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Research Article

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HIV/AIDS and time allocation in rural Malawi

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Abstract

AIDS-related morbidity and mortality are expected to have a large economic impact in rural Malawi, because they reduce the time that adults can spend on production for subsistence and on income-generating activities. However, households may compensate for production losses by reallocating tasks among household members. The data demands for measuring these effects are high, limiting the amount of empirical evidence. In this paper, we utilize a unique combination of qualitative and quantitative data, including biomarkers for HIV, collected by the 2004 Malawi Diffusion and Ideational Change Project, to analyze the association between AIDS-related morbidity and mortality, and time allocation decisions in rural Malawian households. We find that AIDS-related morbidity and mortality have important economic effects on women's time, whereas men's time is unresponsive to the same shocks. Most notably, AIDS is shown to induce diversification of income sources, with women (but not men) reallocating their time, generally from work-intensive (typically farming and heavy chores) to cash-generating tasks (such as casual labor).

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1. Introduction

Because the household is the primary unit of production throughout sub-Saharan African countries, AIDS-related morbidity and mortality are likely to have the most immediate economic impact at the household level (de Waal and Whiteside 2004; Zaba et al. 2004; Barnett et al. 2005; Masanjala 2005). This impact may be particularly severe when compared to the impact of other diseases, since HIV/AIDS usually affects prime-age adults at the peak of their economically productive years, and incapacitates them for significant periods of time before causing their death (Beegle 2005). Moreover, because HIV is sexually transmitted, the impact is often compounded if one spouse is infected by the other. Finally, HIV/AIDS often affects both production and consumption patterns in sub-Saharan Africa: i.e., production is reduced because of prolonged illness and untimely death due to AIDS, and consumption is affected because of increased expenditures on treatment, transportation, and funerals. When income drops below expenditures, assets are depleted as households use them to meet their augmented needs.

The direct effects of illness and death on production may be mitigated by a variety of coping strategies (see McIntyre et al. 2006 for a comprehensive review of these strategies). Existing studies have found that intra-household labor substitution is a particularly important strategy for compensating for production losses in households afflicted by illness (Weisbrod 1973; Nur 1993; Sauerborn et al. 1996; Goudge and Govender 2000). To our knowledge, however, no such study has focused on AIDS-related morbidity and mortality. Estimating the effects of HIV/AIDS on intra-household labor is indeed quite demanding of the data: it requires not only time-use data, but also information on the HIV status of household members, which is rarely collected. Most of the empirical evidence on the economic impact of the epidemic in sub-Saharan Africa thus comes from a small number of studies that lack data on intra-household labor allocation (Beegle 2005 is an exception) and on HIV status, which is typically proxied simply by illness and death (Booysen 2002; Oni et al. 2002; Yamano and Jayne 2004).

In this paper, we use a unique set of quantitative and qualitative data collected by the 2004 Malawi Diffusion and Ideational Change Project to evaluate the association between AIDS-related morbidity and mortality and individual time allocation in rural Malawi. At the time of this study, the epidemic was the leading cause of death among people aged 20-49 in this setting (WHO 2006), and several qualitative studies suggested that the epidemic was having a substantial economic impact (e.g.; Mtika 2000; Shah et al. 2002). The survey data used for the present analysis include information on time use, the HIV status of the respondent and of his/her spouse if married, and the current health status of all household members. The qualitative data consist of lengthy semi-structured interviews with a small number of survey respondents about how their households have

coped with AIDS-related morbidity and mortality, including time allocation. We anticipate that labor supply will serve as an important response mechanism to household morbidity and mortality.

The remainder of this paper is structured as follows. In Section 2, we present a model of time allocation that incorporates household morbidity and mortality. Section 3 describes the data used for the analysis, and introduces the context for the study. Section 4 gives a descriptive overview of MDICP-3 respondents' time allocation in broad categories of work (agricultural, non-agricultural, and domestic) as well as of the burden of AIDS-related morbidity and mortality carried by their households. Section 5 presents univariate and multivariate results about the association between our outcome of interest (time allocation) and selected indicators of HIV/AIDS-related household morbidity and mortality. Section 6 provides concluding remarks.

2. Analytical framework

To evaluate the association between HIV morbidity and AIDS-related mortality and individual time allocation in rural Malawi, we expand the framework developed by Beegle (2005) in her Tanzanian study. Beegle approached time allocation across household activities as a utility maximization problem, and hypothesized that the preceding illness and subsequent death of a household member affects the allocation of time of the remaining members through several pathways: (i) the total stock of time available for allocation in the household, primarily because the total time of the deceased is gone; (ii) the effective time of the dying household member, because the illness preceding the death might be associated with physical disabilities or limited activities; (iii) and the expenditures associated with death and asset stocks (if they are inherited by individuals outside the household after a death), which may result in a reduction in the full household income. Beegle thus models the time allocated to activity *j* by individual *i* (T^j_i) in the reduced form as follows:

$$T_i^{\ j} = \beta_0 + \beta_1 V_h + \beta_2 X_i + \beta_3 Z_h + \beta_4 + D_h + \varepsilon_{ih} \tag{1}$$

where V_h is a vector of village-level characteristics (such as wage rates, prices, and infrastructure), X_i is a vector of individual-level characteristics (including age, education, and headship), Z_h is a vector of household production characteristics, D_h is a set of variables describing AIDS-related household deaths, and ε_{ih} is an error term that captures individual and household time-invariant unobservables, as well as an

individual error term that is assumed to be independently and identically distributed with a mean of zero and a variance σ_{ε}^{2}.

The main limitation of Beegle's approach is that no direct information on the burden of AIDS-related illness is available in her Tanzanian data set when estimating equation 1. This is an important issue because, as was mentioned above, the constraints imposed on the effective time of household members by the debilitating illness of the deceased is one of the main pathways through which AIDS-related mortality may affect household income. To take this limitation into account, Beegle assumed that "future deaths"—that is, deaths occurring in between two survey waves—should identify households with very ill household members, and that in these households time allocation is likely to be affected because of an ex ante illness response, and an ex post death response. As will be explained in detail below, we seek to better address this issue by drawing on the rich data set of the 2004 Malawi Diffusion and Ideational Change Project, which enables us to use direct measures of the burden of HIV-related household morbidity. Specifically, we estimate a model that can be formalized as follows:

$$T_i^{\,j} = \beta_0 + \beta_1 X_i + \beta_2 Z_h + \beta_3 I_h + \beta_4 D_h + \varepsilon_{ih} \tag{2}$$

In this equation, X_i is a vector of individual characteristics, including age and education. Z_{h} is a vector of household characteristics, which include the following: district of residence (north, center, or south), household wealth (as measured by a set of dichotomous assets indicators and land ownership), and type of family arrangement (household size, polygamous/monogamous household).[6] I_{h} is a set of variables describing the burden of illness in the household, which include the following: the respondent's HIV status (if tested); information on whether the respondent, his/her spouse, or both (if married) were ill at the time of the survey; and information about whether other household members were ill at the time of the survey. Finally, the burden of AIDS-related household mortality is represented by D_{h}, a dummy variable for the occurrence of a dependent death (child or elderly) or prime-age adult death in the household during the five years preceding the survey.

We acknowledge that there are unobserved factors that could be associated with both AIDS-related morbidity and mortality and income earning. It is, however, difficult

[6] We exclude from the set of regressors household composition variables which might be endogenous because the age and sex composition among surviving individuals within the household is influenced by the occurrence of adult deaths and other covariates (Rosenzweig 1988; Young 2005). We also exclude controls for whether the household employed hired or non-hired labor, or received cash transfers, because they might also be endogenous to the event of illness or death of household members.

to control for these factors due to the cross-sectional nature of the data used for the study (described in detail in the next section), and we thus cannot establish a causal link between AIDS-related morbidity and mortality and time allocation. When possible, however, we use qualitative evidence to inform our interpretation of the results and the conclusions that we draw from the study.

