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ARV Treatment and Time Allocation to Household Tasks: Evidence from Kenya

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Abstract

Using longitudinal survey data collected over a period of two years, this paper examines the impact of antiretroviral (ARV) treatment on the time allocated to various household tasks by treated HIV-positive patients and their household members. We study outcomes such as time devoted to housework, firewood and water collection, as well as care-giving and care-seeking. As treatment improves the health and productivity of patients, we find that female patients in particular are able to increase the amount of time they devote to water and firewood collection. This increased productivity of patients coupled with large decreases in the amount of time they spend seeking medical care leads to a reduced burden on children and other household members. We find evidence that boys and girls in treated patients' households devote less time to housework and other chores. These results suggest that the provision of ARV treatment generates a wide variety of benefits to households in resource-poor settings.

1. Introduction

With almost two thirds of all persons infected with HIV/AIDS living in sub-Saharan Africa, the continent remains the epicenter of the global HIV epidemic (UNAIDS, 2006). Because HIV usually affects prime-age individuals who are parents and primary income earners within the household, the demographic and socio-economic impact of the disease can be unusually large. For example, twelve million children have been orphaned due to HIV/AIDS (UNAIDS, 2006). In response to these consequences, the provision of antiretroviral (ARV) treatment for people with AIDS has recently become an important component of the policy response to the disease. By December 2006, there were more than one million ARV recipients in sub-Saharan Africa (WHO/UNAIDS, 2007). Yet, despite the scale-up of treatment interventions in recent years in many countries, only 23 percent of the estimated 4.6 million people in need of therapy in this region are currently receiving it. The need to assess the impact of ARV therapy on household welfare is apparent if we consider the resources currently being invested in treatment as well as the future resource needs of many countries.

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A number of longitudinal studies have examined the impact of HIV/AIDS on income, expenditures and other indicators of household welfare (Yamano and Jayne, 2004; Oni et al., 2000). The highly debilitating and chronic nature of AIDS translates into long periods of lower income and higher expenditures, forcing households to adjust not only to the permanent loss of an individual but also to prolonged phases during which the HIV-affected person is unable to perform any activity and requires assistance from his or her family members. HIV-affected households appear to adjust to the health shock through typical coping mechanisms, as identified by the literature on consumption smoothing in settings where credit and insurance markets are lacking. These include a reduction in savings, asset sales, adjustments in labor supply and schooling investments.

The literature on household coping behaviors in the presence of illness and death highlights the role of labor substitution as an important strategy to compensate for the lower productivity of HIV-infected household members (Goudge and Govender, 2000; Nur, 1993). Studies that focus on the impact of HIV/AIDS on rural households find the economic burden resulting from the disease to be extremely heavy. The behavioral change needed to cope with the shock is found to be long lasting: income remains lower even after the sick person's death and household members' coping strategies are retained in the medium term (Yamano and Jayne, 2004). However, response in terms of intrahousehold reallocation of time is also shown to depend on the gender of household members (Pitt and Rosenzweig, 1990) and on the opportunity cost of the adjustment: among farmers in Burkina Faso, time spent seeking health care and caring for sick family members appears to be seasonal, with negative peaks during the sowing and harvesting seasons (Sauerborn et al., 2006). The evidence is consistent with the wider literature on time allocation patterns in the presence of idiosyncratic health and income shocks, both among individuals whose health is directly affected (Pitt and Rosenzweig, 1986; Pitt, Rosenzweig and Hassan, 1990), and among other household members (Pitt and Rosenzweig, 1986; Kochar, 1995) in rural settings.

This paper fills in a gap between two significant bodies of literature. First, we contribute to the large theoretical and empirical literature on coping mechanisms employed by households in the face of illness and income shocks. The coping mechanisms that typically receive attention include asset holdings of households, cash and in-kind transfers to and from relatives, and investments in children's schooling. In this paper, we focus on the intrahousehold allocations of time devoted to non-market labor activities, which consists primarily of household tasks such as cooking and washing, and also includes water and firewood collection. This could be an important coping strategy when the individual afflicted by illness is a working-age adult. However, few studies have attempted to analyze the time allocation to non-market labor activities as a coping mechanism for HIV-related illness and death, because such analyses require panel data on individual time allocation and information on households that have a known HIV-positive adult.

We also add to the literature on the socio-economic impact of ARV therapy for people with AIDS. Research on the effects of ARV therapy on households' socioeconomic welfare is still limited. A large literature has examined the health effects of ARV therapy. Studies have shown that treatment reduces morbidity and mortality among HIV-infected individuals, in both industrialized countries (Hammer et al., 1997; Hogg et al., 1998; Palella et al., 1998) and developing countries (Laurent et al., 2002; Marins et al., 2003; Koenig, Leandre, and Farmer, 2004; Wools-Kaloustian et al., 2006). Such health benefits from ARV therapy are suggestive of its potential to significantly improve socio-economic well-being and possibly to offset the negative effects of HIV/AIDS at the household level, consistent with the broader evidence on the linkages between health and income in developing countries.[6]

This paper employs data from a longitudinal household survey conducted in rural areas of western Kenya. In collaboration with a large ARV treatment program, we collected socioeconomic data from a large sample of HIV-positive adult patients who were receiving ARV therapy. The results presented here complement previous research that used the same data and showed that the provision of ARV therapy to adults with AIDS results in large increases in their labor supply as well as large increases in the school attendance of children in their households (Thirumurthy, Graff Zivin and Goldstein, 2008; Graff Zivin, Thirumurthy and Goldstein, 2006).

We find that intrahousehold time allocation to non-market labor activities is another important coping channel used by households during the decline due to the onset of AIDS and the recovery with ARV therapy. Furthermore, the within household changes in the allocation of these tasks depends substantially on the age and gender of household members. The picture that emerges from our research suggests that as HIV-infected adults become sick and unable to work and contribute to household chores, their family members need to reallocate their time to non-market labor activities. Children appear to be the ones who, at the margin, are called upon to make up for the reduced productivity of the sick person by performing additional household chores. As the sick adults begin to receive ARV therapy, they are able to increase their market and nonmarket labor supply, thereby allowing household members to significantly reduce their time spent performing chores as well as their time spent caring for the sick person. Our results point to significant decreases in the amount of housework performed and care-giving provided by various household members once sick adults are treated with ARV therapy.

The paper is organized as follows: the next section provides background on the treatment program that we study and on the household survey data. Section 3 next describes our strategy for estimating the impact of ARV treatment on time allocation outcomes. Regression results showing the effect of treatment on ARV-recipients and their household members' time allocation patterns are presented in sections 4 and 5 respectively. Section 6 discusses policy implications of the research and concludes.

