

Association between Domestic Violence and Adherence to Antiretroviral Therapy in Southern  
India

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**Abstract**

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**Background:** An estimated 2.4 million HIV positive individuals reside in India; of whom approximately 485,000 are on antiretroviral therapy (ART). The Indian government provides public ART services throughout the country and this availability of ART has transformed HIV/AIDS from an acute life-threatening condition to a manageable chronic disease. However, to gain the clinical benefits of ART, strict adherence is necessary. Given this importance, simple and accurate measures of adherence are essential, and identifying barriers to achieving high adherence levels is key. The prevalence of domestic violence in India is high, but there is limited information about its association with adherence to ART.

**Objective:** To identify the most appropriate self-report measure of adherence in the Indian context and assess the association between domestic violence and medication adherence among ART clinic attendees.

**Methods:** We conducted a cross-sectional study of 246 HIV-positive individuals presenting for care at a Governmental ART clinic in Madras Medical College in Southern India. Data on socio-demographic characteristics, sexual behavior, HIV diagnosis, medications and experience of violence were collected through in-person interview. The AIDS Clinical Trial Group (ACTG) dose inquiry item, ACTG missed time inquiry item and the self-rating scale item (SRSI) self-report adherence to ART measures were administered. CD4 count at treatment initiation and most recent visit was abstracted from the medical records.

**Results:** Overall self-report of  $\geq 95\%$  adherence was highest when measured using the ACTG dose inquiry (88.2%), followed by the ACTG time inquiry item (76.4%) and lowest with the SRSI measure (31.3%). Out of the three adherence to ART measures, the ACTG dose inquiry measure was the only measure that was significantly associated with change in CD4 cell count. There were no statistically significant differences between characteristics of individuals with  $\geq 95\%$  adherence and  $< 95\%$  adherence as measured by the ACTG dose inquiry item. The prevalence of ever having experienced violence was 40% in the study population with gender differences in the association of experience of violence and adherence to ART. Women who experienced violence were 67% less likely to report  $\geq 95\%$  adherence to their ART medications (AOR=0.33, 95% CI 0.08-1.27).

**Conclusion:** The ACTG dose inquiry measure was the most closely correlated with objective markers of adherence among HIV positive individuals in India. Exposure to violence may portend poor adherence to ART for women. Therefore routine screening of women for exposure to violence may be useful in clinical settings where HIV services are provided.

## INTRODUCTION

An estimated 34 million people worldwide are infected with HIV, of whom approximately 2.4 million reside in India, making it the country with the third largest burden of HIV infection in the world (1). The adult prevalence of HIV is estimated to be 0.31%, with 83% of all infected persons between the ages of 15-49 and 39% of all infections occurring in women (2). The government of India provides antiretroviral therapy (ART) to persons living with HIV/AIDS (PLHA) through public ART centers and clinics, with 342 ART centers across India serving an estimated 485,000 HIV-positive individuals to date (3).

In addition to the individual clinical benefits of ART, (slowed disease progression and decreased morbidity and mortality (4-6)), the suppression of viral replication engendered by ART has also been associated with reduced risk of sexual transmission of HIV (4, 5, 7), and pre-exposure prophylaxis (PrEP) can significantly reduce the risk of HIV acquisition among HIV-negative individuals (8, 9). However, high rates of adherence to ART are essential to achieve these benefits (10, 11). A universally accepted level of adherence is 95%, and the Indian national ART guidelines specify greater than 95% adherence to their first line regimen as the goal (12, 13). This translates to “missing fewer than three doses a month on a twice daily regimen” (13). Nevertheless, 16-35% of HIV-infected individuals in India did not achieve this adherence goal in a two year follow-up study, challenging the success of initiatives toward reducing HIV infection and transmission (12).

Globally, many factors have been associated with poor adherence, including medication side effects, low socio-economic status, psychiatric illness, substance use and lack of social support (12-17). Gender differences are also apparent. With increased childcare and household management responsibilities that impede their ability to regularly procure medication, women are at increased risk of poor adherence relative to men (16). Numerous studies have also reported stigma as a major barrier in achieving high adherence levels (15). In India, depression has been strongly associated with low ART adherence, (14) and a systematic review found that food insecurity, lower educational levels, and seeking of traditional healers were associated with low adherence to ART in the Indian context (12). In addition to these constraints, domestic violence occurs more frequently in India than in many other contexts (18), and may disrupt daily activities within a household, preventing individuals from adhering to their strictly scheduled

ART regimens. However, the effects of domestic violence on adherence remain largely unstudied.

