Title

Improved employment and education outcomes in households of HIV-infected adults with high CD4 cell counts

Journal

AIDS, 27(4)

ISSN

0269-9370

Authors

Thirumurthy, Harsha
Chamie, Gabriel
Jain, Vivek
et al.

Publication Date

2013-02-20

DOI

10.1097/qad.0b013e32835c54d8

Peer reviewed

Published in final edited form as:
AIDS. 2013 February 20; 27(4): . doi:10.1097/QAD.0b013e32835c54d8.

Improved employment and education outcomes in households of HIV-infected adults with high CD4 counts: evidence from a community health campaign in Uganda

Harsha THIRUMURTHY[1,*], **Gabriel CHAMIE**[2,3], **Vivek JAIN**[2,3], **Jane KABAMI**[3], **Dalsone KWARISIIMA**[3], **Tamara D. CLARK**[2,3], **Elvin GENG**[2,3], **Maya L. PETERSEN**[4], **Edwin D. CHARLEBOIS**[2,3], **Moses R. KAMYA**[3,5], **Diane V. HAVLIR**[2,3], and **the SEARCH Collaboration**

[1]Department of Health Policy and Management, Gillings School of Global Public Health, University of North Carolina, Chapel Hill, NC, USA [2]University of California, San Francisco (UCSF), San Francisco, CA [3]Makerere University-University of California (MU-UCSF) Research Collaboration, Kampala, Uganda [4]School of Public Health, University of California, Berkeley, Berkeley, CA [5]Makerere University School of Medicine, Kampala, Uganda

Background

There is growing evidence that HIV-infected adults receiving antiretroviral therapy (ART) in sub-Saharan Africa experience a restoration in their economic outcomes following ART initiation [1–6]. However, the socio-economic status of most patients and their households has been very poor at the time of ART initiation, suggesting that it may be possible to avert an economic decline if treatment were initiated earlier.

Along with important new evidence on the direct medical benefits to individual patients as well the secondary preventive benefits from early ART initiation [7], preventing the degradation of a household's or an individual's economic profile may be an additional benefit that has not been carefully examined. The size of such benefits depends on the nature of the association between socio-economic outcomes and CD4+ T-cell counts among HIV-infected individuals, and whether the outcomes at CD4 ranges that are above current treatment initiation thresholds.

Several studies conducted in sub-Saharan Africa have documented the harmful effects of HIV/AIDS on socio-economic outcomes of individuals and households. Some of these studies have examined the household-level consequences of adult mortality due to HIV/AIDS [8, 9], whereas others have employed cross-sectional data to describe socio-economic characteristics of HIV-infected individuals and to compare them to HIV-uninfected individuals and their households [10]. A few studies have also used longitudinal or retrospective data to examine how socio-economic outcomes change as a result of HIV disease progression [11, 12]. However, many subjects in these studies had advanced HIV infection from the outset, and the studies lacked data on the CD4 count of subjects from the time of infection, thus resulting in a gap in knowledge about employment patterns at earlier, higher CD4 count stages of HIV infection. To overcome this gap, there is a need to conduct population-based studies that obtain data on CD4 cell counts and economic outcomes, while

Corresponding author: Harsha Thirumurthy, Department of Health Policy and Management, Gillings School of Global Public Health, University of North Carolina at Chapel Hill, Title page, Campus Box 7411, Chapel Hill, NC 27599-7411, harsha@unc.edu.

Conflicts of interest. None declared.

also identifying persons infected with HIV before they present to care for symptomatic disease and or exhibit CD4+ T-cell decline. This would further our understanding of the full spectrum of the economic effects of early and delayed treatment of HIV.

We sought to examine the association between HIV infection, CD4 cell count and socioeconomic outcomes among adults who participated in a community-wide health campaign aimed at determining HIV status among all community members in a rural parish in Uganda. Data collected during and after the campaign were used to examine adult employment and child schooling outcomes.

Methods

Socio-economic data were collected during a community health campaign in rural Uganda and during a household socio-economic survey conducted among a sample of campaign participants.