2. Background and Data

We use data collected through a household survey we conducted in Kosirai Division, a rural region near the town of Eldoret, in western Kenya. In this section we first provide a brief review of the literature on ARV treatment, followed by a description of the survey and details on the medical data used.

2.1. Treatment of HIV/AIDS with Antiretroviral therapy

The human immunodeficiency virus (HIV) destroys white blood cells that are essential to the immune system. After transmission, that in Sub-Saharan Africa mostly occurs through sexual intercourse between men and women (UNAIDS, 2004), infected individuals go through a latent stage during which health status declines gradually and few symptoms are experienced. Almost all HIV-infected individuals then progress to developing AIDS, a stage associated with substantial weight loss (wasting) and opportunistic infections such as tuberculosis and pneumonia. Median time from seroconversion to AIDS is estimated to be 9.4 years (Morgan et al., 2002), while median survival times after developing AIDS are reported to be between 5.1 months and 9.2 months in developing countries (Chequer et al.,

[6] See Strauss and Thomas (1998), Ruger, Jamison, and Bloom (2001), and Thomas and Frankenberg (2002) for reviews and discussions of the micro-economic literature on linkages between health and income.

1992; Morgan et al., 2002). Opportunistic infections are generally the cause of death in AIDS cases.

Highly active antiretroviral therapy has been proven to prolong the life of HIV-infected individuals by reducing the likelihood of opportunistic infections. According to WHO guidelines, individuals are eligible for ARV therapy after they progress to AIDS. Once they start treatment, patients become asymptomatic and improve their functional capacity after several months of treatment. Positive results have been reported by numerous studies in various countries and patient populations.

While the costs and the effects of ARV therapy on the health of treated patients have been widely documented, much less is known about the broader impact of treatment interventions on the social and economic status of patients and their families. Our survey in western Kenya was designed to examine these impacts.

2.2. Sampling Strategy and Survey Data

The survey was conducted in Kosirai Division, a rural region with an area of 76 square miles and a population of 35,383 individuals living in 6,643 households scattered across more than 100 villages (Central Bureau of Statistics, 1999). Crop farming and animal husbandry are the primary economic activities in the area and maize is the major crop.

The largest health care provider in the survey area is the Mosoriot Rural Health Training Center. In addition to offering primary care services, this government health center also contains a clinic that provides free medical care to HIV-positive patients, including all relevant medical tests and ARV therapy. The Mosoriot HIV clinic was opened in November 2001, one of the first in sub-Saharan Africa, by the Academic Model for the Prevention and Treatment of HIV/AIDS (AMPATH), a collaboration between the Indiana University School of Medicine, the Faculty of Health Science of Moi University, and the Moi Teaching and Referral Hospital. Increases in funding since late-2003 enabled the Mosoriot HIV clinic to grow rapidly, with the number of patients rising from about 150 in early-2003 to 3,714 in February 2007 (communication with AMPATH) and the catchment area of the HIV clinic expanding well beyond the boundaries of Kosirai Division. Even though the growth in the clinic's patient base has been so rapid, the funding available over the period has been adequate to provide free ARV therapy to all patients sick enough to require it, according to the WHO treatment guidelines discussed in the next section.

We implemented three rounds of a comprehensive socio-economic survey between March 2004 and September 2006. There was an interval of roughly six months between the first two rounds, while the third round was conducted one year after the second. The sample consists of two different groups of households. First, a group of 503 households was chosen randomly from a census of non-AMPATH households in Kosirai Division. No AMPATH patient lives in these households, which we refer to as the "random sample." The second group consists of 200 households in which there is at least one AMPATH patient receiving ARV therapy. This sample is referred to as the "ARV sample." The ARV sample was chosen according to the following criteria: it includes all non-pregnant patients residing in Kosirai Division who started receiving treatment at the Mosoriot HIV clinic before April 2004, and (in order to increase the size of the ARV sample), it also includes a random sample of non-pregnant patients residing outside Kosirai Division who started receiving treatment before April 2004. We tried to visit survey respondents at home and conduct interviews there whenever possible, but some of the AMPATH patients from outside Kosirai Division resided too far away from the clinic and were therefore interviewed at the clinic itself. In total, 81 percent of all households were visited at home.

The 200 ARV households in our study contain a total of 217 HIV-positive adults. Between the first and third rounds of the survey, 29 patients either moved, died or were lost to follow-up.[7] We restrict our analysis in this paper to adults who were interviewed in the first and third rounds of the survey. This leaves a total sample of 188 adult ARV recipients for whom we have longitudinal data. In the random sample 28 out of 503 households were not interviewed in the third round, either due to refusal or relocation.

The household survey included questions on different topics, ranging from demographic characteristics to health, agriculture, marriage and family history. Data on many outcomes were recorded in each round to obtain longitudinal data. However, not all questionnaires were administered in each round. In particular, the data on time allocation to nonmarket labor activities are available in the first and third rounds only, giving us two observations for each household with an interval of one and a half years in between.

During household visits, teams composed of one female and one male enumerator interviewed the household head and spouse separately. These individuals provided reports on the time allocated by each household member to various market and nonmarket labor activities. For in-clinic interviews, AMPATH patients were the only sources of information on their households. Height and weight measurements were taken for children under the age of 5 living in the household.

2.3. ARV Therapy and Patient Health

The information collected through our household survey is complemented by medical data on patients at the AMPATH HIV clinic at the Mosoriot Health Center. The AMPATH Medical Record System (AMRS) contains longitudinal information on the health status of patients at AMPATH's HIV clinics in western Kenya. Before estimating how time allocation patterns respond to ARV therapy, we also discuss evidence from the AMRS on the health response to treatment. This section is important both in completing the description of the data available for our analysis, and in highlighting important factors that will shape our empirical strategy.

Since HIV enters and destroys T-cells with the protein CD4 on their surface, the CD4+ T cell count is an important indicator of disease progression among HIV-infected individuals. HIV-infected individuals are considered to have developed AIDS when they contract an opportunistic infection or when their CD4 count falls below 200/mm^3.[8] This is the stage where functional capacity start deteriorating and patients should be initiated on ARV therapy according to WHO guidelines (WHO, 2002).

The AMRS contains CD4 counts of AMPATH patients, monitored at intervals of roughly six months. It also contains more frequent measures of the body mass index, a well-known indicator of short-term health for patients with AIDS (WHO, 1995). Longitudinal data for all non-pregnant adult patients treated with ARV therapy at AMPATH's HIV clinics show significant increases in the CD4 count and weight following initiation of treatment (Wools-Kaloustian et al., 2006). The timing of the health response among patients will be useful for motivating our strategy for estimating and interpreting the time allocation response to treatment. We thus focus here on the AMRS data for patients in our sample.