According to the United Nations guidelines, domestic violence is defined as any “violence that occurs within the private sphere, between individuals that are related through intimacy, blood and law” (19). Women are at increased risk of domestic violence, most often by their intimate partners (20), and the experience of domestic violence is associated with a number of adverse health indicators including high HIV infection rates, psychiatric illness, substance abuse, adverse birth outcomes and self-reported poor health (18, 20-24). According to data from the Indian National Family Health Survey, an estimated 36% of married women in India have experienced intimate partner violence (IPV), of whom 27.8% have experienced physical abuse alone, and 7.7% have experienced both physical and sexual abuse (18). Given the large number of Indian women infected with HIV and the high prevalence of IPV, it will be important to determine if domestic violence plays a role in adherence to ART.

Understanding the association between domestic violence and ART adherence will be predicated upon good measures of both constructs. Even though strict adherence to ART regimen is highly important and advised universally, a “gold standard” measure of adherence is not available (25). Although somewhat hampered by a lack of standardization, self-report measures are low cost and easily administered, and therefore widely used (26). The AIDS Clinical Trial Group (ACTG) self-report measure consists of a number of items that have been used both in aggregate and individually (27) and include assessments of the number of missed pills or number of days that medication doses are missed within a certain time frame. A more recently developed self-rating scale item (SRSI) assesses the respondents’ perceived ability to take medications as prescribed within a certain time frame (25, 26), and correlates well with HIV viral load in U.S. settings, but has not been tested in the Indian cultural context.

To assess the relationship between domestic violence and adherence to ART, this study first sought to identify the most appropriate self-report measure of adherence in the Indian context. Once identified, this measure was used in analyses to assess the association between domestic violence and medication adherence among ART Clinic attendees.

## METHODS

### **Study design, participants and data collection procedure**

From December 2009 to December 2011, HIV positive patients attending a Governmental ART clinic in Madras Medical College in Southern India were enrolled in a cross-sectional study. Eligible participants were at least 6-months post HIV diagnosis, between the ages of 18-49 and either English or Tamil speakers. Interviewers recruited potential participants from the waiting area of the clinics, explained the study and obtained informed consent. Prior to data collection, all materials were translated to Tamil. Data on socio-demographic characteristics (gender, age, education, marital status, employment status, income and living status), sexual behavior, HIV diagnosis, medications and experience of violence were collected through in-person interview via a pen and paper questionnaire. Three single-item adherence measures were also administered. Clinical information such as CD4 count, viral load and ART regimen were abstracted from the medical records.

### **Measures**

#### *Adherence*

Three self-report ART adherence measures were administered. The first measure was derived from the AIDS Clinical Trial Group (ACTG) assessment of adherence to antiretroviral medication and consisted of an inquiry about the number of missed doses over the past 30 days. This item was categorized into  $\geq 95\%$  (missing one or less doses) and  $< 95\%$  adherence (missing more than one dose). The second adherence measure, also derived from the ACTG adherence assessment, asked individuals about the last time they missed their HIV medication/ART dose. This measure was dichotomized to “missed a dose within the last month” and “missed a dose more than a month ago or never.” The third adherence measure was the self-rating scale item (SRSI), which is a single item that asked individuals to rate how well they felt they had been able to take their HIV medications in the last 30 days with response options on a 6 point likert scale. The SRSI measure was dichotomized into  $\geq 95\%$ , which included only the self-rating of excellent, and  $< 95\%$  adherence, which included the categories very poor, poor, fair, good and very good.

### *CD4 cell count*

Viral load data, which are often used to validate self-reported adherence measures, were incomplete for a number of subjects. Therefore, we used CD4 cell count to assess the extent to which each of the 3 self-reported adherence measures were associated with control of HIV infection as measured by higher CD4 count. To account for individual differences in baseline CD4 count (when therapy was initiated) and to more accurately reflect the effects of ART in reconstituting the immune system over time, we calculated change in CD4 cell count. This was defined as the difference of the patients' most recent CD4 cell count and the CD4 cell count at initiation of ART (baseline).