Community health campaign

Over a 5-day period in May 2011, a community-wide health campaign that offered HIV testing and other health services was conducted in Kakyerere parish in Mbarara District, Uganda. All individuals residing in the Parish were offered the opportunity to come to one of three locations where rapid HIV testing and other communicable and non-communicable disease screening was provided. HIV-infected adults not already receiving care were linked to care (including ART) at nearby health facilities. Details on the campaign and health outcomes of participants have been reported previously [13]. Point-of-care CD4+ T cell count testing (PIMA, Alere) was performed on all HIV+ persons. During the campaign, trained counselors also collected information on the demographic characteristics, health behavior, and employment outcomes of participants.

Household socio-economic survey

Following completion of HIV testing, all HIV-infected adult participants and a random sample of HIV-uninfected adult participants (those whose campaign ID ended in “0” or “5”) were asked if they would be willing to participate in a socio-economic survey that would take place at their home in subsequent weeks. Participants were not included in the survey if they resided outside Kakyerere parish. Participants who provided written consent during the campaign were asked to provide contact information including their name, phone number, and location of residence. The household socio-economic survey consisted of several modules that sought information on demographic characteristics of the participants’ household, employment outcomes of household members above the age of 12 years, durable goods and livestock owned by household, cash and in-kind transfers sent or received by the household, and education of household members between the ages of 6–25 years of age. The survey was based on World Bank Living Standards Measurement Surveys[14] and adapted to the study setting. The household survey was conducted by trained interviewers who visited the homes of selected participants between June 13, 2011 and August 13, 2011. Health and demographic information collected from the participants during the community health campaign was linked to the household socio-economic survey data by the participants’ unique community health campaign identification number.

Statistical analyses

Employment outcomes of adults (age ≥18 years) were measured by two continuous variables that were recorded during the campaign: the number of days that a person had worked during the past month and the number of hours that a person reported working on a typical day during the past week. These measures sought to record income-generating work

performed on the farm belonging to one's household, in a household business or enterprise, and for a wage or salary. School enrollment of children between the ages of 6–18 years were recorded in the household survey and was represented by a binary variable indicating whether the person was enrolled in school. Two measures that represented the health status of HIV-infected adult participants were used: CD4+ T-cell count and ART status. The CD4 count was defined as a continuous variable as well as a categorical variable with four categories when using the community health campaign data (CD4≥500, CD4 350–499, CD4 200–349, and CD4<200); these categories were chosen to reflect the various ART initiation thresholds that have been recommended by the WHO or used in Uganda and the US [15, 16]. When using the household survey data that contained fewer observations, CD4 count was defined as a binary variable (CD4≥350 and CD4<350, based on the ART initiation threshold in Uganda) since the statistical power to compare outcomes in the four CD4 categories above was limited.

Least squares regression analysis was used to examine the association between CD4 count and employment outcomes of HIV-infected adult participants, adjusting for age, age squared (in order to capture non-linear effects of age), sex (binary indicator variable equal to 1 if the person was female), interactions between age and sex (to allow the age-employment association to differ by gender), and ART status. Regressions were also performed separately for the sample of HIV-infected adult participants on ART and not on ART. In the regression models that contained four different CD4 categories, CD4<200 served as the reference group. Post-estimation Wald tests were performed the following hypotheses about the coefficients of the CD4 categories: CD4 350–499 = CD4 200–349; CD4≥500 = CD4 200–349; CD4≥500 = CD4 350–499; For adults not on ART, a kernel-weighted local polynomial regression (with zero degree polynomials) was also performed to examine the association between employment outcomes and CD4 count in a flexible, nonparametric form. Finally, to examine the association between children's school enrollment and CD4 count of HIV-infected adults, a probit model was estimated with age, age squared, and sex included as controls and marginal effects were calculated. All statistical analyses were performed using Stata/SE 12.1 (StataCorp, College Station, Texas, USA).

Ethical considerations

The Makerere University School of Medicine Research and Ethics Committee, the Ugandan National Council on Science and Technology, and the UCSF Committee on Human Research approved the study.

Results

During the five-day community health campaign, 2,323 adults attended one of the three sites within the parish. Based on census estimates provided by the Ugandan Bureau of Statistics, approximately 74% of adults in the community participated in the health campaign (95% of women and 52% of men). Overall, 2,282/2,323 adults were tested for HIV, and 179/2,282 (7.8%) tested positive. A CD4 count was successfully measured for 168/179 HIV-infected adults.