Patients at the Mosoriot HIV clinic experience improvements in their health status characterized by a pronounced temporal pattern, as revealed by a significant increase in their

[7]Lost to follow-up is the term used for patients who did not attend the clinic for several appointments and whose mortality status cannot be established.

[8]Most uninfected individuals have CD4 counts of 1,000/mm^3.

mean and median CD4 count following the initiation of ARV therapy (Thirumurthy, Graff Zivin, and Goldstein, 2008). The response of CD4 count is highly non-linear: at 10–20 weeks, the median CD4 count rises to levels at which patients are generally asymptomatic (CD4 of 200). Subsequent changes are smaller and less consistent. A similar non-linear trend is found for the BMI. Patients also have extremely low CD4 counts (often below 100) for patients at time that treatment is initiated. This is relevant because it indicates that these patients have very low life expectancies in the absence of treatment – often on the order of six to twelve months. We discuss the implications of this when interpreting the results in Section 4 and 5.

3. Empirical strategy

We study several key components of time allocation to non-market labor activities. For all household members older than 8 years in both rounds, the survey recorded weekly hours spent doing non-market work, such as cleaning and cooking, collecting water and firewood. We also have data on hours per week spent seeking health care or caring for sick family members. This variable includes time spent waiting to be treated, travelling to health establishments, purchasing medicines, and time devoted to assisting sick household members in all these activities. We thus cannot distinguish between own health care time and time caring for others. We can however infer whether hours devoted to healthcare were due to own illness or to other household members' illness from the data we collected on the number of days during the past week in which the respondent was too sick to perform any kind of work.

We estimate the reduced form effect of providing ARV therapy to an adult household member on the allocation of time to non-labor activities, for both the treated patient as well as his or her household members. We do this by comparing weekly hours devoted to housework, chores and healthcare, and days of work missed due to illness in ARV households in round 1 and 3. When attributing changes between rounds to the provision of treatment to an adult household member, it is necessary to control for other time-varying factors that influence time allocation patterns. In the rural setting that we study, these factors include seasonal fluctuations and unexpected shocks in weather, labor demand, and food availability. We control for these factors by using data from random sample household members and by including a full set of month-of –interview indicators in the time allocation equations. We also include individual fixed effects to control for time-invariant individual and family characteristics such as education, schooling, wealth, as well as unobservables such as ability and tastes, that might influence levels of non-market labor and healthcare time.

3.1. Estimation of time allocation response to treatment for ARV-recipients

The treatment response for ARV-recipients is identified by estimating individual fixed effects regressions in which a time interaction for ARV recipients captures between-round changes in their time allocation that are over and above those that occur in the random sample:

$$Y_{it}=\alpha_i+\beta_1 ARV_{it}+\beta_2(ARV_{it}*ROUND3_t)+\beta_3 ROUND3_t+\sum_{\tau=1}^{10}\gamma_\tau MONTH^\tau{}_t+\varepsilon_{it}. \quad (1)$$

Y_{it} is the time allocation outcome of interest for individual i at time t (in round 1 or 3); α_i is a fixed effect for individual i that captures the effects of observable and unobservable time-invariant variables like demographic characteristics, schooling, ability and tastes; ARV_{it} is an indicator variable equal to 1 if individual i is an ARV recipient at time t, and $ROUND3_t$

indicates whether the observation is from round 3. The round 3 indicator, together with the ten month-of-interview indicator variables, control for monthly fluctuations in time allocation patterns in the entire community.

The specification in equation 1 is designed to capture the time-varying effect of ARV treatment that we discussed in section 2.3. To better understand this point, note that this specification divides the ARV recipients in our sample in two groups: those who were on treatment in both survey rounds and those who started treatment between round 1 and 3. For the group of patients already on treatment in round 1, the fitted value of the dependent variable will be equal to the fixed effect term and the coefficient of ARV_{it} in round 1 ($\alpha_i + \beta_1$), and to the fixed effect plus the coefficients of the two ARV variables in round 3 ($\alpha_i + \beta_1 + \beta_2$). For the group of patients who begin treatment between rounds, the dependent variable will be identical in round 3, while in round 1 it will equal the fixed effect term only (α_i). The division of ARV recipients in two samples will indicate whether there are heterogeneous responses during the post-treatment period. The interpretation of β_1 and β_2 thus points to the temporal pattern in the treatment effect: the impact of ARV therapy is equal to β_2 if the patient has been receiving treatment since round 1, while it is equal to $\beta_1 + \beta_2$ if treatment started between the two survey rounds. This difference aims at capturing the fact that the largest health improvements occur during the first few months of ARV treatment, as noted earlier.

3.2. Estimation of time allocation response to treatment for ARV-recipients' household members

Intrahousehold reallocation of time is known to be an important consumption smoothing mechanism, as noted in Section 1, for households in low-income countries. In settings with imperfect financial markets, households often respond to sudden changes in income and wealth by adjusting the time spent by children and adults in activities such as schooling, housework and employment. The nature of these adjustments may differ depending on the age and gender of household members.

Because of its effect on the health status of treated patients, ARV therapy may influence the number of hours devoted to non-market labor activities by the patients' family members. Two effects are likely to be especially relevant. First, as the treated patient begins to work, the total labor supply of the household increases. This should hold true both when the patient's primary activity is market work and when it is non-market work: the contribution to both market and non-market work required from each household member should decrease as the treated patient's ability to perform both types of work increases. Second, as the treated patient's health improves, the time demanded for taking care of him or her becomes lower, thus expanding other household members' time endowment for market and non-market work. The net effect of treatment on the time devoted by family members to non-market work is thus theoretically ambiguous. There is also a third, cross-substitution effect of a patient's increased productivity on family members' time allocation patterns, which further complicates the household response. This effect can be positive or negative depending on whether the non-market times of the treated patient and the other family member are complements or substitutes, respectively.