### *Violence*

All participants were asked about their lifetime experience of violence. The lifetime violence measure was adopted from the World Studies of Abuse in Family Environment (WorldSAFE study), a collaborative multi-national population-based study conducted in 2004. The WorldSAFE study was designed to investigate the prevalence of family violence, intimate partner violence and child abuse and neglect in eighteen selected sites across five countries (Brazil, Chile, Egypt, India and Philippines) (28). The current study administered a validated subset of the WorldSAFE study questions that dealt with family and intimate partner violence. In addition, participants that reported ever experiencing violence were asked about the types of violence to which they had been exposed (psychological, physical and sexual violence). Psychological violence was defined as being "insulted, frightened, made afraid without touching, or abandoned" (yes/no). Physical violence was defined as being "slapped, hit, kicked, or beaten" (yes/no). Finally, sexual violence was defined as "ever being forced to have sex against the person's will" (yes/no).

### **Data analysis**

Characteristics of individuals with  $\geq 95\%$  versus  $< 95\%$  adherence to ART and ever versus never experience of violence were compared using chi-squared tests for categorical variables and t-tests for continuous variables to assess statistical significance.

To assess the association of the adherence measures with CD4 cell count, we fitted a linear regression model. The measure that was most strongly associated with change in CD4 cell count in these analyses was selected for subsequent analyses of the association of the experience of violence and adherence to ART.



Logistic regression was used to estimate odds ratios (OR) and 95% confidence intervals (CI) describing the association of violence with adherence to ART. Violence was assessed in aggregate, as well as by its three components: psychological, physical and sexual violence. Age, marital status, education, household income, living status, age at sexual debut, disclosure of HIV status and time since diagnosis were explored as potential confounders and retained in the multivariate model if they altered the measure of associations by 10% or more. Effect modification by gender was assessed by fitting stratified models and testing for interaction. Statistical significance was defined as two-sided  $p < 0.05$  for all analyses and all analyses were carried out using Stata version 11 (College Station, TX).

## RESULTS

### **Socio-demographic characteristics**

A total of 299 HIV positive individuals that attended and received medical care and counseling services at the Madras Medical College ART clinic were enrolled in the study, of whom 53 (17.7%) had not initiated ART and were excluded from these analyses. Of the 246 participants included here, slightly less than half (44.3%) were female, and the mean age was 37 years (SD  $\pm$  5.71 years) (Table 1). The majority of participants (66.7%) were married, approximately half of them (53.7%) had completed secondary schooling, and about 80% were employed. Nearly all of the participants (94.7%) had disclosed their HIV status to their partners, and about 47% of them had been diagnosed more than five years ago. More than half of the participants (55.2%) had one lifetime sexual partner, and the mean age at first sexual intercourse was 19.9 years (SD  $\pm$  4.3 years).

### **Adherence**

Overall self-reported adherence ranged from 31.3% - 88.2% depending on the measure used. Adherence  $\geq$ 95% was most frequently reported when measured by the ACTG dose inquiry item (88.2%), followed by the ACTG time inquiry item (76.4%). Adherence  $\geq$ 95% was lowest when measured by the SRSI; only 31.3% rated themselves as excellent.

Only the ACTG dose inquiry measure was significantly associated with the change in CD4 cell count (Table 2). Participants who had  $<$ 95% adherence (missed  $>$  1 dose) experienced less improvement in their CD4 cell count (an average of 142 cells/ $\mu$ L lower) than those who had  $\geq$  95% adherence (missed  $\leq$  1 dose).

### *Characteristics associated with adherence to ART*

There were no statistically significant differences between characteristics of individuals with  $\geq 95\%$  adherence and  $< 95\%$  adherence as measured by the ACTG dose inquiry item (Table 3). However, participants who were diagnosed with HIV 1-5 years ago were somewhat more likely to have  $< 95\%$  adherence than those who had been diagnosed more than 5 years ago (62.1% vs. 40.6%,  $p=0.07$ ) and somewhat younger at first sexual intercourse (18.6 vs. 20.0,  $p=0.09$ ). Individuals with  $\geq 95\%$  adherence were also somewhat more likely to be currently married than those with  $< 95\%$  adherence, but this difference was not statistically significant ( $p=0.16$ ).

### **Violence**

Lifetime experience of any type of violence (psychological, physical or sexual) was reported by 98 (39.8%) participants. The most common type of violence reported was psychological violence (29.3%), followed by physical violence (19.5%); sexual violence was the least frequently reported (10.6%).