For the household survey, 302 HIV-uninfected participants and 90 HIV-infected participants were consented at the time of the campaign. A substantial number of HIV-infected participants were not consented for the household survey due to logistical problems during the first day of the one-week campaign and residence outside of the parish. HIV-infected participants who were consented had similar characteristics as those who were not consented (72% and 80% female, 32.5 and 33.6 years of age, CD4 cell count 455 and 447, respectively). Among those who provided consent, household survey interviews were conducted at 339 households (86.4%). Reasons for non-completion of 53 surveys included

an incorrect or inaccurate address (31), relocation since the time of the campaign (14), and not being able to find a participant at home (8).

Demographic characteristics

Demographic and other socio-economic characteristics of participants in the community health campaign and in the household survey are described in Table 1. Compared to HIV-uninfected participants, HIV-infected campaign participants were significantly more likely to be female and less likely to be married. They were also significantly younger and came from households that were smaller in size. No significant differences were found in educational attainment of the adult participants. Households of HIV-infected adults generally had lower wealth (measured by land and livestock holdings) than those of HIV-uninfected adults. Among HIV-infected adults, the median CD4 count was 416 (IQR: 283–568) and 37% were receiving ART.

Adult employment outcomes and children's school enrollment

Table 2 shows the mean employment of campaign participants and education levels of children in the households that were part of the household survey. HIV-infected participants with CD4<200 and CD4 200–349 worked fewer days in the past month than both HIV-uninfected participants and HIV-infected participants with CD4 350–499 and ≥500 (17.9 and 20.3 days compared to 23.3 and 22.7 days, respectively). The number of hours worked on a typical day in the past week, however, was lowest among those with CD4<200 (5.5 hours) but higher and roughly similar among those in the higher CD4 categories. In households of HIV-uninfected adults, school enrollment rates were 97.2% and 84.8% among children 6–11 and 12–18 years of age, respectively. In households of HIV-infected participants with CD4<350 and CD4≥350, enrollment rates of children 6–11 years of age were 95% and 96.6% respectively. Among children 12–18 years of age, however, enrollment rates were lower in households of adults with CD4<350 (75.0%) than in households with corresponding CD4≥350 (87.0%).

Association between employment outcomes and CD4 count

After adjusting for age and sex, a higher CD4 count was associated with more days worked in the past month (0.60 more days per 100 cells/μL; column 1 of Table 3). In results not reported, the square of the CD4 cell count was included in the regression model and not found to be statistically significant. Compared to the reference group of participants with CD4<200, those with CD4 350–499 and ≥500 worked 6.04 and 5.97 more days in the past month, respectively ($p<0.01$ for both coefficients; column 2). Given the number of days worked by those with CD4<200 (17.9), these results imply that participants with CD4 350–499 and CD4≥500 worked 34% and 33% more, respectively. We observed no significant difference in days worked/month by participants with CD4 200–349 compared to CD4<200. The association between CD4 and employment remained intact even after controlling for whether participants were on ART (column 3). The number of days worked in the past month by those on ART was not significantly different from days worked by those not on ART. Importantly, post-estimation Wald tests did not reject the hypothesis that the coefficients for CD4≥500 and CD4 350–499 were identical ($p=0.97$ and $p=0.85$ in columns 2 and 3). However, the *p*-values were considerably smaller for the tests of the hypotheses that the coefficients of CD4≥500 and CD4 350–499 were equal to the coefficient of CD4 200–349, suggesting that these higher CD4 groups worked substantially more than those with CD4<200 as well CD4 200–349.

For the second employment measure, hours worked/day, columns 4–6 of Table 4 show a largely similar association with CD4 count. After adjusting for age and sex, a higher CD4 count was associated with more hours worked but the effect was not statistically significant.

Participants with CD4≥500 worked 2.1 hours/day more than those with CD4<200 ($p<0.05$), or 38% more hours/day than the reference group. Those with CD4 200–349 worked 2.1 hours/day more than those with CD4≤200 ($p<0.05$), but no such effect was found for those with CD4 350–499. These results persisted even after controlling for receipt of ART (column 6).