To estimate the net effect of treatment on the time allocation patterns of children and adult household members of treated patients', we examine longitudinal data on weekly hours allocated to housework, chores, healthcare, and days of work missed due to illness. We again use data from random sample households to control for monthly fluctuations in non-market labor time. Specifically, we estimate the following equation with longitudinal data for non-patient individuals in ARV households and others in the random sample:

$$Y_{iht}=\alpha_{ih}+\beta_1 ARVHH_{iht}+\beta_2(ARVHH_{iht}*ROUND3_t)+\beta_3 ROUND3_t+\sum_{\tau=1}^{10}\gamma_t MONTH^{\tau}{}_t+\varepsilon_{iht} \quad (2)$$

Y_{iht} is the time allocation outcome of interest for individual i in household h at time t (in round 1 or 3); α_{ih} is a fixed effect for individual i in household h that captures the effects of observable and unobservable time-invariant variables like demographic characteristics, schooling, ability and tastes; $ARVHH_{ht}$ is an indicator variable equal to 1 if household h has an adult who is receiving ARV therapy at time t, and $ROUND3_t$ indicates whether the observation is from round 3. The round 3 indicator, together with the ten month-of-interview indicator variables, control for monthly fluctuations in time allocation patterns in the entire community. It should also be noted that the treated patient is excluded from the sample when we estimate equation 2.

The interpretation of equation 2 follows very closely the one given above for equation 1. Again, the presence of the two *ARVHH* variables divides the sample of ARV recipients' household members in two groups: those living in households where the treated patient began receiving ARV before round 1, and those living in households where treatment began between the two survey rounds for the HIV-infected member. The heterogeneous time effect that such a specification aims to capture and the interpretation of the coefficients do not differ from the ones discussed in the previous subsection.

4. Results for Adult Patients' Time Allocation

The analysis of time allocation decisions is conducted for two different groups of individuals – the treated patients and their household members. The focus in this section is on the ARV recipients themselves. The next section turns to time allocation decisions of the ARV recipients' household members.

Table 1 presents summary statistics for the 1,122 adults in the random sample and the 188 ARV patients who appear in both rounds.[9] We report data on mean hours spent performing household chores, as well as on hours spent seeking health care, and on the number of days in the past week when the respondent was too sick to perform any work.[10]

As expected, women spend more hours performing household chores than men. Women devote nearly six times as many hours to cleaning the house, preparing meals, fetching water and collecting firewood. This is a feature of the data that spans both rounds and samples. In both rounds and across genders, ARV recipients spend significantly more time receiving health care than adults in the random sample. This finding is consistent with ARV patients having to attend the HIV clinic for monthly check ups and collection of medicines, even after their health status improves. However, the number of hours spent seeking health care by men and women in the ARV sample is about one third as large in round 3 than round 1, a fact that could be explained by improved health conditions among ARV recipients.

Improved health status in the third round among HIV-positive individuals receiving treatment is also suggested by data on days of work lost due to sickness. In the first round,

[9]For five of the ARV patients, data on time allocation are unavailable.

[10]Time spent doing housework includes time spent preparing meals, cleaning the house, doing the laundry or shopping for food. Hours spent seeking health care includes time spent traveling to health establishments, waiting to be treated, buying medicines and caring for sick household members

adults in the ARV sample are significantly more likely to report having missed days of work in the past week due to illness, compared to adults in the random sample. However, these differences are greatly reduced and not statistically significant in the third round. The summary statistics presented in Table 1 are therefore consistent with ARV treatment having a positive effect on people with AIDS.

To contrast adults in the ARV sample and random sample in the two survey rounds while controlling for omitted characteristics of ARV patients that could explain the differences in the summary statistics, we estimate longitudinal regressions with individual fixed effects. Table 3 reports results from estimating equation 1. As discussed in section 3.1, coefficients of the variable *ARV at time t,* or ARV_{it} (a dummy equal to one if the respondent is receiving ARV treatment at the time of the interview) capture the effect of starting ARV therapy between the first and the third round and reveal whether patients who started treatment between rounds experience an additional change in the outcome of interest relative to those who were already on treatment in round one. Coefficients of the interaction variable *ARV at time t*Round3,* or ARV_{it}*$ROUND3_t$, capture the effect of treatment that is common to both early-stage and late-stage ARV recipients (including those who were already on treatment during round 1). For those patients who were put on treatment between the two rounds, the overall effect of ARV therapy should thus be computed as the sum of these two sets of coefficients.

Columns 4 and 9 of Table 3 show that ARV therapy leads to a large and statistically significant decrease in time spent seeking health care for both male and female patients. Having been on ARV therapy since the first round is associated with a reduction in hours devoted to health care in the past week (3.5 hours for men and 3 hours for women). The impact on individuals who started treatment between the two rounds is smaller for men, but larger for women: combining the coefficients of the two ARV variables, there is a net reduction of about 2 hours in time spent seeking health care for men, and more than 4.5 hours for women. This result confirms what we already noted based on the summary statistics: time spent seeking health care declines significantly over time for patients receiving ARV therapy. Given that the average time spent seeking health care in round 1 was 4.55 hours for men and 5.76 hours for women, these estimated impacts are very large.

Columns 5 and 10 also present evidence that is consistent with the improved health status over time for patients receiving ARV therapy. Although not statistically significant, the effect of ARV therapy on days of work missed in the past week due to sickness is of substantial magnitude and has the expected sign. Adding the two ARV coefficients we see that days of work missed in the past week drop by nearly 1.5 for both men and women who started treatment between the two rounds. The fact that both ARV coefficients have the same sign suggests that the effect of ARV treatment is greater for those patients who started therapy between rounds, as they experience an additional reduction in days of work missed relative to those who were already on treatment in round one. We would expect the reduced time spent seeking health care and the fewer days of work missed due to poor health to be reflected in an increase in hours spent performing household chores.

This indeed seems to be the case for women receiving ARV treatment. In particular, columns 7 and 8 of Table 3 show a positive and significant relationship between the length of time a woman has been on ARV therapy and the number of hours in the past week that she reports performing physically more demanding tasks, such as collecting water and firewood. For female ARV recipients in both rounds, time devoted to collecting water increases by nearly 2 hours in the past week, and time devoted to fetching firewood increases by 1 hour. For women who started ARV therapy between the two rounds, the increases in time devoted to both activities are not significantly different from those for

patients already on treatment in round 1. While these point estimates may appear small, the average reported hours spent by female patients in round 1 on firewood and water collection were 2.18 and 3.14, respectively. Hence, relative to the baseline levels of these activities, these are large increases.[11]

The evidence on time spent performing household chores by men is more mixed and not significant. A possible explanation can be found in the fact that household chores are, as apparent from the summary statistics in Table 1, activities typically performed by women. We can argue that, as their health status improves, men are more likely to spend time performing activities not included in Table 1, such as farming or other income generating activities. Indeed, this is supported by the results we present in an earlier paper on the market labor supply of ARV recipients (Thirumurthy, Graff Zivin and Goldstein, 2008), where we find significant increases in labor supply among male and female ARV recipients.