3. Data and methods

3.1 Study setting

Malawi is one of the poorest countries in Africa, and it has the ninth-highest HIV prevalence in the world (UNAIDS 2006). According to the 2004 Malawi Demographic Health Survey, among men and women aged 15-49 who were tested for HIV, HIV prevalence was 17.1% for those who lived in urban areas, compared to 10.8% for those who were living in rural areas (National Statistical Office and ORC Macro 2005).

Malawi is a predominantly rural country, with approximately 80% of men and women living in rural areas (National Statistical Office and ORC Macro 2005). As might be expected in this rural setting, approximately 90% of the total workforce is involved in the agricultural sector (UNDP 2002). Most of the production is for subsistence and small-scale retail, but cash crops (primarily tobacco, cotton, and tea) are also grown. In addition, agricultural production is supplemented by wage labor, either in the modern sector, or in the form of casual, part-time agricultural labor for others.

As in other sub-Saharan African countries, the gendered division of labor in Malawi has important implications for individual time allocation. Men are primarily responsible for providing income for items considered to be basic necessities, but which the household does not produce, such as salt, soap, and clothing; and women are primarily responsible for childcare and domestic chores, including collecting wood for fuel, fetching water, accessing local services (e.g.; Bryceson and Howe 1993; Barwell 1996). Both women and men are engaged in agricultural production, but since women are also engaged in domestic tasks, they work more hours overall per day than men do (Beckerson 1983; Davison 1992). Gender differences also appear in the non-household agricultural labor that supplements subsistence agriculture. Kerr (2005) finds that, in the northern region, men are more frequently hired for casual seasonal agricultural labor (*ganyu*). By contrast, when women are involved in *ganyu*, they are often given tasks considered more tedious, and they are employed for shorter lengths of time (Vaughan and Chipande 1986). Specific gender roles also define the type of small-scale enterprise that can be carried out by women and men. For example, women opt for selling

homegrown produce or baked goods, while men sell higher-end items, such as clothing, which require greater capital input. Finally, there are differences in cultural practices across regions that may affect farming patterns. For example, the northern region of Malawi follows a patrilocal tradition, and the southern and central regions are primarily matrilocal. These traditions exert different influences on land access (Green and Baden 1994; Kerr 2005).

3.2 Data source and analytical samples

We use quantitative and qualitative data collected by the Malawi Diffusion and Ideational Change Project to evaluate the association of AIDS-related morbidity and mortality and individual time allocation to different activities (farming, non-farming including cash-generating activities, and household labor). Since 1998, the MDICP has collected longitudinal data for a population-based sample of approximately 3,000 respondents to examine the role of social networks in changing attitudes and behavior regarding HIV/AIDS, family size, and family planning. The MDICP was designed as a couples' survey, targeting approximately 1,500 ever-married women and 1,000 of their husbands in rural areas of three Malawian districts, one in each of the three regions of the country (north, center, and south).[7] After household enumeration of the three survey sites was conducted, a random sample of approximately 500 ever-married women aged 15 to 49 were selected to be interviewed at each site. If these women were currently married, their spouses were also eligible to participate in the survey (Watkins et al. 2003). Each successive wave of the MDICP followed up the respondents in the 1998 sample, and researchers also interviewed any new spouses if the respondents had remarried between survey waves.

The quantitative data used in the present study come from the third wave of the MDICP, which was carried out in the summer of 2004 (henceforth, MDICP-3). In the MDICP-3, respondents from the original MDICP-1 sample—and, if they had remarried between survey waves, their new spouses[8]— yielded interviews with 1,526 women and 1,071 men aged 15 or older. The response rate for the MDICP-3 was 66.2% for women

[7] While there are different definitions of "marriage" across and within countries in sub-Saharan Africa (Meekers 1992; van de Walle 1968), the MDICP relies on respondents' self-reported descriptions of their status as "married," regardless of whether or not there had been any sort of public marriage ceremony.
[8] The MDICP-3 sample also included a new sample of unmarried adolescents who were given a different questionnaire, and who are thus excluded from the present analysis.

and 57.9% for men. The two main reasons for non-response were having moved since the previous survey wave, and being away at the time of the interview.[9]

The MDICP-3 is well-suited for our purposes, because respondents were questioned about their time allocation during the previous workday, as well as about the burden of household morbidity and mortality, which will be discussed in detail in the following sections. In addition, the MDICP-3 offered individual voluntary biomarker testing, which allowed us to determine whether the respondents and his/her spouse (if married and tested) were infected with HIV at the time of the survey (details of the MDICP-3 biomarker testing protocol are provided in Section 3.3.2). The response rate for the MDICP-3 HIV testing program was quite high. Of all the respondents interviewed, 1,256 women (82.3%) and 841 men (78.5%) agreed to be tested for HIV. The main reason for non-response was not being found by the HIV testing team (because away). Since individual HIV status is a key variable in our analytical framework, MDICP-3 respondents who were interviewed and tested for HIV represent the sample for the present analysis.

It is important to note that, although the MDICP-3 is the third wave of a longitudinal panel, because time-use data, HIV biomarker data, and information about household composition were not collected prior the MDICP-3, we could not exploit the longitudinal information from previous waves for the purposes of the present analysis.

In addition, the men seem to have had higher remarriage rates than the women in the MDICP-3 sample. As a result, of all of the 841 men interviewed and tested for HIV by the MDICP-3, only two (0.2%) were not married at the time of the survey because they were separated, divorced, or widowed. In contrast, the corresponding figure for women was 153 (12.2%) of 1,256.[10] Time-use models (described in more detail in Section 3.4) cannot be estimated separately for this latter group because of its sheer size. For the purposes of the present analysis, we thus focus on the MDICP-3 samples of currently married adults (1,103 women and 839 men), but we also provide a descriptive overview of time-use patterns and AIDS-related morbidity and mortality for formerly married women.

The background characteristics of our chosen samples are presented in Table 1. Overall, the respondents were almost equally distributed among the three survey sites

[9] The MDICP-3 sample is thus skewed towards non-mobile individuals and, obviously, survivors. Deaths or illness may result or hamper moves. Moves, in turn, may be linked with economic outcomes (moving to a better job, for example). It follows that our results may be under- or overstated, depending on assumptions about the economic impact of moving. Yet the data do not allow us to make assumptions in this regard, and the economic impact of moving in this sample remains speculative.

[10] Among MDICP-3 respondents who were interviewed but not tested for HIV, the proportion of formerly married is 11.1% for women (chi-squared test for difference in HIV testing status by marital status: 0.24, p=0.623) and 7.0% for men (chi-squared test for difference in HIV testing status by marital status: 49.3, p=0.000).

(north, center, and south). 45.5% of respondents was 35 years or older (with formerly married women and currently married men being slightly older, as expected, than currently married women) and they tended to have some primary education. Household wealth was generally low, with less than 15% of respondents lived in a household with a tin roof. Almost one-quarter of currently married women and one-tenth of currently married men lived in a polygamous household. Finally, the majority of spouses of currently married respondents (62.4% for women and 75.1% for men) were also interviewed and tested for HIV. Compared to wives, husbands were less likely to participate in the survey, which is consistent with higher male mobility in the study setting.

Table 1: Background characteristics of MDICP-3 adult respondents who were interviewed and tested for HIV, by sex and marital status

	Currently married women		Formerly married women		Currently married men	
	Number	%	Number	%	Number	%
Sample size	1103		153		839	
District						
South	415	37.6	60	39.2	313	37.3
Center	315	28.6	45	29.4	246	29.3
North	373	33.8	48	31.4	280	33.4
Age						
24 years or younger	233	21.2	22	14.4	99	9.2
25-34	365	33.1	31	20.3	235	21.9
35 years or older	502	45.5	98	64.1	690	64.4
Education						
No education	299	27.1	54	35.3	127	15.1
Some primary education	737	66.8	82	53.6	543	64.7
Some secondary education	65	5.9	17	11.1	132	15.7
Household wealth						
Household has iron roof	141	12.8	21	13.7	105	12.5
Household owns radio	800	72.5	65	42.5	661	78.8
Household owns bicycle	599	54.3	51	33.3	487	58.1
Household owns cattle	105	9.5	21	13.7	92	11.0
Household owns land	815	73.9	136	88.9	763	90.9
Family arrangement						
Currently in polygamous household	256	23.2	n.a.	n.a.	91	10.9
Interview and HIV testing status of spouse						
Spouse neither interviewed nor tested for HIV	266	24.1	n.a.	n.a.	135	16.1
Spouse interviewed only	115	10.4	n.a.	n.a.	60	7.2
Spouse tested for HIV only	34	3.1	n.a.	n.a.	14	1.7
Spouse interviewed and tested for HIV	688	62.4	n.a.	n.a.	630	75.1

Note: Percentages may not add to 100 due to missing values.