### *Characteristics associated with violence*

Female participants reported ever having experienced violence significantly more often than males (66.3% vs. 33.7%,  $p<0.001$ ) (Table 4). Of those 98 individuals that reported experiencing violence, the same trend was observed with each type of violence. Significantly more females than males reported experiencing psychological violence (43.1% vs. 18.3%,  $p<0.001$ ) and females were more likely to report experiencing physical violence (37.6% vs. 5.1%,  $p<0.001$ ). Although women also reported more sexual violence, this was of borderline statistical significance (14.7% vs. 7.3%,  $p=0.06$ ).

Ever having experienced violence was significantly associated with marital status, education and age of sexual debut. Currently married participants were more likely to experience violence than unmarried participants (58.2% vs. 41.8%,  $p=0.021$ ), and individuals with higher levels of education (secondary schooling and above) reported violence more often than those that had less than a secondary school education (61.2% vs. 38.8%,  $p=0.03$ ). Those who experienced any type of violence were on average younger when they first engaged in sexual intercourse than those that did not experience violence (19.1 vs. 20.4,  $p=0.03$ ). Most participants had disclosed their HIV status to their partners and such individuals were somewhat less likely to report exposure to violence, although this was of borderline statistical significance ( $p=0.10$ ) (Table 5).

### **Experience of violence and ART adherence**

Although a somewhat higher proportion of participants who experienced any violence reported <95% adherence to ART than participants who did not experience violence (44.8% vs. 39.2%,  $p=0.553$ ), this difference was not statistically significant (Table 6). Similarly no associations were observed with any of the specific types of violence. These associations did not change after adjusting for age at first sexual intercourse, which was associated with both adherence to ART and experience of violence.

In analyses stratified by gender, the association between adherence to ART and violence was different for females than for males ( $p=0.043$ , for interaction). Women who experienced violence were 67% less likely to report  $\geq 95\%$  adherence to their ART medications (AOR=0.33, 95% CI 0.08-1.27) whereas men who experienced violence were more likely to have  $\geq 95\%$  adherence (AOR=4.53, 95% CI 0.09-36.28).

### DISCUSSION

Identifying accurate and reliable measures of adherence to ART as well as barriers to maintaining high levels of adherence is critical to effective HIV treatment and prevention efforts. This study found that the ACTG dose inquiry measure was more strongly associated with CD4 count than either the ACTG time inquiry measure or the SRSI, suggesting that it is the more appropriate measure in the Indian context. The prevalence of ever having experienced violence was high (40%), and married individuals, individuals who initiated sexual intercourse at a younger age and individuals with secondary and higher schooling were more likely to report having experienced violence than persons without these characteristics. The association between violence and adherence to ART differed significantly by gender. Women who experienced violence were more likely to have poor adherence to ART, whereas men who experienced violence were more likely to have better adherence.

The ACTG dose inquiry measure was originally validated in HIV-positive persons in the US with a recall period of 15 days and correlated well with HIV viral load (29). As a result, this measure has been widely used to assess adherence to ART in developing countries such as India, Viet Nam, Zambia, Namibia and Tanzania, with recall periods varying from 4 to 30 days (30-34). Similar to our study, Walshe and colleagues studied private ART clinic attendees in Mumbai and found the ACTG self-report dose inquiry measure with a 4 day recall period was strongly

associated with HIV viral load (OR=3.08 95% CI 1.65-5.740) (30). In contrast, several US based studies found that the SRSI measure was superior to all other single item measures of adherence to ART (ACTG dose inquiry, ACTG frequency inquiry and visual analogue scale (VAS)) (26, 35). Feldman et al. conducted a longitudinal study among a cohort of western participants and found that the SRSI measure was more reliable and predictive of clinical outcomes using HIV viral load than either of the two ACTG measures we assessed and/or a VAS with a 30-day recall period (35). In another study, Lu et al. also found that the SRSI performed well in capturing adherence levels to ART within a 30 day recall period when compared to medical event monitoring system (MEMS) data (26). Unlike the studies conducted in the US, we found that the SRSI was the least associated with CD4 cell count and hypothesize that this may be due to cultural differences between western and non-western countries. Western culture, and US culture in particular, values high self-esteem and self-promotion that may result in more accurate assessment of adherence on a value-based rating of self-performance (e.g, excellent, good, fair, poor). In contrast, many non-western cultures promote modesty, shyness and low self-promotion, possibly leading individuals to rate their own performance/ability lower than it actually is. These cultural differences are supported by our analysis in which approximately 70% of the participants rated themselves as having < 95% adherence using the SRSI measure, whereas when they were asked more objective questions about the number of missed doses (ACTG dose inquiry item), only 12% were classified as having < 95% adherence. Similarly, in Namibia the SRSI adherence measure was not associated with HIV viral load despite a higher proportion of participants reporting  $\geq 95\%$  adherence using that measure. (33).