Employment and CD4 count association among those on ART and not on ART

Figure 1 shows the results of a nonparametric regression that estimates the association between days worked in the past month and CD4 count among adults not on ART, without adjustment for other characteristics. Higher CD4 counts are associated with more days worked/month, with a difference of more than 10 days between the low and high end of the CD4 distribution. Table 4 shows the results of estimating the main regression model separately for those on ART and not on ART. Among those not on ART, participants with CD4 above 350 cells/μL had the best employment outcomes (columns 1 and 3, Table 4). Participants with CD4≥500 worked 6.9 days/month and 2.5 hours/day more than those with CD4<200 ($p<0.01$ and $p<0.05$, respectively). Given the mean employment for those with CD4<200 and not on ART, these effects represent differences of 39% (6.9/17.7) and 44% (2.5/5.7) respectively. Those with CD4 350–499 worked 5.8 days/month more than those with CD4<200 ($p<0.05$) but not significantly more hours/day. However, when comparing the effects for the various CD4 categories, we could not reject the hypotheses that (a) the coefficients for CD4≥500 and CD4 350–499 were identical to that for CD4 200–349; and (b) that the coefficients for CD4≥500 and CD4 340–499 were identical.

Among those on ART, the biggest differences in days worked/month were found between participants with CD4 350–499 and CD4<200 (difference of 6.9 days, $p<0.10$). For hours worked on a typical day in the past week, the comparison between those with CD4 200–349 and CD4 ≤200 revealed the largest difference (2.3 hours, $p<0.10$). Differences between the high CD4 categories were not significant, as indicated by the post-estimation hypothesis tests.

Association between children's school enrollment and CD4 count

Table 5 shows that an increase of 100 cells/μL in adult CD4 count was associated with 1 percent increase in the probability that a child in the adult's household was enrolled in school, but this association was not significant (column 1). Children in households of adults with CD4≥350 had a 7% higher probability of being enrolled in school than children in the reference group of households with adult CD4<350 (column 2). The school enrollment differences between high and low CD4 count households were especially large among children between 12–18 years of age (columns 4): those in high CD4 households had a 10% higher probability of being enrolled in school than those in low CD4 households. However, the school enrollment differences between high and low CD4 households were not statistically significant.

Discussion

Our multi-disease community health campaign in rural southwestern Uganda provided an opportunity to study the association between socio-economic outcomes and health status among a population that includes HIV-infected adults who were previously undiagnosed and had higher CD4 counts than would normally be observed in a clinic-based population. We were therefore able to compare employment and household-level education outcomes of HIV-infected adults with high CD4 counts to those with low CD4 counts. Among HIV-infected adults not on ART, we found an especially strong association between employment outcomes and CD4 count. Participants with CD4≥500 worked nearly one full week more per

month and 44% more hours per day than those with CD4<200. Those with CD4 350–499 also worked significantly more days than those with CD4<200. These findings raise the possibility that ART initiation at CD4 counts of 350 or further above could prevent a decline in economic status and enable HIV-infected adults to work just as much as their HIV-uninfected peers.

An important advantage of this study is that by conducting a community-wide health campaign, we were able to examine the association between socio-economic outcomes and CD4 count over a larger range of CD4 counts and disease stages than in previous studies [2, 3]. Clinic-based longitudinal studies are useful for assessing the effect of ART on employment outcomes, but in many cases patients are enrolled with low CD4 counts or shortly before ART initiation. Along with poor immunologic status, they have low socioeconomic status and high food insecurity at the outset. In our study, among HIV-infected adults not on ART, those with the highest CD4 counts (CD4 350–499 and CD4≥500) worked considerably more than those with CD4 200–349 and CD4<200. However, due to the small sample size of HIV-positive participants in our study, employment differences between those with CD4≥500 and CD4 350–499 were not statistically significant.