3.3 Measures

3.3.1 Measures of individual time use

The MDICP-3 individual questionnaire contained a section on time allocation (henceforth "time diary"), in which respondents were asked to provide information on the number of hours they had spent on different work or leisure activities during their most recent workday from the time they woke up until the time they went to sleep.

Overall, item non-response for the MDICP-3 time diary was low (Appendix 1, Table A1-1). Of all of the 1,526 women interviewed by the MDICP-3, only 44 (2.9%) respondents had incomplete, and four (0.3%) had missing time diaries. The corresponding figures for all men interviewed were 27 (2.5%) and two (0.2%). Among the currently married respondents who were tested for HIV (i.e., our analytical sample), item non-response for the time diary was even lower: 2.5% and 0.1% of women had, respectively, incomplete or missing time diaries; and the corresponding figures for men were 1.8% and 0.1%.[11]

We use information from the MDICP-3 time diary to calculate the respondent's time allocation (T_i^j in equation 2) in the following three broad categories of work: agricultural labor, non-agricultural self-employment and wage employment, and domestic work (see Table A2-1 in Appendix 2 for details on the activities included in each group).

3.3.2 Measures of HIV-related household morbidity

To evaluate the burden of HIV-related household morbidity (I_h in equation 2) in our sample, we use two measures: individual HIV status, and current illness of the respondent and other co-residing household members.

The first measure, HIV status, is imperfect. For sub-Saharan Africa, the median survival time from HIV infection to death has been estimated to be 9-11 years, but the duration from AIDS-related symptoms to death is approximately 5-9 months (Boerma et al. 1998). Thus, it is only at the end of the prolonged period of apparent health that there are likely to be illnesses that affect the allocation of time to household production. It is nonetheless interesting to include HIV status in our analysis, because at the time

[11] As it can be seen in Appendix 1, Table A1-1 the difference in the item non-response between currently married women who agreed to be tested for HIV and those who did not is not statistically significant (p=0.209), whereas for men it is (p=0.004).

the data were collected, antiretroviral treatment for HIV was not available. Thus, even when people knew their serostatus or believed they were infected, they assumed it would not be long before they died, which would reasonably affect their motivation to work.

HIV status for respondents in our sample was determined through voluntary biomarker testing. According to the MDICP-3 biomarker protocol (Bignami-Van Assche et al. 2004), after the survey interview was administered by locally recruited interviewers, all interviewed respondents were approached by a biomarker testing team. Written informed consent (either a signature or thumbprint) was obtained from all respondents who agreed to be tested. Then nurses trained in biomarker collection obtained saliva samples from respondents who consented. The biomarker samples were sent to a laboratory in Lilongwe, Malawi, where HIV antibody status was assessed using enzyme-lined immunosorbent asseys (ELISA) kits for initial screening, and positive results were confirmed by a Western Blot test. After the fieldwork, all of the respondents tested were given the opportunity to receive their results at temporary counseling centers set up in central locations within MDICP sample villages. The HIV test results were presented together with post-test counseling by a trained nurse within four months of testing (Thornton 2005).

The second measure of HIV-related morbidity that we use in the analysis is derived from information on current illness that was collected for all household members during the household interview. Before the beginning of the woman's interview, a household informant (generally the household head) was asked to provide basic information about all household members. This information includes name, sex, regular membership in the household, relationship to the household head, age, parental survival, year of arrival in the household, education, marital status, and health status. The latter refers to whether each household member was ill at the time of the survey, was often ill, and/or was seriously ill at the time of the survey. We use this information to determine whether at the time of interview the respondent was ill or often ill,[12] whether the respondent's spouse (if married) was ill or often ill, and how many household members other than the respondent and his/her spouse (if any) were ill at the time of the survey.

Unfortunately, the household roster was not collected before the man's interview. It follows that household-level information (including the burden of household morbidity) was not available for currently married men whose wives were not interviewed. As can be seen in Table 1 above, this group represents 17.8% of all currently married men interviewed and tested for HIV in the MDICP-3.

[12] We do not use information about whether the respondent was seriously ill because this question had a very high item non-response (more than 50% for all samples).

3.3.3 Measures of AIDS-related household mortality

To measure the burden of AIDS-related household mortality (D_h in equation 2) in our sample, we rely on information that was collected in the individual questionnaire about the number of deaths experienced by the household in the five years preceding the survey, as well as about the ages at which those deaths occurred and the sex of the deceased household members. We had to rely on this self-reported information about household mortality because information about household composition was not collected prior to the MDICP-3.

As has been done in other studies (e.g.; Beegle 2005, Yamano and Jayne 2004; Evans and Miguel 2005), we use this information as a proxy for the potential impact of AIDS-related deaths in the household. An analysis of verbal autopsies of deaths between the 1998 and 2001 MDICP surveys indeed found that approximately two-thirds of all prime-age adult deaths were due to AIDS (Doctor and Weinreb 2003; Doctor 2004).

3.4 Methods of analysis

We begin the analysis by presenting a descriptive overview of time allocation patterns and the burden of AIDS-related morbidity and mortality for our study samples (currently married women, formerly married women, and currently married men). Next, we evaluate the univariate association between selected indicators of AIDS-related household morbidity and mortality, and the individual time allocation of currently married women and men. Finally, we estimate the model described in our analytical framework (i.e., equation 2) by fitting a series of tobit models (Tobit 1958; Amemiya 1984) to the MDICP-3 time-use data for currently married respondents.

To elaborate on the results of the quantitative analysis, we draw from a set of in-depth qualitative interviews with MDICP-3 respondents in 18 households, which were carried out in the southern and central districts of Malawi between June and August of 2005 under the supervision of Van de Ruit and Fleming. A purposive sample of MDICP-3 households was employed: a third of sampled households were selected on the basis of one or more members being HIV-positive, another third were chosen because they had experienced a death during the three years before the MDICP-3, and the remaining households were selected because they had neither HIV-positive members nor recent household deaths.[13] The study sought to understand accounts of

[13] To ensure the respondents' confidentiality, only van de Ruit and Fleming were aware of the household selection criteria.

negative socioeconomic shocks (including ill health and death) and their social outcomes (including changes in livelihoods, family disruption, and changes in relationships within extended kin networks). Emphasis was placed upon the timing and sequence of events to explore the relationship between crises and their consequences.[14]

4. Patterns of time allocation and burden of AIDS-related household morbidity and mortality: An overview

4.1 Individual time allocation patterns

As can be seen in Table 2, 94.3% of respondents in our sample with complete time diaries reported having performed some type of work during the most recent workday. This proportion was found to be higher for women (regardless of their marital status) than for men, because most of the women (98.3% of currently married and 98.0% of formerly married women) reported having done domestic work in the previous workday, compared to less than one third (27.8%) of currently married men. In contrast, the proportion of respondents who indicated they carried out agricultural or non-agricultural work was found to be higher for men than for women, and the average number of hours spent doing either type of work was also shown to be considerably higher for men than for women.