5. Results for household members of treated patients

The focus of our analysis in this section is on time allocation patterns of ARV recipients' household members. The results presented in the previous section suggest that health status affects an individual's ability to perform most kinds of housework. We now investigate whether the reduced contribution to household tasks by ARV patients is compensated by other household members devoting more hours to housework relatively to their random sample counterparts – and whether differences in time allocation outcomes between adults and kids in ARV and random households disappear as ARV patients' health improves. In what follows, results are presented separately by gender for adult and young household members.

5.1 Adults in ARV households

Table 2 reports summary statistics on time allocation patterns of patients' household members, as compared to similar data for individuals in the random sample. The ARV sample includes 178 individuals between the ages of 18 and 65 years who appear in both rounds and live in households where there is an ARV recipient. The random sample features 1,118 adults appearing in both rounds and living in random sample households.

Table 2 shows that time spent seeking health care in round one is significantly higher among ARV recipients' household members than among adults in the random sample. Recalling that this variable also includes time spent seeking health care and caring for sick household members, we could interpret this result as suggesting that adults living in ARV households spend more time looking after their sick family members. According to this interpretation, we would expect the differences in hours devoted to health care between the two samples to disappear over time as the health status of the ARV recipient in the household improves. Indeed, the difference in time spent seeking health care between adults in ARV and random sample households is not significant in round 3. Coupling these results with the ones for ARV recipients, we can argue that as ARV patients get healthier they require less assistance from family members.

An alternative interpretation for the higher values of the health care variable in the ARV sample is that ARV recipients' adult family members are more likely to get sick between rounds. However, this interpretation is not supported by the data on days of work missed due

[11]We have verified that these results hold even when we focus on ARV patients who reside within Kosirai Division. The random sample of households in Kosirai Division is arguably more directly comparable (on the dimensions of seasonality and aggregate patterns) to this limited sample of ARV patients than to the entire sample of ARV patients which includes those from outside Kosirai Division.

to illness. The summary statistics for this variable do not reveal significant differences between the two samples, nor a clear pattern over the two rounds.

Women living in ARV households appear to devote fewer hours to housework. This finding is at first surprising, as we would expect female household members to increase the time they spend performing chores in order to make up for the reduced contribution of their sick family member to these activities. Less surprisingly, men in the ARV sample do not differ significantly from their counterparts in the random sample when it comes to time allocated for household chores. Also, there is no clear pattern in hours devoted to housework in both rounds, for men or women. In order to explain these findings and examine changes between rounds more closely, we estimate regressions using the longitudinal data and individual fixed effects.

Table 4 presents the results from estimating equation 2 with individual fixed effects. We regress time allocation outcomes on a dummy variable indicating whether the individual lives in a household with an adult ARV recipient at the time of the interview (*ARV household at time t*, or $ARVHH_{iht}$), as well as on an interaction term between this variable and a round 3 dummy variable ($ARVHH_{iht}*ROUND3_t$). Coefficients of the latter term capture the effect of ARV treatment on the time allocation of treated patients' household members. The former variable instead reveals whether starting treatment between rounds is associated with any additional changes in the time that ARV recipients' household members devote to housework and chores.

As noted in our discussion of Table 2, we do not observe a significant relationship between time spent performing household chores and the ARV variables. This holds for both male and female household members of ARV recipients. This finding is consistent with results on labor supply of ARV recipients' adult household members presented in Thirumurthy, Graff Zivin and Goldstein (2008). The regression results also show that female household members spend significantly less time seeking health care as the patient starts receiving ARV treatment. Column 9 of Table 4 shows that women living in households where the ARV recipient started treatment before round one experience a significant reduction in time spent seeking health care, by about one hour per week. In households where the ARV recipient started therapy between rounds, time spent seeking health care actually increases (the sum of the coefficients on the two ARV variables) but only by a small amount. The results for men tell a slightly different story. As column 4 shows, the time that male household members spend seeking health care declines significantly (by nearly 1.4 hours per week) among households in which the ARV recipient began treatment between round 1 and 3. The reduction in health care seeking time for men living in these households is also substantial compared to their levels in round 1. However, living with someone who was already on ARV treatment during round 1 is associated with no significant change in time spent by men seeking health care: we infer this from the coefficient of the $ARVHH_{iht}*ROUND3_t$ interaction variable.

5.2. Children in ARV households

Table 2 also reports summary statistics on hours spent performing household chores, seeking health care, and days of work missed due to illness for boys and girls aged 8 to 18 years. Children living in households where there is an ARV recipient are contrasted to children of the same age from random sample households. Restricting attention to individuals appearing in both rounds, we have observation for 291 children in the ARV sample and 739 in the random sample.

The results for the first round show that boys living in households from the ARV sample are more likely to spend time seeking health care than their random sample counterparts.

Whether in this case the health care variables captures time devoted to seeking treatment for own illness or caring for a sick household member is hard to tell. Given that boys in ARV households are reported to have missed more days of work due to illness, it is plausible both that these children spend more time looking after their sick family member and that they are themselves more prone to falling ill than children living in random sample households.

During the first round, boys in the ARV sample also spend more time performing household chores than boys from the random sample. In results that are not reported in Table 2, we find that if we restrict attention to boys aged 14 to 18 years, some of the differences between the two samples become more apparent. In particular, older boys in ARV households spend nearly three times as much time collecting firewood. This result is consistent with our previous findings for the first round, in particular with women who receive ARV therapy spending significantly less time collecting firewood than adult women in the random sample. Remarkably, differences in time allocation between boys in the two samples are greatly reduced in the third round, suggesting that improved health status of ARV patients allows boys in the household to perform fewer chores. Note in particular the dramatic drop in the number of hours that boys in ARV households spend performing housework between the two rounds.

The amount of time spent by girls performing housework and chores does not show such significant differences between samples and rounds. However, it is worth mentioning a result that is not reported in Table 2: in the first round, girls who live in ARV households and are between the ages of 14 and 18 years devote significantly more time to collecting water than girls of the same age who live in random sample households. Such differences between the two samples disappear in the third round. Recall that collecting water is the other activity that female ARV patients devote significantly less time to in the first round, when their heath status is poorer. These results are jointly consistent with older children in ARV households performing physically more demanding chores when adult patients cannot carry them out due to poor health in the first round.

Table 5 presents results from estimating equation 2 with individual fixed effects for young household members aged 8 to 18. Column 1 confirms that boys in ARV households devote significantly fewer hours to housework (2.4 fewer hours in the past week, on average) as a result of an adult household member receiving ARV treatment. Given that the average time spent by these boys in housework in round 1 was 2.98 hours, these are sizable effects. The results for girls presented in Column 8 show a significant reduction in time spent collecting water, a drop of 0.86 hours against a round 1 average of 2.32 hours. Living with an adult ARV recipient who started treatment between rounds is not associated with any *additional* change between rounds in the time spent by girls collecting water and firewood. Considering the results for boys and girls together, we can argue that, as the ARV recipient becomes healthier, there is not only a reallocation of non-income work between the patient and the children living in the household, but also among the children of different gender and, possibly, of different ages.