Violence is a major public health problem globally. In the past decade the study of violence, especially against women, has been given international focus and produced staggering evidence of the prevalence and association with adverse health outcomes including HIV infection, psychiatric illnesses and substance use problems (18, 20). Women and children are disproportionately affected by violence and therefore, most studies conducted in India and elsewhere are focused on women. The current study assessed exposure to violence in men and women attending ART clinics in India and found high levels of experience with violence. Nearly 40% reported experiencing some type of violence and this was much more common among women than men (nearly 60% as compared to 24% in men).

The prevalence of exposure to violence in women that we observed was substantially higher than in previous reports from India, with the exception of one study that assessed psychological violence in three different Indian cities. Ramiro et al., using the WorldSAFE data observed high prevalence of psychological lifetime violence reported by women in India that ranged from 24.7% - 50.1% depending on the geographic areas within India (36). Among the WorldSAFE sites in India, Trivandrum (State of Kerala) had the highest lifetime prevalence of psychological violence (50.1%) (36), followed by Lucknow (State of Uttar Pradesh) at 24.9% and Vellore (State of Tamil Nadu) at 24.7% (36). Similarly, Silverman et al., using the Indian National Family Health Survey, found that 35.5% of married women reported experiencing physical violence (18). Furthermore, Shrivastava et al. found that 36.9% of women residing in urban slums of Mumbai experienced spousal domestic violence with psychological/verbal violence being the most common type (37), again comparable to our findings. The differences in prevalence of violence in India may be due to differences in definitions of violence (Silverman et al measured experience of physical violence only), or differences in the populations studied. Women with HIV infection constitute a higher risk group of people in general and the two conditions (HIV infection and domestic violence) may have common antecedents. In other countries, the prevalence of violence ranges from 37-55%. In rural Uganda 36.6% of HIV infected women, reported experiencing intimate partner violence (22) and 55% of South African women who sought care at antenatal clinics reported intimate partner violence (38), which was more comparable to the current findings.

Although, the focus of many studies of violence has been on women, a few investigators have studied violence against men (39, 40). A study from Portugal estimated the prevalence of male victims of intimate partner violence perpetrated by their female partners at 11.5% using medico-legal data from the Clinical Forensic Medicine Department (40). A study conducted in the Philippines using the Cebu Longitudinal Health and Nutrition Survey found that about 55% of female participants reported violent acts against their male partners, and 30% of male participants reported victimization, (39) which parallels our findings in the current sample of HIV positive males. Although psychological violence was the most common form reported by both women and men in our study, the discrepancy between women and men was highest for physical violence, where women were more than seven times more likely to be exposed compared to men.

To date, only one published study has examined the association of violence and adherence to ART. In the US, Lopez et al. found that report of experiencing extreme violence, defined as using a weapon to inflict physical violence, was negatively associated with adherence to HIV medication as measured by the ACTG dose inquiry item over a four day period (41). Similar to our findings, they observed that the association between experience of violence and adherence differed for men and women, with a stronger effect of violence exposure on non-adherence among women than among men. Lopez et al. hypothesized that the gender differences in adherence may arise from other independent factors that affect men and women differently (41). For instance, women may be more concerned than men about their personal safety than about maintaining ideal adherence levels. Violence can also cause a chaotic living environment, making women, who have more household and childcare responsibilities, at increased risk of forgetting to take their ART medications properly (16). Our finding that men who experienced violence were somewhat more likely to have better adherence was unexpected and should be interpreted with caution. The subgroup of men reporting violence and imperfect adherence was very small, making it difficult to estimate the true association given the statistical instability inherent in small sample sizes. However, given that women are more likely to experience violence than men, the stronger effect of violence on adherence in women is an area warranting further research.