We also found a positive association between employment levels and CD4 counts among adults taking ART. Adults with CD4>200 had better employment outcomes, although the sample size of those with CD4≥500 was limited. These findings are consistent with the restorative effects of ART on employment outcomes identified in other studies [1, 2, 6] as well as decreases in food insecurity following ART initiation near this study setting.[17] However, controlling for CD4 count, those on ART had lower employment than those not on ART. Explanations for this finding include the possibility that those on ART experienced a decline in economic status prior to ART initiation that may be difficult to recover from completely, but also that ART dampens productivity to some degree by necessitating time off work to attend clinic appointments.

Higher CD4 counts among adults were also associated with better educational outcomes for the children living with those adults, particularly those between 12–18 years of age. But due to the small sample size of children in households of HIV-infected adults, these differences were not statistically significant. The effect on older children is consistent with the hypothesis that children with higher labor productivity are most likely to be diverted away from school and into the labor force when the health of an adult deteriorates.

Several limitations of this study should be emphasized. First, the cross-sectional and non-experimental study design limits our ability to draw causal inferences. A particular concern is that the results from comparing adults who are not on ART and have high vs. low CD4 counts may be biased because those who with low CD4 counts may have characteristics (such as high discount rates) that also cause them to have low employment levels. Longitudinal data would enable us to better identify the period during HIV infection when socio-economic outcomes begin to deteriorate. A second limitation stems from the relatively small sample size of HIV-infected adults in the study. This led us to examine the association between fewer categorical ranges of CD4 count than would have been possible with a larger sample size. Moreover, we were unable to detect statistically significant differences in employment outcomes among those with CD4≥200. For example, although HIV-infected adults with CD4≥500 worked more days/month than adults with CD4 200–349 and CD4 350–499, there was insufficient power to detect a significant effect. Future attempts to implement community-wide HIV testing campaigns in a greater number of regions can help overcome this limitation. Finally, while we did not observe differences in the CD4-employment association between men and women, it should be noted that men were less

likely to participate in the campaign than women.[13] The generalizability of the results may thus be greater among women, as it is possible that healthier, more productive men were less likely to attend the campaign. Future campaigns in the study area will pilot strategies to increase men's participation, which would enable us to test whether the association between health status and employment is markedly different from the current findings.

Our findings from a community health campaign that included HIV-infected adults who had not been diagnosed previously show that socio-economic outcomes are better among those with CD4 counts that are well above the thresholds at which ART is typically initiated in Uganda and other resource-limited settings. This suggests that early ART initiation may keep employment and schooling outcomes at levels similar to those of HIV-uninfected adults and households. However, due to the cross-sectional analyses and the small sample size of the study, the results presented here do not allow us to identify the CD4 threshold at which ART initiation would generate such benefits. Randomized controlled trials of early ART initiation, combined with socio-economic data, will be useful for determining the size of these benefits.

Acknowledgments

Funding: This work was supported by the National Institute of Allergy and Infectious Diseases at the National Institutes of Health [Grant Number UM1AI069502 to DH]

We are grateful to the residents of Kakyerere Parish, Mbarara district, Uganda for their generous participation in this research study.

References

1. Larson BA, Fox MP, Rosen S, Bii M, Sigei C, Shaffer D, et al. Early effects of antiretroviral therapy on work performance: preliminary results from a cohort study of Kenyan agricultural workers. AIDS. 2008; 22:421–425. [PubMed: 18195569]
2. Thirumurthy H, Goldstein M, Graff Zivin J. The Economic Impact of AIDS Treatment: Labor Supply in Western Kenya. Journal of Human Resources. 2008; 43:511–552. [PubMed: 22180664]
3. Rosen S, Larson B, Brennan A, Long L, Fox M, Mongwenyana C, et al. Economic outcomes of patients receiving antiretroviral therapy for HIV/AIDS in South Africa are sustained through three years on treatment. PLoS ONE. 2010; 5:e12731. [PubMed: 20856821]
4. Beard J, Feeley F, Rosen S. Economic and quality of life outcomes of antiretroviral therapy for HIV/AIDS in developing countries: a systematic literature review. AIDS Care. 2009; 21:1343–1356. [PubMed: 20024710]
5. Bor J, Tanser F, Newell ML, Barnighausen T. In a study of a population cohort in South Africa, HIV patients on antiretrovirals had nearly full recovery of employment. Health affairs. 2012; 31:1459–1469. [PubMed: 22778335]
6. Habyarimana J, Mbakile B, Pop-Eleches C. The Impact of HIV/AIDS and ARV Treatment on Worker Absenteeism Implications for African Firms. Journal of Human Resources. 2010; 45:809–839.
7. Cohen MS, Chen YQ, McCauley M, Gamble T, Hosseinipour MC, Kumarasamy N, et al. Prevention of HIV-1 infection with early antiretroviral therapy. N Engl J Med. 2011; 365:493–505. [PubMed: 21767103]
8. Evans DK, Miguel E. Orphans and schooling in Africa: a longitudinal analysis. Demography. 2007; 44:35–57. [PubMed: 17461335]
9. Case A, Paxson C, Ableidinger J. Orphans in Africa: Parental Death, Poverty, and School Enrollment. Demography. 2004; 41:483–508. [PubMed: 15461011]
10. Levinsohn JMZ, Shisana S, Zuma K. HIV status and labor market participation in South Africa. The Review of Economics and Statistics. 2012 in press.