To explore this hypothesis we estimate equation 2 for children in different age groups. Table 6 presents regression results for younger children, aged 8 to 13. Column 1 of Table 6 shows that hours devoted to housework decrease significantly for younger boys in households with ARV recipients. There is no significant difference between the ARV households that start treatment before or after round 1. When we consider time spent seeking health care and days of inactivity due to illness, we see from columns 4 and 5 of Table 6 that the more significant reductions in these outcomes for younger boys take place when the ARV patient in the household is in the early stages of treatment (i.e. the reductions are observed in households in which patients began treatment between rounds 1 and 3).

The results from estimating equation 2 with individual fixed effects for older boys and girls (those between 14 and 18 years) are presented in Table 7. Column 1 shows that the decrease in hours spent performing housework between rounds is on average 2.1 hours for older boys in all ARV households. The regression results for girls indicate the impact of ARV therapy changes depending on the amount of time that the household experiences treatment. There is a large and significant reduction in hours spent collecting water by older girls in all ARV households. For children in the ARV households where treatment began after round 1, there is no significant additional change in time allocation to this activity. Once more, the results for boys and girls jointly suggest that reallocation of non-income work within the household takes place not only between the sick and the healthy, but also between boys and girls of different ages.

The results presented in this section show that ARV therapy has different effects on time allocation patterns of young household members, depending on their age and gender. We can better understand the results outlined here if we complement them with the findings we present in other papers where we analyze the impact of ARV treatment on labor supply and children's schooling using data from the first two rounds of the survey. We show in these papers that, while the impact of improved health status among ARV recipients on labor supply and school enrollment is small for older children in the household, it is large and significant for younger children. With the results in this paper we can complement the analysis of time spent in school and market work with an analysis of work in the household. Here we find that in response to treatment there is little change in the time that the non-ill adult members of the household devote to households tasks, while for children, both young and older boys do more housework and older girls spend more time gathering water.

6. Conclusion

AIDS morbidity and mortality are found to have large economic impacts since they reduce the ability of adult individuals to perform income generating activities. However, the results presented in this paper suggest that when analyzing the economic impact of HIV we must consider its effects on a broader range of activities and shift the focus from individual to family well-being. We provide evidence on how ARV therapy affects non-market labor activities of AIDS patients and their household members. Using data from our household survey, we find that treatment has impacts not only on HIV-infected individuals, but also on their family members' time allocation outcomes.

The diminished earning capacity of HIV-infected adults along with the caregiver burden associated with their illness induces a reallocation of time among non-market activities. Women in HIV households devote less time to labor intensive tasks, such as fetching water and firewood. Additional analysis of our data suggests that women reallocate their time to cash-generating tasks in order to compensate for the reduction in household income due to the illness. While men's time allocation to household chores seems unresponsive to the health shock, other household members need to substitute for women's reduced contribution to housework in HIV-affected households. In particular, we find that the heavier burden falls on children, who are called upon to perform more physically demanding chores. Additional analyses of our survey data show children's school attendance rates to be lower in HIV households, thus suggesting a reallocation of their time from education to labor activities.

Our results suggest that ARV therapy, by dramatically improving the health of infected individuals, reverses these effects. Our analysis thus has implications for how one should value investments in ARV treatment. Most research in this area denominates returns to treatment in terms of health measures, focusing on morbidity and mortality impacts for patients. Even studies that capture patient income effects through the use of quality- (or

disability-) adjusted-life-years-saved, still miss the important non-patient impacts described in this paper. The magnitude of these impacts is large. After the initiation of treatment for HIV-infected adults, young boys in the household reduce the time they devote to housework by 2.5 hours and they spend less time seeking health care. Indeed, time spent seeking health care and caring for sick family members drops dramatically both for the ARV recipients as well as their household members. We also find significant declines in the amount of time spent on non-market activities by older boys and older girls. Given the high returns of reallocating time to income generating activities and school attendance, our results suggest that ARV treatment has benefits that extend well beyond those experienced directly by treated patients.

In the absence of data from a randomly chosen sample of AIDS patients who do not receive ARV therapy, it will be difficult to estimate the full impact of treatment on the treated. Given ethical constraints to implement such an evaluation, our strategy represents the best available method of estimating the response to treatment while controlling for important household and community level characteristics. Our results are underestimates of the treatment effect because there is extensive medical evidence that AIDS will quickly lead to death in the absence of therapy. Our conclusion that treatment results in significant intra-household reallocation of time would only be strengthened if the analysis were based on comparison to a true counterfactual group.

The finding that ARV therapy has both direct impacts on patients and indirect impacts on their households, especially the younger members, suggests that intergenerational impacts must be taken into account when evaluating the benefits of treatment programs. This is an important policy implication of this paper, since treatment programs have yet to be scaled up in many countries. Intertemporal economic consequences of *not* providing treatment are likely to include lower levels of human capital among children in AIDS-affected households, and thus lower rates of economic growth in the future. This long term impacts are of course to be considered along with the economic contraction resulting from the disease burden on the current adult generation.

The impacts of treatment on time allocation found in this paper have a non economic component as well, which should also be taken into account when evaluating the benefits of ARV therapy. Non-market activities have great private value to the household as a whole, and measuring the welfare gains of reallocating time between them is a non-trivial challenge, since schooling and other forms of investment are also affected. However, any discussion on the costs and benefits of ARV programs must attempt to weigh these social and intertemporal welfare gains against the costs of treatment. The HIV/AIDS pandemic and our response to it exert a profound influence on household investment decisions, creating a link between the welfare of current and future generations in countries where the disease burden is heaviest.