This study has a number of strengths. First, we were able to determine the association of three different self-reported adherence to ART measures with an objective measure (change in CD4 count) to identify the measure most appropriate for the Indian context. This likely resulted in a more accurate assessment of adherence among Indian PLHA. Secondly, we assessed the association between violence and adherence to ART in an HIV-positive population in Southern India for the first time, using measures that have been previously used and validated in global studies of violence and this enabled us to make comparisons with other similar cultural and socio-demographic settings. However, this study also has some limitations. Due to the cross-sectional nature of the study, we were only able to demonstrate associations between violence and adherence and cannot determine whether one caused the other. We relied on self-report to collect sensitive information on violence and adherence, thus creating potential for social desirability bias and misclassification. Experience of violence is often considered a private family matter (42), and there may have been underreporting. Collecting valid data on violence in India is especially hard, since there is a culture of silence when it comes to the topic (43). In addition we assessed the experience of lifetime violence as compared to shorter durations,

making it difficult to evaluate the role of recent experiences of violence on current ART usage and adherence. ART adherence may have been over reported because patients who have been told by their healthcare providers to maintain proper compliance may be less likely to disclose poor adherence to a life-prolonging medication. However, any effect of this is likely to be small given that the measure of ART adherence we used had good concordance with CD4 cell count. Lastly, we had a relatively small sample size which resulted in low statistical power to detect significant relationships (44).

These findings have important implications for clinical settings and healthcare providers that deliver HIV related services and must effectively and accurately assess patients' adherence levels. The ACTG dose inquiry measure was most closely correlated with objective markers of adherence among HIV positive individuals in India. Although additional confirmation is needed in other populations, these results provide little support for using the SRSI adherence measure in a non-US based setting such as India. Furthermore, our results suggest that for women, exposure to violence may portend poor adherence to ART. Therefore routine screening of women for violence exposure may be useful in clinical settings where HIV services are provided to anticipate where extra adherence support may be needed. Finally, confirmation of these findings in other populations and in larger samples is recommended.

**Table 1. Selected characteristics of study population**

| Characteristic                                     | All participants |        |
|--|------------------|--------|
|  | N=246            |        |
| <b>Gender (n, %)</b>                               |                  |        |
| Female   | 109              | 44.3%  |
| Male   | 137              | 55.7%  |
| <b>Age (n, %)</b>                                  |                  |        |
| 18-24  | 2                | 0.8%   |
| 25-29  | 27               | 11.0%  |
| 30-34  | 48               | 19.5%  |
| 35-39  | 72               | 29.3%  |
| ≥40  | 97               | 39.4%  |
| <b>Marital status (n, %)</b>                       |                  |        |
| Married  | 164              | 66.7%  |
| Single   | 26               | 10.6%  |
| Previously Married*                                | 56               | 22.8%  |
| <b>Education (n, %)</b>                            |                  |        |
| No Education                                       | 35               | 14.2%  |
| Primary Schooling                                  | 41               | 16.7%  |
| Secondary Schooling                                | 132              | 53.7%  |
| Higher Secondary                                   | 17               | 6.9%   |
| College and above                                  | 21               | 8.5%   |
| <b>Employed (n, %)</b>                             |                  |        |
| Yes  | 196              | 79.7%  |
| No   | 50               | 20.3%  |
| <b>Household income (mean ± SD)</b>                | 6878.7           | 5585.1 |
| <b>Age at first sexual intercourse (mean ± SD)</b> | 19.9             | ± 4.3  |
| <b>Lifetime sexual partners (n, %)</b>             |                  |        |
| One  | 128              | 55.2%  |
| Greater than One                                   | 104              | 44.8%  |
| <b>Disclosure of HIV status (n, %)</b>             |                  |        |
| No   | 13               | 5.3%   |
| Yes  | 233              | 94.7%  |
| <b>Time since HIV diagnosis (n, %)</b>             |                  |        |
| 6 months to 1 year ago                             | 25               | 10.2%  |
| 1-5 years ago                                      | 106              | 43.1%  |
| >5 years ago                                       | 115              | 46.8%  |

\*Category includes individuals who are separated, divorced and widowed. All percentages are column percentages and may not add to 100%