11. Fox MP, Rosen S, MacLeod WB, Wasunna M, Bii M, Foglia G, et al. The impact of HIV/AIDS on labour productivity in Kenya. Tropical Medicine and International Health. 2004; 9:318–324. [PubMed: 14996359]

12. Linnemayr S, Lawson BS, Glick P, Wagner G. Economic Status and Coping Mechanisms of Individuals Seeking HIV Care in Uganda. J Afr Econ. 2011

13. Chamie G, Kwarisiima D, Clark TD, Kabami J, Jain V, Geng EH, et al. Leveraging rapid community-based HIV testing campaigns for non-communicable diseases in rural Uganda. PLoS ONE. 2012 in press.

14. Grosh, M.; Glewwe, P. Designing Household Survey Questionnaires for Developing Countries: Lessons from 15 Years of the Living Standards Measurement Study. Vol. 1, 2, and 3. Washington: The World Bank; 2000.

15. Thompson MA, Aberg JA, Cahn P, Montaner JS, Rizzardini G, Telenti A, et al. Antiretroviral treatment of adult HIV infection: 2010 recommendations of the International AIDS Society-USA panel. JAMA : the journal of the American Medical Association. 2010; 304:321–333. [PubMed: 20639566]

16. WHO. Antiretroviral therapy for HIV infection in adults and adolescents: recommendations for a public health approach. Geneva: World Health Organization; 2010.

17. Weiser SD, Gupta R, Tsai AC, Frongillo EA, Grede N, Kumbakumba E, et al. Changes in Food Insecurity, Nutritional Status, and Physical Health Status After Antiretroviral Therapy Initiation in Rural Uganda. Journal of acquired immune deficiency syndromes. 2012; 61:179–186. [PubMed: 22692093]

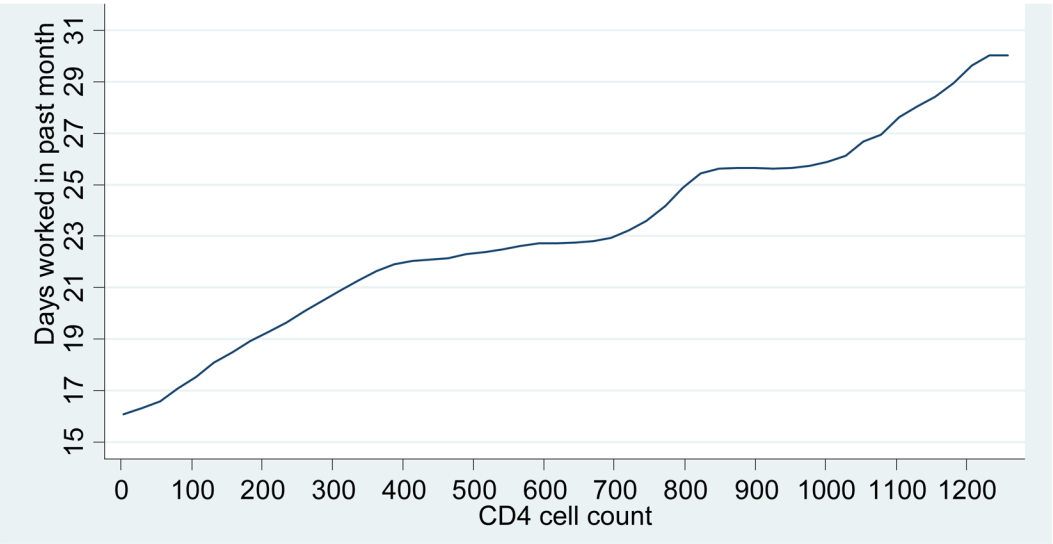

Figure 1. Nonparametric regression results showing association between employment outcomes and CD4 cell counts among HIV-infected adults not on ART