[14] The Malawian interviewers who carried out the qualitative data collection had an interview guide that incorporated visual elements to provide a better understanding of household composition, and changes to household structure (Adato et al. 2003). This instrument was designed in collaboration between the principal investigators and the Malawian interviewers. Interviews were open-ended, lasting approximately an hour, and were recorded and immediately transcribed from Chichewa or Yao into English. The interviews usually raised further questions, and follow-up interviews were conducted with all respondents. A systematic coding strategy was employed, modeled on the approach described by Glaser and Strauss (1967), and a later adaptation by Morrow and Smith (1995). This systematic approach lends itself to the study of the social and economic consequences of morbidity and mortality by exploring changes in time use allocation as a response to crises and shocks, together with the narrower conditions within which these strategies took place.

Table 2: Individual time allocation patterns of MDICP-3 adult respondents who were interviewed and tested for HIV*, by sex and marital status

	Any activity	Activity group *j* **			Sample size[2]
		Agricultural labor	Non-agricultural labor[1]	Domestic labor	
All respondents					
Number and percent who performed	*1928*	*1000*	*452*	*1430*	2045
	94.3 %	48.9 %	22.1 %	69.9 %	
Average number of hours spent	8.0	2.6	1.3	4.1	
	(3.6)	(3.4)	(2.9)	(3.7)	
Currently married women					
Number and percent who performed	*1061*	*448*	*162*	*1056*	1074
	98.8 %	41.7%	15.1%	98.3%	
Average number of hours spent	8.8	1.8	0.6	6.4	
	(3.0)	(2.7)	(1.8)	(2.8)	
Formerly married women					
Number and percent who performed	*145*	*60*	*20*	*145*	148
	98.0 %	40.5 %	13.5 %	98.0 %	
Average number of hours spent	8.0	1.9	0.5	5.6	
	(3.3)	(2.9)	(1.7)	(2.8)	
Currently married men					
Number and percent who performed	*722*	*491*	*270*	*229*	823
	87.7 %	59.7 %	32.8 %	27.8 %	
Average number of hours spent	6.9	3.7	2.2	0.9	
	(4.1)	(3.9)	(3.8)	(2.2)	

Notes: * Among respondents with complete time diaries, number and percent who performed any labor activity and specific activities, and average number of hours spent doing any activity and specific activities during the last workday (with standard deviations in parentheses)

** See Appendix 2 for details on the activities included in each group.

1 Includes non-agricultural self-employment and wage employment.

2 Excludes respondents with incomplete or missing time diaries (29 currently married women, five formerly married women, and 16 currently married men).

Approximately half of the entire sample (59.7% of currently married men and 41.7% of currently married women) said they had farmed their own field or the fields of others during the most recent workday. As has been shown to be the case in other sub-Saharan African countries (e.g.; Beegle 2005), individual farm hours were low relative to Western standards, as they averaged slightly less than four hours daily among men, and slightly more than two hours daily among women. Since the MDICP-3 was carried out after the harvesting season[15] and we do not have information about seasonal peak times, we cannot establish whether this is evidence of labor underemployment in agriculture.

Non-farm self-employment and wage employment were found to be less common economic activities than farming in the MDICP-3 sample. Only one-fifth of all respondents (one third of all married males) reported performing non-agricultural work, such as basket weaving and other artifact production, during the most recent workday.

All of the observed differences between women and men in the time spent doing any activity or specific activities are statistically significant (not shown). By contrast, the differences in time use found between currently and formerly married women respondents are not statistically significant, which suggests that the results of our multivariate analyses are not biased by the exclusion of this latter group. In addition, because the patterns of time use for respondents who agreed to be tested for HIV (shown in Table 2) and those who did not (shown in Appendix 1, Table A1-2) are not statistically different, the results are not likely to be biased because of our recruitment criteria.

4.2 Burden of AIDS-related household morbidity

As can be seen in Table 3, HIV prevalence in our sample is 6.7% among currently married women, 18.3% among formerly married women, and 7.4% among currently married men. Among the currently married respondents whose spouse was interviewed, the majority (55.3% of women and 66.4% of men) were HIV-negative concordant couples. In addition, in couples where at least one spouse was HIV-infected, serodiscordance (especially with the husband infected and the wife not infected) is slightly more common than concordance of HIV-positive status.

[15] For the staple maize, the farming cycle begins in September or October. At this time, agricultural labor involves burning weeds, cleaning the fields, and removing insects from the soil. The crop is then planted and fertilized. The rainy season begins in November or December, and agricultural-related labor turns to weeding and banking. After the rainy season ends in March or April, maize dries on the stalk until around May, when it is harvested and put into storage. In the colder months of July and August, when the MDICP survey data were collected, Malawians are occupied by planting vegetables (Brummett 2002).

Table 3: Burden of AIDS-related morbidity in households of MDICP-3 adult respondents who were interviewed and tested for HIV: individual HIV status and couple HIV status, by sex and marital status

	Currently married women		Formerly married women		Currently married men	
	Number	%	Number	%	Number	%
Sample size	1103		153		839	
Individual HIV status						
HIV negative	1022	92.7	125	81.7	772	92.0
HIV positive	74	6.7	28	18.3	62	7.4
Indeterminate	7	0.6	0	0.0	5	0.6
Couple HIV status[1]						
Concordant HIV+	17	1.5	n.a.	n.a.	16	1.9
Concordant HIV-	610	55.3	n.a.	n.a.	557	66.4
W+, H-	23	2.1	n.a.	n.a.	21	2.5
W-, H+	31	2.8	n.a.	n.a.	29	3.5
Other[2]	7	0.6	n.a.	n.a.	7	0.8
Spouse not tested	415	37.6	n.a.	n.a.	209	24.9

Notes: W+: wife is HIV+; W-: wife is HIV-; H+: husband is HIV+; H-: husband is HIV-.

[1] Among currently married respondents whose spouse was interviewed.

[2] Includes cases in which both spouses were tested for HIV, but one had an indeterminate HIV test result.

Table 4 presents our other indicators of the burden of AIDS-related household morbidity. Approximately 17.5% of currently married women and 10.1% of currently married men were reported to be ill at the time of the survey. Having been often ill prior to the survey date was slightly more frequent than being currently ill, and the two indicators are mildly correlated (not shown). Item non-response for being seriously ill is too high to allow for a separate analysis. The figures for formerly married women were similar to those for currently married women, and the difference between the two is not statistically significant (not shown).

Table 4: Burden of AIDS-related morbidity in households of MDICP-3 adult respondents who were interviewed and tested for HIV, by sex and marital status

	Currently married women		Formerly married women		Currently married men	
	Number	%	Number	%	Number	%
Sample size	1103		153		839	
INDIVIDUAL ILLNESS						
Respondent is currently ill	193	17.5	30	19.6	84	10.1
Respondent is often ill	233	22.1	35	22.9	100	11.9
Respondent is currently or often ill	343	31.1	50	32.7	141	16.8
Number of other household members who are currently ill (excl. the respondent)						
None	809	73.4	116	75.8	474	56.5
One	197	17.9	29	18.9	163	19.4
Two or more	97	8.8	8	5.2	88	10.5
Information not collected	—	—	—	—	112	13.6
SPOUSE'S ILLNESS						
Spouse is currently ill	96	8.7	n.a.	n.a.	135	16.1
Spouse is often ill	131	11.9	n.a.	n.a.	160	19.1
Spouse is currently or often ill	177	16.0	n.a.	n.a.	237	28.2
Number of other household members who are currently ill (excl. the respondent and his/her spouse)						
None	819	74.3	n.a.	n.a.	545	65.0
One	154	14.0	n.a.	n.a.	113	13.5
Two or more	76	6.9	n.a.	n.a.	60	7.2
Information not collected	54	4.9	n.a.	n.a.	97	11.6

The proportion of currently married women whose husbands were also currently or often ill is lower than the proportion of women who were ill themselves; whereas the opposite can be seen for currently married men. Finally, 20.9% of currently married women and 20.7% of currently married men lived in households in which at least one other household member was ill at the time of the survey.