**Table 2. Linear regression assessing the association of three ART adherence measures with change in CD4 count between initiation of ART and most recent visit (N=239)**

| <b>Adherence Measure</b>  | <b>Change in CD4 cell count (cells/<math>\mu</math>L)*</b> | <b>95% CI</b> | <b>p-value</b> |
|---|--|---------------|----------------|
| ACTG - dose inquiry item (baseline = $\leq$ 1 missed dose vs. $>$ 1 [imperfect adherence])<br><i>During the last 30 days, how many of your ART or HIV medication doses did you miss?</i>      | -142.1   | -253.1, -31.1 | 0.012          |
| ACTG - time inquiry item (baseline = $\geq$ 1 month or never vs. $<$ 1 month [imperfect adherence])<br><i>When was the last time you missed your HIV medications/ART dose?</i>                | -32.4  | -117.2, 52.4  | 0.452          |
| Self-report rating item - SRSI (baseline = excellent vs. less than excellent [imperfect adherence])<br><i>Rate your ability to take your medication as prescribed within the past 30 days</i> | 62.9   | -15.0, 140.7  | 0.113          |

\*7 individuals had missing CD4 cell count values in the medical records

**Table 3. Selected characteristics of study population by ART adherence status**

| Characteristic                                     | ART Adherence |        |        |          | p-value |
|--|---------------|--------|--------|----------|---------|
|  | Low           |        | High   |          |         |
|  | N=29          | 11.8%  | N=217  | 88.2%    |         |
| <b>Age (Mean ± SD)</b>                             | 36.2          | ± 6.3  | 37.3   | ± 5.6    | 0.313   |
| <b>Gender (n, %)</b>                               |               |        |        |          |         |
| Female   | 15            | 51.7%  | 94     | 43.3%    | 0.392   |
| Male   | 14            | 48.3%  | 123    | 56.7%    |         |
| <b>Marital status (n, %)</b>                       |               |        |        |          |         |
| Currently Married                                  | 16            | 55.2%  | 148    | 68.2%    | 0.162   |
| Not Currently Married                              | 13            | 44.8%  | 69     | 31.8%    |         |
| <b>Education (n, %)</b>                            |               |        |        |          |         |
| Less than secondary schooling                      | 9             | 31.0%  | 67     | 30.9%    | 0.986   |
| Secondary & plus schooling                         | 20            | 69.0%  | 150    | 69.1%    |         |
| <b>Employed (n, %)</b>                             |               |        |        |          |         |
| Yes  | 21            | 72.4%  | 175    | 80.7%    | 0.301   |
| No   | 8             | 27.6%  | 42     | 19.4%    |         |
| <b>Household income (mean ± SD)</b>                | 5750.0        | ± 2897 | 7029.5 | ± 5839.5 | 0.247   |
| <b>Age at first sexual intercourse (mean ± SD)</b> | 18.6          | ± 4.3  | 20.0   | ± 4.3    | 0.087   |
| <b>Lifetime sexual partners (mean ± SD)</b>        | 14.0          | ± 47.1 | 12.5   | ± 72.8   | 0.919   |
| <b>Disclosure of HIV status (n, %)</b>             |               |        |        |          |         |
| No   | 2             | 6.9%   | 11     | 5.1%     | 0.680   |
| Yes  | 27            | 93.1%  | 206    | 94.9%    |         |
| <b>Time since diagnosis (n, %)</b>                 |               |        |        |          |         |
| 6 months to 1 year ago                             | 3             | 10.3%  | 22     | 10.1%    | 0.070   |
| 1-5 years ago                                      | 18            | 62.1%  | 88     | 40.6%    |         |
| >5 years ago                                       | 8             | 27.6%  | 107    | 49.3%    |         |

**Table 4. Experience of violence by type and gender**

| Exposure variables                   | Female<br>(N=109) |       | Male<br>(N=137) |       | p-value |
|--------------------------------------|-------------------|-------|-----------------|-------|---------|
|                                      | n                 | %     | n               | %     |         |
| <b>Experience of any violence*</b>   | 65                | 59.6% | 33              | 24.1% | p<0.001 |
| <b>Types of violence<sup>†</sup></b> |                   |       |                 |       |         |
| Psychological                        | 47                | 43.1% | 25              | 18.3% | p<0.001 |
| Physical                             | 41                | 37.6% | 7               | 5.1%  | p<0.001 |
| Sexual                               | 16                | 14.7% | 10              | 7.3%  | 0.061   |

\*percentage is based on the entire sample (N=246)

<sup>†</sup>percentage is based on the number of individuals that reported experience of violence (N=98)

