.04)
Female death future 0-6 months	-1.79	0.89	-0.91	-0.03
	(2.64)	(2.90)	(3.03)	(2.14)
Female death future 7-12 months	-1.02	-4.35	-4.98	0.59
	(3.42)	(3.75)	(3.70)	(2.61)
Male death past 0-6 months	-2.73	-1.12	0.25	-1.97
	(2.43)	(2.66)	(3.21)	(2.26)
Male death past 7-12 months	-1.50	-2.63	3.33	-1.58
	(2.80)	(3.07)	(3.64)	(2.57)
Male death future 0-6 months	6.19**	-1.47	-0.15	3.34
	(3.05)	(3.35)	(4.43)	(3.13)
Male death future 7-12 months	-6.92	-8.52*	2.29	10.12**
	(4.26)	(4.68)	(5.37)	(3.79)
P-value for joint significance:				
Female death past & future	0.89	0.17	0.50	0.76
Male death past & future	0.01	0.43	0.87	0.01
PANEL B	**Women 15-19 years**		**Men 15-19 years**	
	Farm hours	**Chore hours**	**Farm hours**	**Chore hours**
Female death past 0-6 months	-2.33	-4.09*	0.79	-1.17
	(2.42)	(2.40)	(2.56)	(2.26)
Female death past 7-12 months	0.17	-0.56	0.85	0.15
	(2.54)	(2.52)	(3.51)	(3.10)
Female death future 0-6 months	-7.74**	-4.44	0.74	0.34
	(3.47)	(3.44)	(3.05)	(2.70)
Female death future 7-12 months	-3.25	-0.94	-5.56*	-2.81
	(4.00)	(3.98)	(3.36)	(2.97)
Male death past 0-6 months	-2.05	0.84	-1.85	-3.95
	(3.87)	(3.84)	(3.08)	(2.72)
Male death past 7-12 months	-4.20	2.10	-0.74	1.08
	(3.81)	(3.79)	(3.38)	(2.99)
Male death future 0-6 months	0.14	1.16	7.03*	-0.61
	(4.41)	(4.39)	(4.05)	(3.59)
Male death future 7-12 months	-1.28	6.18	-0.45	1.10
	(7.52)	(7.47)	(5.03)	(4.45)
P-value for joint significance:				
Female death past & future	0.22	0.41	0.37	0.83
Male death past & future	0.80	0.92	0.19	0.39

Annex Table 1: Impact of Adult Household Member Deaths (15-50) on Hours (cont.)

PANEL C	Children 7-14 years		Adults 51-65 years	
	Farm hours	Chore hours	Farm hours	Chore hours
Female death past 0-6 months	-1.59	0.15	0.70	-4.05*
	(1.11)	(1.17)	(3.01)	(2.42)
Female death past 7-12 months	-0.07	-0.27	0.67	0.31
	(1.31)	(1.38)	(3.15)	(2.53)
Female death future 0-6 months	-0.58	1.02	-0.40	-4.85
	(1.42)	(1.50)	(4.50)	(3.62)
Female death future 7-12 months	-5.58**	0.46	-8.75*	-2.57
	(1.80)	(1.90)	(5.20)	(4.18)
Male death past 0-6 months	-3.17**	-0.16	-2.98	0.18
	(1.52)	(1.60)	(3.28)	(2.64)
Male death past 7-12 months	-2.82*	-0.76	-0.23	1.82
	(1.59)	(1.67)	(3.63)	(2.92)
Male death future 0-6 months	3.07*	1.37	1.36	-2.95
	(1.77)	(1.86)	(4.28)	(3.44)
Male death future 7-12 months	-2.25	1.23	0.98	5.78
	(2.17)	(2.29)	(5.51)	(4.42)
P-value for joint significance:				
Female death past & future	0.02	0.96	0.45	0.35
Male death past & future	0.00	0.85	0.81	0.35

Source: KHDS 1991-1994. Notes: Standard errors are in parentheses. * indicates statistical significance at 10% and ** at 5%. Fixed effects estimations also control for the set of time-varying individual, household, and community covariates outlined in the text.