It is important to note that, as expected based on the long period of apparent good health between HIV infection and death, the correlation between being reported ill and HIV status at the time of the survey is not very strong for either men or women (0.06 and 0.10, respectively). HIV status is also uncorrelated with being reported "often" or "seriously ill" at the time of the survey. It thus seems that the two measures of HIV/AIDS-related household morbidity that we consider in this study are associated with individual time allocation in different ways. Indeed, our multivariate results (discussed in Section 5) indicate that HIV status affects time allocation only when considered together with an individual's illness.

4.3 Burden of AIDS-related household mortality

Approximately a quarter of the currently married respondents in our sample (24.9% of females and 24.6% of males) had experienced at least one death in their household during the five years preceding the survey (Table 5). This proportion is, as expected, much higher for formerly married women (41.8%). On average, 1.4 deaths occurred in the households of currently married women and men; the corresponding figure for the households of formerly married women is 1.6.

Table 5: Burden of AIDS-related mortality in households of MDICP-3 adult respondents who were interviewed and tested for HIV ‡, by sex and marital status

	Currently married women		Formerly married women		Currently married men	
	Number	%	Number	%	Number	%
At least one child death[1]	129	46.9	13	20.3	77	37.4
At least one adult death[2]	49	17.8	20	31.3	66	32.0
At least one adult & child death	12	4.4	5	7.8	8	3.9
At least one elderly death[3]	13	4.7	3	4.7	14	6.8
Unknown age at death	72	26.2	23	35.9	41	19.9
Any death	275	24.9	64	41.8	206	24.6

Notes: ‡ Occurrence of any household death and of at least an adult or child death in the five years preceding the survey. See Appendix 1 Table A1-3 for a more detailed breakdown.

[1] Deaths of children less than 10 years old.

[2] Deaths of adults 10-59 years old.

[3] Deaths of adults age 60 years or older.

For currently married respondents, the majority of household deaths of known age (46.9% and 37.4% in, respectively, the households of currently married women and men) were deaths of children aged 10 years or under, as might be expected in the context of a developing country such as Malawi, which has high fertility and high infant and child mortality. The households of formerly married women were the only ones in which a greater proportion of respondents had, not surprisingly, experienced the death of a working-age adult (i.e., ages 10-59 years) than a child death. Yet even in the households of currently married respondents, the burden of adult mortality was quite high, especially for men: 17.8% of currently married women lived in households in which a prime-age adult death had occurred in the previous five years; and the corresponding figure for currently married men was 32.0%. We cannot ascertain the relationship between the respondents and these recently deceased working-age adults because the MDICP-3 questionnaire did not collect this information. However, we verified that these cases were not connected to the recent death of a spouse, since the majority of currently married women and men whose households experienced an adult death had been married only once (not shown).

As can be seen in Table 5, one limitation of the data is that about 25% of respondents (and about 40% of formerly married women) could not remember or did not know the age at death of recently deceased household members. Yet the main problem we face when relying on individual reports to measure the occurrence of household deaths in highly AIDS-affected areas is that we may be trying to measure something that is not there (Zaba et al. 2004). This is because AIDS deaths stimulate a variety of responses, including an increase in household dissolution and in sending children to live elsewhere (Heuveline 2004; Monasch and Boerma 2004), so that household surveys might miss the surviving members who have relocated. Indeed, the MDICP-2 data indicate that 36% of the surviving spouses of respondents who had died could not be interviewed because they had relocated (comparable data for the MDICP-3 are not available). In addition, if the surviving household members had joined other households, survey questions addressed to the new household head may not shed light on the events that led to the relocation, because these events occurred in another household.

Another limitation of individual reports on the occurrence of deaths in the MDICP-3 households is that the definition of household membership of the deceased was left to the respondent. It is therefore not possible to evaluate whether the deceased had recently entered the household specifically because he or she was seriously ill and was seeking terminal care (Chimwaza and Watkins 2004), or had wished to die in his or her home area to save the family the cost of shipping a body. The qualitative interviews indeed contain several accounts of sick kin joining households to receive care. For example, Absalom[16] told the story of his brother, who came back from Zambia with his wife and two children when he fell ill "because all his relatives were here [in Malawi] and that is where he could get more care than where he was." Similarly, Delia Lungu, widowed and in ill health, reported that she returned to her brother's compound after her husband's death, where her nephew came to live with her to care for her. Indeed, among households in our sample that received new adult members (excluding new spouses) in the previous five years, a slightly higher proportion had experienced a death during the same period (for women: 27.9 vs 26.8%, p=.733; for men: 32.4 vs. 23.8, p=.109). It is, however, not possible to evaluate whether these new household members were indeed those who then died, or whether they arrived instead after the death of an existing member to help the surviving ones in dealing with the loss. This raises concerns that the event of an adult death in a household might be endogenous if fatally ill individuals are selecting households in which they intend to die (Chapoto and Jayne 2008).

[16] All names are fictitious to preserve the anonymity of the respondents.

5. Association of time allocation and AIDS-related household morbidity and mortality

5.1 Univariate analysis

We begin by evaluating the univariate associations between our outcome of interest (time allocation) and selected indicators of AIDS-related household morbidity and mortality (Tables 6 and 7). Our univariate analysis leads to two main findings. First, AIDS-related household morbidity and mortality affect women's time allocation, but not men's, with only few exceptions. Second, for women, AIDS-related morbidity influences individual time allocation for labor-intensive activities, such as farming and domestic work; whereas AIDS-related mortality affects only the time allocated to cash-generating activities.

This is because the proportion of women who were HIV-positive was lower among those who had been engaged in agricultural labor and domestic labor during the previous workday than among those who had not done these activities (agricultural labor: 3.8% vs. 9.1%, $p< .001$; domestic labor: 6.8% vs. 16.7%, $p<0.1$). It is, however, the compounded effect of being HIV positive at the time of the survey, and of having been often ill prior to the survey date, that was associated with the largest differentials in time allocation: 15.4% of women who did not perform any work in the previous workday had been often ill and were HIV-positive, compared to only 1.7% of women who performed any work. This is because having been often ill and HIV-positive reduces the time spent in labor-intensive activities, such as domestic work and farming.

The burden of current household illness was also significantly associated with differentials in time allocation for women for any labor activity, and, in particular, for farming and domestic work. Overall, if they were currently ill, women tended to work less, but they tended to work more if their spouse or other household members were ill.

Table 6: Among MDICP-3 respondents who were interviewed and tested for HIV and who performed any labor activity or specific activities, percent who were HIV positive, who were HIV positive and often ill, who were currently ill, whose spouse was also currently ill or who lived in households in which other households members were currently ill, and who lived in households in which at least one death of a dependent or one prime-age adult death had occurred in the previous five years[1]: Currently married women

	Performed any labor activity		Performed labor activities in group *j* ‡					
			Agricultural labor		Non-agricultural labor[2]		Domestic labor	
	No	Yes	No	Yes	No	Yes	No	Yes
HIV status[3]	[*13*]	[*1055*]	[*624*]	[*444*]	[*906*]	[*162*]	[*18*]	[*1050*]
R is HIV+	23.1**	6.7**	9.1***	3.8***	6.8	7.4	16.7*	6.8*
R is often ill	38.5	21.0	18. 4**	25.2**	21.6	18.8	44.4**	20.8**
R is HIV+ & often ill	15.4**	1.7**	2.6**	0.9**	17.7	2.5	11.1*	1.7*
Current HH illness[4]	[*13*]	[*1025*]	[*606*]	[*432*]	[*883*]	[*155*]	[*18*]	[*1020*]
R is currently ill	61.5***	13.6***	14.2***	14.1***	14.6	11.6	55.6***	13.4***
R & S are currently ill	0.0***	4.0***	3.0***	5.3***	3.7	5.2	0.0***	4.0***
Others are currently ill	15.4***	18.3***	24.5***	23.6***	18.1	19.4	16.7***	18.3***
No one is currently ill	23.1***	64.1***	68.3***	56.9***	63.5	63.9	27.8***	64.2***
Deaths in the HH in past 5 years[5]	[*13*]	[*988*]	[*582*]	[*419*]	[*853*]	[*148*]	[*17*]	[*984*]
At least one dependent death[6]	23.1	13.7	14.1	13.6	14.4**	10.8**	17.7	13.8
At least one prime-age adult death[7]	7.7	6.1	5.7	6.7	5.4**	10.1**	5.9	6.1
No deaths	69.2	80.2	80.2	79.7	80.2**	79.1**	76.5	80.1

Notes: ‡ See Appendix 2 for details on the activities included in each group. R: respondent; S: spouse; Others: other HH members (excluding respondent and spouse).