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Table 1

Time allocation summary statistics for adult ARV recipients

	Round 1					Round 3				
	Random Sample		ARV recipients			Random Sample		ARV recipients		
	Mean	Std. Error	Mean	Std. Error	P-value	Mean	Std. Error	Mean	Std. Error	P-value
Treated Patients - Adult Men										
Number of observations	588		42			577		43		
Housework	3.21	0.22	3.74	0.97	0.539	2.66	0.14	2.70	0.70	0.938
Firewood	0.27	0.04	0.45	0.34	0.288	0.21	0.04	0.26	0.14	0.760
Water	1.33	0.10	1.19	0.44	0.719	1.51	0.10	1.26	0.31	0.491
Seek care	0.27	0.08	4.55	1.08	0.000	0.21	0.04	1.26	0.33	0.000
Days less work	0.03	0.01	1.17	0.37	0.000	0.25	0.17	0.28	0.17	0.965
Treated Patients - Adult Women										
Number of observations	534		141			528		141		
Housework	20.62	0.50	18.02	0.99	0.019	21.14	0.48	18.60	0.86	0.015
Firewood	2.68	0.13	2.18	0.24	0.086	2.62	0.16	3.26	0.28	0.065
Water	3.83	0.15	3.14	0.24	0.031	4.18	0.15	5.43	0.42	0.001
Seek care	0.56	0.11	5.76	0.65	0.000	0.62	0.09	1.92	0.22	0.000
Days less work	0.08	0.03	1.10	0.19	0.000	0.29	0.19	0.23	0.08	0.868

Table 2

Time allocation summary statistics for non-patient children and adults

	Round 1					Round 3				
	Random Sample		ARV households			Random Sample		ARV households		
	Mean	Std. Error	Mean	Std. Error	P-value	Mean	Std. Error	Mean	Std. Error	P-value
Treated Patients' Household Members - Adult Men										
Number of observations	585		84			574		80		
Housework	3.22	0.22	2.60	0.32	0.289	2.65	0.14	1.90	0.34	0.060
Firewood	0.28	0.04	0.44	0.14	0.145	0.21	0.04	0.21	0.09	0.996
Water	1.34	0.10	1.27	0.20	0.817	1.50	0.10	1.61	0.28	0.684
Seek care	0.26	0.08	1.07	0.57	0.007	0.20	0.04	0.10	0.06	0.378
Days less work	0.03	0.01	0.06	0.04	0.394	0.25	0.17	0.19	0.12	0.895
Treated Patients' Household Members - Adult Women										
Number of observations	532		94			526		95		
Housework	20.66	0.50	15.52	1.15	0.000	21.15	0.49	14.66	1.11	0.000
Firewood	2.67	0.13	2.18	0.26	0.144	2.63	0.16	2.89	0.36	0.516
Water	3.84	0.15	3.34	0.52	0.236	4.19	0.15	4.49	0.48	0.459
Seek care	0.57	0.11	1.05	0.30	0.105	0.62	0.09	0.50	0.23	0.594
Days less work	0.08	0.03	0.06	0.03	0.834	0.29	0.19	0.13	0.06	0.711
Treated Patients' Household Members - Boys Aged 8 to 18										
Number of observations	423		153			406		155		
Housework	2.53	0.20	2.98	0.32	0.238	4.18	0.25	2.65	0.30	0.001
Firewood	0.62	0.08	0.95	0.15	0.037	0.58	0.06	0.57	0.12	0.987
Water	1.84	0.13	1.97	0.19	0.610	2.44	0.13	3.03	0.32	0.040
Seek care	0.07	0.03	0.34	0.14	0.004	0.11	0.04	0.18	0.10	0.480
Days less work	0.04	0.01	0.18	0.08	0.009	0.07	0.02	0.11	0.06	0.415
Treated Patients' Household Members - Girls Aged 8 to 18										

	Treated Patients' Household Members - Adult Men									
	Round 1					Round 3				
	Random Sample		ARV households			Random Sample		ARV households		
	Mean	Std. Error	Mean	Std. Error	P-value	Mean	Std. Error	Mean	Std. Error	P-value
Number of observations	315		133			292		133		
Housework	6.18	0.33	5.83	0.61	0.588	8.78	0.51	7.47	0.74	0.145
Firewood	1.85	0.21	1.32	0.14	0.109	1.55	0.12	1.69	0.19	0.509
Water	2.10	0.12	2.32	0.25	0.374	2.99	0.17	2.74	0.27	0.412
Seek care	0.30	0.11	0.65	0.32	0.192	0.27	0.09	0.36	0.20	0.639
Days less work	0.05	0.02	0.12	0.05	0.107	1.14	0.59	0.22	0.10	0.289

Table 3

Impact of ARV treatment on patients' time allocation patterns

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
			Men					Women		
	Hours Housework	**Hours Firewood**	**Hours Water**	**Hours Seek/give care**	**Days less work**	**Hours Housework**	**Hours Firewood**	**Hours Water**	**Hours Seek/give care**	**Days less work**
ARV_{it}	0.407 [2.087]	0.251 [0.469]	0.884 [1.067]	1.104 [1.058]	−0.832 [1.488]	−4.080 [2.500]	0.749 [0.806]	−0.314 [0.974]	−1.712 [0.881]*	−0.667 [0.818]
ARV_{it} * Round 3_t	−0.797 [1.086]	−0.128 [0.244]	−0.308 [0.555]	−3.520 [0.529]***	−0.523 [0.785]	−0.073 [1.428]	1.056 [0.461]**	1.945 [0.556]***	−3.057 [0.504]***	−0.715 [0.468]
Round 3_t	−0.540 [0.308]*	−0.092 [0.069]	0.145 [0.157]	−0.020 [0.150]	0.081 [0.220]	1.476 [0.680]**	0.105 [0.219]	0.297 [0.265]	0.053 [0.241]	0.151 [0.222]
Month controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	4.608 [0.551]***	0.184 [0.124]	1.860 [0.282]***	0.778 [0.280]***	0.143 [0.393]	22.803 [1.293]***	3.432 [0.417]***	4.707 [0.504]***	1.775 [0.459]***	0.447 [0.423]
Observations	1250	1251	1251	1233	1242	1344	1344	1344	1339	1343
Number of group(hhn id)	631	631	631	631	631	676	676	676	676	676
R-squared	0.04	0.01	0.02	0.11	0.01	0.03	0.04	0.07	0.18	0.02

Standard errors in brackets

* significant at 10%;

** significant at 5%;

*** significant at 1%

Table 4

Impact of ARV treatment on household members' time allocation patterns -- adults

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
			Men					Women		
	Hours Housework	**Hours Firewood**	**Hours Water**	**Hours Seek/give care**	**Days less work**	**Hours Housework**	**Hours Firewood**	**Hours Water**	**Hours seek/give care**	**Days less work**
$ARVHH_{it}$	−0.430 [1.490]	0.419 [0.322]	0.487 [0.788]	−1.380 [0.756]*	−0.284 [1.049]	0.017 [3.314]	−0.468 [1.054]	−0.788 [1.335]	1.495 [0.816]*	0.056 [1.079]
$ARVHH_{it}$ * Round 3_t	−0.382 [0.796]	−0.218 [0.171]	−0.049 [0.421]	−0.629 [0.399]	0.275 [0.565]	−2.543 [1.676]	0.735 [0.533]	0.726 [0.675]	−0.983 [0.413]**	0.198 [0.546]
Round 3_t	−0.369 [0.298]	−0.128 [0.064]**	0.169 [0.157]	−0.059 [0.149]	0.129 [0.210]	1.028 [0.695]	0.010 [0.221]	0.386 [0.280]	0.226 [0.172]	0.074 [0.226]
Month controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	4.744 [0.565]***	0.110 [0.122]	2.020 [0.298]***	0.884 [0.293]***	0.056 [0.396]	21.395 [1.264]***	3.410 [0.402]***	5.248 [0.509]***	0.569 [0.313]*	0.084 [0.411]
Observations	1323	1325	1324	1305	1315	1247	1247	1247	1243	1247
Number of group(hhn id)	669	669	669	669	669	629	629	629	630	630
R-squared	0.04	0.02	0.02	0.03	0.01	0.02	0.02	0.03	0.03	0.01