Notes

Results from estimating kernel-weighted local polynomial regression with width of 100 cells/μL around each point and 50 points at which relationship is evaluated. Vertical axis displays the number of days worked in the past month, while the horizontal axis displays the CD4 cell count.

Table 1

Characteristics of adult campaign participants

Variable	HIV−	HIV+	P-value[1]
N	2,103	179	
With CD4 count		168	
Female	65%	77%	<0.01
Age	39.5	33.2	<0.01
Married	67%	58%	0.01
Above primary education	20%	18%	0.52
Above secondary education	4%	4%	0.93
Household size	6.1	4.7	<0.01
Number of children	2.7	1.9	<0.01
# acres of land owned	4.4	2.5	<0.01
# acres ≥ 1	88%	72%	<0.01
# of cows owned	2.4	0.6	<0.01
# cows ≥ 1	0.3	0.1	<0.01
# of poultry owned	2.5	1.8	0.07
CD4 count among HIV+	Mean	450.4	
	Median	416	
	IQR	(283–568)	
On ART		37%	

Notes

[1] p-values from comparison of HIV− and HIV+ adults using chi-squared tests for categorical variables and t-tests for continuous variables.

Table 2

Employment and education outcomes of adults and children

		HIV-positive adults, by CD4 counts			
	HIV-negative adults	<200	200–349	350–499	≥500
N	2,103	26	40	37	65
Days worked in past month	21.9	17.9	20.3	23.3	22.7
Hours worked on typical day	6.7	5.5	7.5	6.3	7.2

		Children in HIV-positive households	
	Children in HIV-negative households	CD4<350	CD4>=350
N (Age 6–11)	252	22	26
Percent enrolled in school	97.2%	95.0%	96.6%
N (Age 12–18)	278	28	31
Percent enrolled in school	84.8%	75.0%	87.0%

Notes

Employment data were collected during community health campaign. Education data were collected during household survey.

Table 3

Association between employment outcomes and CD4 count among HIV+ adults

	(1)	(2)	(3)	(4)	(5)	(6)
Outcome variable:	**Days worked in the past month**			**Hours worked on usual day in past week**		
Female	−37.49*** (14.26)	−37.45*** (14.31)	−38.30*** (14.28)	−4.31 (5.77)	−6.09 (5.78)	−6.83 (5.73)
Age (years)	−1.16* (0.61)	−1.19* (0.61)	−1.17* (0.61)	−0.04 (0.25)	−0.10 (0.25)	−0.04 (0.24)
Age squared	0.01** (0.01)	0.01** (0.01)	0.01** (0.01)	0.001 (0.003)	0.001 (0.003)	0.001 (0.003)
Female * Age	2.09*** (0.68)	2.11*** (0.68)	2.13*** (0.68)	0.23 (0.28)	0.32 (0.28)	0.34 (0.27)
Female * Age squared	−0.02*** (0.01)	−0.03*** (0.01)	−0.03*** (0.01)	−0.003 (0.003)	−0.004 (0.003)	−0.004 (0.003)
CD4 count (units of 100)	0.60** (0.27)			0.18 (0.11)		
CD4 <200	Reference	Reference	Reference	Reference	Reference	Reference
CD4 200–349		3.31 (2.18)	3.38 (2.17)		2.12** (0.88)	2.14** (0.87)
CD4 350–499		6.04*** (2.22)	6.43*** (2.23)		0.93 (0.90)	1.00 (0.90)
CD4 ≥500		5.97*** (2.04)	6.08*** (2.03)		2.08** (0.82)	2.16*** (0.82)
On ART			−1.62 (1.51)			−1.38** (0.60)
Constant	39.79*** (12.96)	38.45*** (12.95)	37.41*** (12.92)	7.16 (5.24)	7.71 (5.23)	7.08 (5.19)
Observations	168	168	167	168	168	167
P-values for post-estimation estimation Wald tests						
CD4 350–499 = CD4 200–349		0.17	0.12		0.13	0.15
CD4≥500 = CD4 200–349		0.13	0.12		0.95	0.97
CD4≥500 = CD4 350–499		0.97	0.85		0.12	0.11

Notes

Regression coefficients are reported first followed by standard errors in parentheses.