1 Sample sizes are indicated in parentheses above each set of percentages. For each set, we also indicate next to the percentages the significance of chi-square tests for differences between those who performed any activity or specific activities, and those who did not (* $p<0.1$; ** $p<0.05$; *** $p<0.001$).

2 Includes non-agricultural self-employment and wage employment.

3 Sample sizes exclude respondents with indeterminate HIV test results.

4 Sample sizes exclude 36 respondents for who did not provide information about current illness of household members.

5 Sample sizes exclude 73 respondents who could not indicate the age at death of recently deceased household members.

6 Includes only deaths of children less than 10 years old and deaths of adults age 60 years or older.

7 Deaths of adults 10-59 years old that occurred alone or in combination with deaths of children less than 10 years old.

Table 7: Among MDICP-3 respondents who were interviewed and tested for HIV and who performed any labor activity or specific activities, percent who were HIV positive, who were HIV positive and often ill, who were currently ill, whose spouse was also currently ill or who lived in households where other households members were currently ill, and who lived in households where at least one death of a dependent or one prime-age adult death had occurred in the previous five years[1]: Currently married men

	Performed any labor activity		Performed labor activities in group *j* ‡					
			Agricultural labor		Non-agricultural labor[2]		Domestic labor	
	No	Yes	No	Yes	No	Yes	No	Yes
HIV status[3]	[*101*]	[*717*]	[*330*]	[*488*]	[*550*]	[*268*]	[*592*]	[*226*]
R is HIV+	7.9	7.3	9.1	6.2	7.5	7.1	7.3	7.5
R is often ill	15.1	13.3	13.8	13.3	13.5	13.7	12.5	16.4
R is HIV+ & often ill	0.0	0.8	0.9	0.6	0.7	0.7	0.8	0.4
Current HH illness[4]	[*93*]	[*620*]	[*298*]	[*415*]	[*479*]	[*234*]	[*522*]	[*191*]
R is currently ill	5.4	7.1	6.7**	7.0**	6.5	7.7	6.5	7.9
R & S are currently ill	6.5	4.7	3.7**	5.8**	5.0	4.7	5.6	3.1
Others are currently ill	17.2	27.4	21.5**	29.4**	26.5	25.2	26.6	24.6
No one is currently ill	71.0	60.8	68.1**	57.8**	62.0	62.4	61.3	64.4
Deaths in the HH in past 5 years[5]	[*100*]	[*682*]	[*320*]	[*462*]	[*525*]	[*257*]	[*568*]	[*214*]
At least one dependent death[6]	9.0	11.9	10.3	12.3	11.8	10.9	10.2*	15.0*
At least one prime-age adult death[7]	11.0	9.2	9.7	9.3	9.3	9.7	8.9*	11.2*
No deaths	80.0	78.9	80.0	78.4	78.9	79.4	81.0*	73.0*

Notes: ‡ See Appendix 2 for details on the activities included in each group. R: respondent; S: spouse; Others: other HH members (excluding respondent and spouse).

1 Sample sizes are indicated in parentheses above each set of percentages. For each set, we also indicate next to the percentages the significance of chi-square tests for differences between those who performed any activity or specific activities, and those who did not (* $p<0.1$; ** $p<0.05$; *** $p<0.001$).

2 Includes non-agricultural self-employment and wage employment.

3 Sample sizes exclude respondents with indeterminate HIV test results.

4 Sample sizes exclude 110 respondents for who did not provide information about current illness of household members.

5 Sample sizes exclude 41 respondents who could not indicate the age at death of recently deceased household members.

6 Includes only deaths of children less than 10 years old and deaths of adults age 60 years or older.

7 Deaths of adults 10-59 years old that occurred alone or in combination with deaths of children less than 10 years old.

Finally, deaths in the household during the five years before the survey affected only the proportion of women who carried out non-agricultural labor during the previous workday. Yet the effect was found to differ depending on the age of the deceased household members: in the case of a prime-age adult death, the proportion of women who engaged in cash-generating activities was higher than the proportion of women who did not; but the reverse was true if a dependent (child or elderly relative) had recently died.

5.2 Multivariate regression analysis

Table 8 presents the multivariate regression results for the response regarding daily hours spent farming, in non-farm self-employment and wage employment, and doing domestic work to AIDS-related morbidity and mortality.[17] The main finding of our multivariate regression analysis is that, as with the univariate analysis (presented in the previous section), AIDS-related morbidity modifies individual time allocation for labor-intensive activities, such as farming and domestic work; whereas AIDS-related mortality affects the time allocated to cash-generating activities. In the two sections that follow, we look at each of these findings in greater detail. In addition, the brunt of household AIDS-related sickness and death seems to have fallen on female household members, whereas men's time allocation remained unaffected by these shocks. For this reason, in the discussion below we will concentrate on the results for women.

[17] Coefficients, standard errors and *p*-values for the other covariates included in the models are presented in Appendix 1, Table A1-4.

Table 8: Association between selected indicators of AIDS-related household morbidity and mortality and daily hours spent doing different labor activities (farming, non-farm self-employment and wage employment, and domestic work) for currently married MDICP-3 respondents who were interviewed and tested for HIV, by sex[1]: coefficients, standard errors (SE) and *p*-values

	Farm hours		Non-farm hours		Chores hours	
	Coef.	***SE***	**Coef.**	***SE***	**Coef.**	***SE***
CURRENTLY MARRIED WOMEN (*N = 929*)						
HIV status						
R is HIV+	–.531	*.973*	.079	*1.68*	–.270	.432
R is often ill	**1.42****	*.476*	**-2.27***	*1.11*	–.048	.237
R is HIV+ & often ill	**–5.11****	*1.98*	4.37	*3.05*	–.740	.784
Current HH illness						
R is currently ill	–.256	*.565*	–.626	*1.18*	**-.612****	.269
R & S are currently ill	1.09	*.938*	1.82	*1.97*	–.713	.475
Others are currently ill	.638	*.497*	.365	*1.01*	.122	.243
No one is currently ill	Ref.		Ref.		Ref.	
Deaths in the HH in past 5 years						
At least one dependent death[2]	.084	*.547*	–1.38	*1.14*	**.473***	.260
At least one prime-age adult death[3]	.797	*.761*	**2.52***	*1.37*	**–.776****	.371
No deaths	Ref.		Ref.		Ref.	
CURRENTLY MARRIED MEN (*N = 583*)						
HIV status						
R is HIV+	.058	*1.09*	-2.16	*1.81*	.770	*1.23*
R is often ill	-.467	*.829*	-.289	*1.41*	.961	*.939*
R is HIV+ & often ill	-1.21	*3.10*	-2.94	*6.25*	-1.79	*3.91*
Current HH illness						
R is currently ill	-1.52	*1.09*	3.32	*1.79*	-.605	*1.25*
R & S are currently ill	1.42	*1.18*	2.61	*2.01*	-2.48	*1.48*
Others are currently ill	0.26	*.586*	.796	*.996*	-.017	*.683*
No one is currently ill	Ref.		Ref.		Ref.	
Deaths in the HH in past 5 years						
At least one dependent death[2]	.619	*.810*	-.481	*1.37*	.477	*.917*
At least one prime-age adult death[3]	.318	*.995*	-1.24	*1.75*	.650	*1.15*
No deaths	Ref.		Ref.		Ref.	

Notes: $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.001$.

[1] The covariates included in the models are: district of residence, age, education, socioeconomic status, family arrangement (polygamous or monogamous), and household size. Coefficients, standard errors, and *p*-values for the other covariates are presented in Appendix 1, Table A1-4.