**Table 5. Selected characteristics of study population by experience of violence**

| Characteristic                                     | Experienced any type violence |          |        |          | p-value |
|--|-------------------------------|----------|--------|----------|---------|
|  | Yes                           |          | No     |          |         |
|  | N=98                          | 39.8%    | N=148  | 60.2%    |         |
| <b>Age (Mean ± SD)</b>                             | 36.4                          | ± 5.7    | 37.7   | 5.7      | 0.933   |
| <b>Gender (n, %)</b>                               |                               |          |        |          |         |
| Female   | 65                            | 66.3%    | 44     | 29.7%    | p<0.001 |
| Male   | 33                            | 33.7%    | 104    | 70.3%    |         |
| <b>Marital status (n, %)</b>                       |                               |          |        |          |         |
| Currently Married                                  | 57                            | 58.2%    | 107    | 72.3%    | 0.021   |
| Not Currently Married                              | 41                            | 41.8%    | 71     | 27.7%    |         |
| <b>Education (n, %)</b>                            |                               |          |        |          |         |
| Less than secondary schooling                      | 38                            | 38.8%    | 38     | 25.7%    | 0.029   |
| Secondary & plus schooling                         | 60                            | 61.2%    | 110    | 74.3%    |         |
| <b>Employed (n, %)</b>                             |                               |          |        |          |         |
| Yes  | 19                            | 19.4%    | 31     | 21.0%    | 0.766   |
| No   | 79                            | 80.6%    | 117    | 79.1%    |         |
| <b>Household income (mean ± SD)</b>                | 6700.0                        | ± 7113.6 | 6996.6 | ± 4308.5 | 0.685   |
| <b>Age at first sexual intercourse (mean ± SD)</b> | 19.1                          | ± 4.0    | 20.4   | ± 4.4    | 0.025   |
| <b>Lifetime sexual partners (mean ± SD)</b>        | 18.9                          | ± 104.6  | 8.3    | ± 25.8   | 0.254   |
| <b>Disclosure of HIV status (n, %)</b>             |                               |          |        |          |         |
| No   | 8                             | 8.2%     | 5      | 3.4%     | 0.101   |
| Yes  | 90                            | 91.8%    | 143    | 96.6%    |         |
| <b>Time since diagnosis (n, %)</b>                 |                               |          |        |          |         |
| 6 months to 1 year ago                             | 12                            | 12.2%    | 13     | 8.8%     | 0.678   |
| 1-5 years ago                                      | 41                            | 41.8%    | 65     | 43.9%    |         |
| >5 years ago                                       | 45                            | 45.9%    | 70     | 47.3%    |         |

**Table 6. Association of violence with ART adherence**

| Characteristics                                       | < 95% Adherence (N=29) |       | ≥ 95% Adherence (N=217) |       | Unadjusted |              |         | Adjusted* |              |         |
|---|------------------------|-------|-------------------------|-------|------------|--------------|---------|-----------|--------------|---------|
|   |                        |       |                         |       | OR         | 95% CI       | p-value | OR        | 95% CI       | p-value |
|   | n                      | %     | n                       | %     |            |              |         |           |              |         |
| <b>Types of Violence</b>                              |                        |       |                         |       |            |              |         |           |              |         |
| Any Violence  | 13                     | 44.8% | 85                      | 39.2% | 0.79       | 0.36 - 1.73  | 0.560   | 0.87      | 0.39 - 1.92  | 0.727   |
| Psychological   | 11                     | 37.9% | 61                      | 28.1% | 0.64       | 0.29 - 1.43  | 0.278   | 0.70      | 0.31 - 1.57  | 0.387   |
| Physical  | 8                      | 27.6% | 40                      | 18.4% | 0.59       | 0.25 - 1.44  | 0.247   | 0.63      | 0.26 - 1.54  | 0.313   |
| Sexual  | 4                      | 13.8% | 22                      | 10.1% | 0.71       | 0.22 - 2.21  | 0.549   | 0.79      | 0.25 - 2.50  | 0.688   |
| <b>Experiencing any violence stratified by gender</b> |                        |       |                         |       |            |              |         |           |              |         |
| Female  | 15                     | 51.7% | 94                      | 43.3% | 0.32       | 0.08 - 1.22  | 0.096   | 0.33      | 0.08 - 1.27  | 0.106   |
| Male  | 14                     | 48.3% | 123                     | 56.7% | 4.57       | 0.57 - 36.35 | 0.151   | 4.53      | 0.09 - 36.28 | 0.155   |

\*Adjusted for age at first sexual intercourse

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