Standard errors in brackets

* significant at 10%;

** significant at 5%;

*** significant at 1%

Table 5

Impact of ARV treatment on household members' time allocation patterns – children aged 8 to 18

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
			Boys					Girls		
	Hours Housework	**Hours Firewood**	**Hours Water**	**Hours Seek/give care**	**Days less work**	**Hours Housework**	**Hours Firewood**	**Hours Water**	**Hours Seek/give care**	**Days less work**
$ARVHH_{it}$	−1.230 [1.128]	−0.192 [0.384]	−0.771 [0.695]	−0.109 [0.236]	−0.142 [0.148]	−0.225 [1.958]	0.954 [0.759]	0.607 [0.740]	−0.144 [0.648]	−0.124 [1.723]
$ARVHH_{it}$ * Round 3_t	−2.400 [0.698]***	−0.281 [0.236]	0.242 [0.428]	0.003 [0.144]	−0.031 [0.091]	−1.250 [1.173]	−0.185 [0.453]	−0.856 [0.443]*	−0.257 [0.380]	−0.005 [1.033]
Round 3_t	1.748 [0.378]***	−0.142 [0.129]	0.713 [0.233]***	−0.029 [0.079]	0.023 [0.050]	1.990 [0.672]***	−0.186 [0.260]	0.963 [0.254]***	−0.173 [0.218]	0.869 [0.591]
Month controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	3.313 [0.672]***	0.278 [0.229]	2.904 [0.415]***	0.064 [0.143]	0.101 [0.088]	2.930 [1.230]**	1.664 [0.477]***	2.546 [0.465]***	0.252 [0.419]	0.490 [1.090]
Observations	1137	1139	1139	1123	1128	873	874	873	859	870
Number of group(hhn id)	580	580	580	580	580	450	450	450	450	450
R-squared	0.08	0.04	0.08	0.04	0.01	0.12	0.09	0.09	0.02	0.05

Standard errors in brackets

* significant at 10%;

** significant at 5%;

*** significant at 1%

Table 6

Impact of ARV treatment on household members' time allocation patterns – children aged 8 to 13

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Young boys (8–13)					Young girls (8–13)				
	Hours Housework	**Hours Firewood**	**Hours Water**	**Hours Seek/give care**	**Days less work**	**Hours Housework**	**Hours Firewood**	**Hours Water**	**Hours Seek/give care**	**Days less work**
$ARVHH_{it}$	0.671 [1.373]	0.673 [0.555]	−1.079 [1.011]	−0.919 [0.285]***	−0.526 [0.221]**	−0.702 [1.919]	0.867 [0.802]	0.172 [0.719]	0.144 [0.358]	−0.242 [2.498]
$ARVHH_{it}$ * Round 3_t	−2.500 [0.782]***	−0.145 [0.313]	0.112 [0.569]	0.184 [0.157]	0.003 [0.124]	−1.052 [1.206]	−0.428 [0.504]	−0.053 [0.452]	0.073 [0.226]	0.009 [1.573]
Round 3_t	2.361 [0.418]***	−0.044 [0.169]	0.926 [0.308]***	−0.084 [0.085]	−0.019 [0.067]	2.256 [0.671]***	0.134 [0.280]	0.635 [0.251]**	−0.205 [0.126]	1.093 [0.874]
Month controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	1.685 [0.761]**	0.308 [0.308]	2.741 [0.562]***	0.194 [0.159]	0.161 [0.123]	3.453 [1.283]***	1.350 [0.536]**	2.418 [0.480]***	0.152 [0.239]	0.641 [1.670]
Observations	635	636	636	633	635	479	479	479	476	478
Number of group(hhn id)	322	322	322	322	322	245	245	245	245	245
R-squared	0.16	0.02	0.12	0.10	0.04	0.16	0.08	0.13	0.04	0.06

Standard errors in brackets

* significant at 10%;

** significant at 5%;

*** significant at 1%

Table 7

Impact of ARV on household members' time allocation patterns – children aged 14 to 18

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
			Old boys (14–18)					Old girls (14–18)		
	Hours Housework	**Hours Firewood**	**Hours Water**	**Hours Seek/give care**	**Days less work**	**Hours Housework**	**Hours Firewood**	**Hours Water**	**Hours Seek/give care**	**Days less work**
$ARVHH_{it}$	−2.481 [1.846]	−0.522 [0.540]	−0.448 [1.000]	0.482 [0.391]	0.117 [0.202]	0.028 [3.804]	1.277 [1.416]	1.396 [1.429]	−0.579 [1.519]	0.303 [2.376]
$ARVHH_{it}$ * Round 3_t	−2.128 [1.227]*	−0.505 [0.359]	0.400 [0.665]	−0.315 [0.263]	−0.055 [0.136]	−1.263 [2.147]	0.139 [0.796]	−1.837 [0.807]**	−0.734 [0.803]	−0.026 [1.343]
Round 3_t	0.727 [0.679]	−0.295 [0.198]	0.413 [0.367]	0.074 [0.144]	0.073 [0.074]	1.703 [1.270]	−0.608 [0.472]	1.350 [0.477]***	−0.118 [0.475]	0.632 [0.795]
Month controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	4.872 [1.168]***	0.039 [0.342]	3.076 [0.633]***	0.062 [0.255]	0.080 [0.128]	2.360 [2.240]	1.943 [0.835]**	2.488 [0.841]***	0.434 [0.934]	0.313 [1.417]
Observations	502	503	503	490	493	394	395	394	383	392
Number of group(hhn id)	258	258	258	258	258	205	205	205	205	205
R-squared	0.10	0.14	0.05	0.06	0.01	0.14	0.13	0.13	0.05	0.03

Standard errors in brackets

* significant at 10%;

** significant at 5%;

*** significant at 1%