[2] Includes only deaths of children less than 10 years old and deaths of adults aged 60 years or older.

[3] Deaths of adults 10-59 years old that occurred alone or in combination with deaths of children less than 10 years old.

5.2.1 Individual time allocation and AIDS-related household mortality

A prime-age adult death increases the time that surviving female household members spend doing non-agricultural work by approximately 2.5 hours daily. This finding is not surprising given that wage employment and non-farm self- employment have been shown to be the main cash-generating activities for MDICP households. When a family member dies, the extra cash flow the women generate helps to replace the lost income of the deceased, and to cover immediate expenditures for both medical expenses and funeral activities. Other studies have indeed shown that, in Malawi, *ganyu*(casual labor) is an important source of livelihood, especially for the poorer categories of households, and that it is also often the only coping strategy for these households when they are faced with stress in their livelihoods (Shah et al. 2002). The qualitative interviews support this result, and help in clarifying the type of cash-generating activities women are engaged in, typically casual work and micro-enterprise activities. For example, after the death of her husband, Felicity Sindo started a small-scale business selling banana fritters at the market in order to make up for the reduced farm output associated with the loss of her husband's manpower. Similarly, Nat Mkandawire recounted that her family's efforts to sustain their tobacco cultivation were undermined by the illness and subsequent death of her two children, and that the family had to rely on subsistence agriculture and *ganyu*labor to sustain their livelihood. These strategies must be seen in the context of wider challenges to income diversification in rural Malawi, which include land shortages, environmental conditions such as drought, increasing land rental rates, and limited infrastructural support for both agricultural and small enterprises in the form of loans (Peters 2006).

The time spent doing domestic work also appears to be affected by the recent death of an adult: women slightly decrease their chore hours (by about three-quarters of an hour) following the death of a prime-age household member, which could be due to the fact that the deceased had required care prior to death. Interestingly, women slightly increase their chore hours (by about half an hour) following the death of a dependent, which could suggest that children (who represent, as noted earlier, the largest proportion of household dependents in this setting) share the burden of domestic work, perhaps by providing care for ill household members.

By contrast, the results show that the number of hours spent farming is unresponsive to a prime-age adult death in the household. This finding might be explained by the fact that the MDICP-3 data were not collected at the peak of the cropping season, when in rural areas there is substantial labor underemployment (Wodon and Beegle 2006). In addition, there are several obvious coping mechanisms which might drive this result. One is the reallocation of farm labor before the death, perhaps stimulated by the development of obvious AIDS symptoms. These symptoms

are well-known in rural Malawi, as is the fact that there is no cure for AIDS. Thus, once it is evident that an individual may have AIDS, or if a person is suspected of having AIDS, households are likely to anticipate a death. An alternative coping mechanism is drawing on hired or non-hired labor (e.g., assistance from family members, friends, or neighbors) to maintain agricultural output. Adjustments in household composition might also be important in coping with an adult death (see Beegle 2005 for a similar argument). As noted earlier, households in our sample that experienced adult deaths were indeed more likely to have received new adult co-residents. This suggests that the households most vulnerable to prime-age deaths may be those without access to new household members, making them prone to dissolution.

5.2.2 Response of individual time allocation to HIV-related household morbidity

AIDS-related household morbidity seems to have a larger effect than household mortality on women's time allocation. As we noted earlier, HIV status is an imperfect measure of morbidity, since the infected may remain asymptomatic for several years. Indeed, HIV status alone is not significantly associated with individual time allocation in any model. It is rather the compounded effect of being HIV-positive, and of having been often ill prior to the survey, that is negatively and significantly associated with decreased farm hours (about five) and about three quarters of an hour less spent doing domestic work, although this latter effect is not statistically significant. Having been often ill is also significantly associated with decreased time spent doing non-agricultural work (approximately two hours).

The reduction in the time allocated to farming and cash-generating activities by women who are often ill or are HIV-positive is not mirrored by a corresponding increase in the time allocated by men to these activities. This raises the possibility that the burden of these activities might fall on other household members, particularly children. This supposition is consistent with our findings regarding the changes in women's time allocation in response to recent household deaths, and it is supported by the qualitative evidence. For example, Felicity Sindo's two sons, who lost their father in 2004, initially dropped out of school to take over some of the household chores, and then engaged in casual labor to generate cash income while the father was ill, and following his death. Nat Mkandawire also reported that her elder children stopped going to school in order to join the family in performing *ganyu* labor after the death of her two infants. Finally, Mpume Mkawa shared that she had been forced to cut back on growing tobacco due to ill health, and that several of her adult children had thus had to start performing *ganyu* labor to support the other family members.

Unlike having been often ill prior to the survey date, being currently ill does not have a significant association with either farm or non-farm hours. Rather, and perhaps not surprisingly, being currently ill slightly reduces chore hours (by about half an hour). By contrast, women's time is unresponsive to the illness of her spouse or of other household members. It therefore appears that women do not offer replacement labor when other household members, including their spouses, are incapacitated or bedridden. In addition, this raises the possibility that the burden of caring for sick household members falls on others living in the household, mostly notably children. Once again, this is consistent with our finding about the changes in time allocation in response to recent household deaths. Further research is needed to better address the question of how children's caregiving roles fit into the broader patterns of care and support provided by households (Robson et al. 2006).

6. Conclusion

HIV/AIDS morbidity and mortality are expected to have a large economic impact in Malawi, since they reduce the time that adults can spend on subsistence production and income-generating activities. However, the data demands for estimating this impact are high, limiting the amount of empirical evidence. In this paper, we took advantage of quantitative and qualitative data collected by the 2004 Malawi Diffusion and Ideational Change Project to analyze the association between AIDS-related morbidity and mortality and time allocation decisions for rural Malawians.

Our main finding is that AIDS-related mortality and morbidity at the household level are associated with a diversification of income sources, with women reallocating their time from work-intensive (typically farming and heavy chores) to cash-generating tasks (such as casual labor). As men's time allocation is unresponsive to the same shocks, this raises the question of whether other household member(s) will substitute for women's agricultural and domestic work. Both the quantitative and the qualitative data indicate that new co-resident members are likely to join households that have experienced a recent household death, and might contribute significantly in sharing the work burden, especially if the deceased or the ill person is the male head of household. In addition, the qualitative data show that some of the burden falls on children.

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APPENDIX 1

Table A1-1: Percentage of respondents with complete, incomplete, or missing time diaries; by sex, marital status, and HIV testing status, MDICP-3

	Sample size	Complete	Incomplete	Missing
WOMEN				
All interviewed[1]	1526	96.9%	2.9%	0.3%
Currently married[2,3]	1343	97.0%	2.9%	0.1%
Formerly married[2,4]	183	95.6%	2.7%	1.6%
All interviewed and tested[1]	1256	97.3%	2.5%	0.2%
Currently married[3,5]	1103	90.0%	2.5%	0.1%
Formerly married[4,5]	153	96.7%	2.0%	1.3%
MEN				
All interviewed[6]	1071	97.3%	2.5%	0.2%
Currently married[7]	1053	97.2%	2.6%	0.2%
All interviewed and tested[6]	841	98.1%	1.8%	0.1%
Currently married[7]	839	98.1%	1.8%	0.1%

Notes: Figures for formerly married men are not presented because of small sample size.

[1] Chi-squared test for difference in completeness of time use data by whether the respondent was tested for HIV, among all women interviewed = 4.53; p=0.104.

[2] Chi-squared test for difference in completeness of time use data by marital status, among all women interviewed = 15.1; p=0.001.

[3] Chi-squared test for difference in completeness of time use data by whether the respondent was tested for HIV, among currently married women = 3.13; p=0.209.

[4] Chi-squared test for difference in completeness of time use data by whether the respondent was tested for HIV, among formerly married women = 2.78; p=0.249.

[5] Chi-squared test for difference in completeness of time use data by marital status, among women interviewed and tested for HIV = 8.51; p=0.014.