** p<0.05,

* p<0.1.

Columns 1–3 report results from different regression models that have "days worked in the past month" as the outcome variable. Columns 4–6 report results from different regression models that have "hours worked on a typical day in the past week" as the outcome variable. The reference group for the CD4 categories is CD4<200.

Table 4

Association between employment outcomes and CD4 count, by ART status

	(1)	(2)	(3)	(4)
Outcome:	**Days worked in the past month**		**Hours worked on usual day in past week**	
Sample:	**Not on ART**	**On ART**	**Not on ART**	**On ART**
Female	−24.84 (19.26)	−61.31** (26.49)	−8.78 (8.22)	−7.27 (9.07)
Age (years)	−0.44 (0.85)	−2.09** (1.0)	−0.14 (0.36)	0.05 (0.34)
Age squared	0.01 (0.01)	0.02** (0.01)	0.002 (0.004)	−0.000 (0.004)
Female * Age	1.52 (0.92)	3.18** (1.25)	0.44 (0.40)	0.34 (0.43)
Female * Age squared	−0.02** (0.01)	−0.04** (0.01)	−0.01 (0.004)	−0.004 (0.01)
CD4 <200	Reference	Reference	Reference	Reference
CD4 200–349	3.31 (2.74)	4.15 (3.80)	2.01* (1.17)	2.50* (1.30)
CD4 350–499	5.83** (2.92)	6.91* (3.66)	1.29 (1.25)	0.53 (1.25)
CD4 ≥500	6.86*** (2.59)	5.23 (3.48)	2.53** (1.11)	1.59 (1.19)
Constant	22.85 (18.0)	56.61*** (20.94)	9.12 (7.68)	3.76 (7.17)
Observations	107	60	107	60
P-values for post-estimation estimation Wald tests				
CD4 350–499 = CD4 200–349	0.33	0.41	0.51	0.10
CD4≥500 = CD4 200–349	0.10	0.71	0.58	0.37
CD4≥500 = CD4 350–499	0.67	0.57	0.24	0.30

Notes

Regression coefficients are reported first followed by standard errors in parentheses.

** p<0.05,

* p<0.1.

Columns 1 and 2 report results from regression models that have “days worked in the past month” as the outcome variable. Columns 3 and 4 report results from regression models that have “hours worked on a typical day in the past week” as the outcome variable. In columns 1 and 3, the sample is restricted to HIV-infected adults not on ART. In columns 2 and 4, the sample is restricted to HIV-infected adults on ART. The reference group for the CD4 categories is CD4<200.

Table 5

Association between child school enrollment and CD4 count of adult

	(1)	(2)	(3)	(4)
Outcome:	**Enrolled in school**			
Sample:	**Age 6–18**	**Age 6–18**	**Age 6–11**	**Age 12–18**
Male	−0.01 (0.05)	−0.003 (0.05)	0.06 (0.04)	−0.05 (0.08)
Age (years)	0.13** (0.05)	0.12** (0.05)	0.22 (0.18)	−0.20 (0.36)
Age squared	−0.01*** (0.002)	−0.01*** (0.002)	−0.01 (0.01)	0.004 (0.01)
CD4 count (units of 100)	0.01 (0.01)			
CD4<350	-	Reference	Reference	Reference
CD4 =350	-	0.07 (0.056)	0.04 (0.05)	0.10 (0.08)
Observations	107	107	50	57

Notes

Marginal effects from estimating a probit model are reported followed by standard errors in parentheses.

*** p<0.01,

** p<0.05.

The reference group for the CD4≥350 is CD4<350.