[6] Chi-squared test for difference in completeness of time use data by whether the respondent was tested for HIV, among all men interviewed = 9.67; p=0.008.

[7] Chi-squared test for difference in completeness of time use data by whether the respondent was tested for HIV, among currently married men = 11.09; p=0.004.

Table A1-2: Individual time allocation patterns in the MDICP-3: percentage of all interviewed respondents who performed any labor activity and specific activities, and average number of hours spent doing any activity and specific activities during the last workday (with standard deviations in parentheses), by sex and marital status

	Any activity	Activity group *j* ‡			Sample size[2]
		Agricultural labor	Non-agricultural labor[1]	Domestic labor	
All respondents					
Percent who performed	94.2	49.7	22.2	69.5	2502
Average number of hours spent	7.9 (3.6)	2.7 (3.4)	1.3 (2.9)	4.0 (3.6)	
Currently married women					
Percent who performed	98.9	42.8	15.4	98.5	1303
Average number of hours spent	8.8 (3.0)	1.9 (2.7)	0.7 (1.9)	6.3 (2.8)	
Formerly married women					
Percent who performed	98.3	40.6	13.7	98.3	175
Average number of hours spent	7.9 (3.3)	1.9 (2.9)	0.5 (1.6)	5.5 (2.8)	
Currently married men					
Percent who performed	87.6	59.9	32.4	27.6	1024
Average number of hours spent	6.8 (4.1)	3.7 (3.9)	2.2 (3.8)	0.9 (2.1)	

Notes: ‡ See Appendix 2 for details on the activities included in each group.
[1] Includes non-agricultural self-employment and wage employment.
[2] Excludes respondents with incomplete or missing time diaries (40 currently married women; eight formerly married women; and 29 currently married men).

Table A1-3: Burden of AIDS-related mortality in households of MDICP-3 adult respondents who were interviewed and tested for HIV: occurrence of any household death and of deaths of children, adults, or elderly in the five years preceding the survey, by sex and marital status

	Currently married women		Formerly married women		Currently married men	
	Number	%	Number	%	Number	%
At least one child death[1] only	124	45.1	12	18.8	77	35.9
At least one adult death[2] only	42	15.3	19	29.7	59	28.6
At least one elderly death[3] only	13	4.7	3	4.7	14	6.8
At least one adult & child death only	12	4.4	5	7.8	7	3.4
At least one child & one elderly death	5	1.8	1	1.6	3	1.5
At least one adult & one elderly death	7	2.6	1	1.6	7	3.4
At least one child, one adult & one elderly death	0	0.0	0	0.0	1	0.5
Unknown age at death	72	26.2	23	35.9	41	19.9
Any death	275	24.9	64	41.8	206	24.6

Notes: [1] Deaths of children less than 10 years old.
[2] Deaths of adults 10-59 years old.
[3] Deaths of adults age 60 years or older.

Table A1-4: Association between selected indicators of AIDS-related household morbidity and mortality and daily hours spent doing different labor activities (farming, non-farm self-employment and wage employment, and domestic work) for currently married MDICP-3 respondents who were interviewed and tested for HIV: coefficients, standard errors (SE), and *p*-values of control variables used in the multivariate tobit models[1], currently married women (*N = 929*)

	Farm hours		Non-farm hours		Chores hours	
	Coef.	***SE***	**Coef.**	***SE***	**Coef.**	***SE***
District (ref: South)						
Center	4.98***	*0.52*	-5.29***	*1.13*	-1.46***	*0.24*
North	1.88**	*0.62*	-4.44***	*1.22*	0.36	*0.29*
Age (ref: 24 years or younger)						
25-34	0.50	*0.57*	0.29	*1.14*	0.10	*0.27*
35 years or older	1.10*	*0.58*	0.77	*1.14*	-0.92***	*0.27*
Education (ref: no education)						
Some primary education	-0.57	*0.50*	2.29**	*1.00*	0.19	*0.24*
Some secondary education	-0.53	*0.97*	3.30**	*1.91*	-0.21	*0.46*
Household wealth						
Household has iron roof	-1.57**	*0.62*	1.40	*1.11*	-0.28	*0.28*
Household owns radio	0.32	*0.46*	0.41	*0.94*	-0.04	*0.22*
Household owns bicycle	0.61	*0.41*	-1.07	*0.84*	-0.32	*0.20*
Household owns cattle	-0.13	*0.66*	0.34	*1.41*	0.16	*0.32*
Household owns land	-0.05	*0.48*	0.96	*1.05*	0.04	*0.23*
Family arrangement						
Currently in polygamous household	0.24	*0.45*	-0.34	*0.91*	-0.17	*0.22*
Household size (*continuous variable*)	-0.01	*0.10*	0.13	*0.19*	0.03	*0.05*

Notes: *p<0.1; **p<0.05; *** p<0.001.

[1] Coefficients, standard errors and *p*-values for the variables of interest are presented in Table 8.

Table A1-4: (Continued). Association between selected indicators of AIDS-related household morbidity and mortality and daily hours spent doing different labor activities (farming, non-farm self-employment and wage employment, and domestic work) for currently married MDICP-3 respondents who were interviewed and tested for HIV: coefficients, standard errors (SE), and *p*-values of control variables used in the multivariate tobit models[1], currently married men (*N = 583*)

	Farm hours		Non-farm hours		Chores hours	
	Coef.	***SE***	**Coef.**	***SE***	**Coef.**	***SE***
District (ref: South)						
Center	4.16***	*0.67*	-9.03***	*1.23*	0.55	*0.80*
North	0.72	*0.72*	-6.50***	*1.19*	2.63	*0.83*
Age (ref: 24 years or younger)						
25-34	-4.31**	*1.58*	4.26	*2.90*	-0.21	*1.97*
35 years or older	-3.83**	*1.54*	4.06	*2.84*	0.21***	*1.92*
Education (ref: no education)						
Some primary education	-0.19	*0.71*	-0.82	*1.12*	-0.88	*0.81*
Some secondary education	-1.10	*0.99*	0.50	*1.64*	-1.05	*1.11*
Household wealth						
Household has iron roof	-1.47*	*0.81*	-0.46	*1.36*	-0.34	*0.93*
Household owns radio	-0.47	*0.66*	-0.59	*1.10*	0.56	*0.77*
Household owns bicycle	-0.12	*0.55*	1.19	*0.93*	-0.47	*0.64*
Household owns cattle	-0.48	*0.84*	-2.65	*1.70*	-0.55	*1.00*
Household owns land	0.51	*0.88*	-0.51	*1.48*	-0.70	*0.98*
Family arrangement						
Currently in polygamous household	0.66	*0.85*	-0.39	*1.53*	-1.29	*1.00*
Household size (*continuous variable*)	0.38**	*0.14*	-0.14	*0.23*	-0.39	*0.16*

Notes: *p<0.1; **p<0.05; *** p<0.001.

[1] Coefficients, standard errors and *p*-values for the variables of interest are presented in Table 8.

APPENDIX 2

Table A2-1 Activities included in each activity group, MDICP-3 time diary

Activity group	Specific activities
Agricultural labor	Own field preparation
	Own field ridging
	Own field planting
	Own field transplanting/supply
	Own field fertilizing/manuring
	Own field weeding
	Own field harvest
	Animal care
	Gathering vegetables
	Other own field operations
	Agricultural wage-labor (for cash)
	Agricultural wage-labor (in-kind)
	Group field labor
	Salaried employment
Non-agricultural labor	Marketing work/sales
	Handicraft production
	Alcohol production
	Transporting goods
	Metal work
	Basket/mat weaving
	Carpentry
	Charcoal/firewood preparation
	Water collection for sale
	Other cash activity
Domestic labor	Making food/cooking
	Fetching water
	Fetching/splitting firewood
	Child care
	Washing clothes
	Repairing/building house or farm
	Cleaning home
Leisure activities	Religious activities
	Attending a funeral
	Village help/community work
	Attending school/studying
	Political meeting
	Visiting with friends
	Resting/sleeping
	Eating
	Other leisure activities