

# Longitudinal Study of Mental Health and Psychosocial Predictors of Medical Treatment Adherence in Mothers Living with HIV Disease

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## ABSTRACT

Cross-sectional studies to date that examine psychosocial correlates of antiretroviral adherence have insufficiently addressed the challenges of long-term adherence. This longitudinal study examined mental health, substance abuse, and psychosocial predictors of long-term adherence to antiretroviral medications and medical appointments among HIV-seropositive mothers recruited from an infectious disease clinic of a large urban medical center. Individual interviews were conducted at baseline and two follow-up points, 8 to 18 months after enrollment. Based on a model of health behavior, we examined psychiatric and psychosocial predictors of adherence to antiretroviral medications and medical appointments over time. Presence of a psychiatric disorder, negative stressful life events, more household members, and parenting stress were significantly associated with both missed pills and missed medical appointments at follow-up. Baseline substance abuse was associated with missed pills at follow-up and lack of disclosure to family members at baseline was associated with missed medical appointments at follow-up. These findings suggest that interventions that integrate mental health, substance abuse and medical care may be important to improving the medical adherence and health of HIV-seropositive women, particularly in multistressed populations with substantial caregiving and other life demands.

## INTRODUCTION

CONTINUED IMPROVEMENTS IN HIV therapeutic regimens have resulted in longer survival and improved quality of life for persons living with HIV disease in the United States.<sup>1</sup> However, 95% or greater adherence to antiretroviral treatment (ART) and consistent utilization of primary care services may be criti-

cal to achieving these benefits.<sup>2</sup> Even brief episodes of missed HIV medication doses can permanently undermine treatment, leading to reduced efficacy of and increased resistance to medications. Numerous studies to date have found that adherence to antiretroviral therapy improved virologic outcome<sup>2</sup> and health-related quality of life outcomes.<sup>3</sup> However, not all persons living with HIV/AIDS are able to

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take advantage of these medical treatment improvements in the United States because of access disparities,<sup>4</sup> arduous regimens that can interfere with everyday lifestyle,<sup>5</sup> and competing subsistence needs such as housing, transportation, and financial constraints that make treatment adherence difficult.<sup>6</sup>

Recent studies have shown that low-income, HIV-infected women of color are particularly at risk for suboptimal adherence to antiretroviral medication and medical services.<sup>5,7,8</sup> Given that the incidence of AIDS cases is increasing fastest in populations including women and ethnic minorities, this is of particular concern. In New York State, 33% of new AIDS cases in 2001 were in women and 88% of female AIDS cases were among women of color, the majority of whom were black (54%) and Hispanic (33%). Most of the women living with AIDS reside in low-income communities, and are affected by substance abuse; 30% of AIDS cases among women in 2001 were attributed to injection drug use (IDU) and an additional 15% of female cases were the partners of IDUs.<sup>9</sup>

In addition to high rates of substance use, studies on HIV-infected women reveal high rates of psychiatric disorders, including major depression and posttraumatic stress disorder (50%–89%), significant levels of psychological distress, and histories of extreme trauma.<sup>10</sup> These mental health problems are critical to the issue of adherence, given that HIV-infected people who present with mental health problems have demonstrated poorer adherence to antiretroviral medication.<sup>11,12</sup> For example, in a cross-sectional examination of 128 HIV-seropositive mothers treated at an urban medical center in New York City, Mellins and colleagues<sup>13</sup> found that psychiatric disorders, substance abuse, and parenting stress were the strongest correlates of mother's nonadherence to antiretroviral medication.

HIV-infected women are often mothers with significant caregiving demands.<sup>14</sup> In a recent study of HIV-infected women in four U.S. epicenters, 69% had been pregnant, 42% became pregnant since testing HIV-seropositive, and 71% chose to carry to term.<sup>15</sup> The confluence of illness demands,<sup>16</sup> stressors related to low socioeconomic status,<sup>17</sup> IDU,<sup>18</sup> psychiatric/

psychological distress,<sup>11,19</sup> and family caretaking demands<sup>20–22</sup> render consistent adherence over time to antiretroviral treatment and medical services a particular challenge for HIV-seropositive mothers.<sup>23</sup>

Recent cross-sectional studies of HIV-seropositive pregnant and postpartum women have found poor adherence to antiretroviral treatment.<sup>24</sup> However, there are few longitudinal studies on the adherence of HIV-infected mothers. A recent study that examined patterns of adherence among a cohort of HIV-infected adults indicated that the number of participants who reported 100% adherence decreased over a 12-month period, suggesting that adherence is not static, but rather changes over time.<sup>25</sup> Changes in patterns of adherence may be caused by changes in biomedical and psychosocial stressors over time.<sup>26</sup> Given that HIV-infected mothers contend with a myriad of changing stressors that might be associated with poor adherence, understanding the most salient predictors of adherence to HIV treatment at any given timepoint is important for developing interventions that help women optimize the benefits of their long term medical care.

The purpose of this study was to examine the longitudinal effects of mental health, substance abuse, stress, and family caretaking demands on long-term adherence to medical treatment among a cohort of HIV-seropositive mothers who participated in the Mellins et al.<sup>13</sup> study described above. Based on the baseline findings, we hypothesized that the presence of a psychiatric or substance abuse disorder, higher level of psychological distress, more parenting stress, and poorer family communication about HIV disease would predict lower adherence to antiretroviral regimens and attendance at medical appointments over time.

## METHODS

### *Participants*

Participants were recruited between 1998 and 1999 from the waiting room of an adult infectious disease clinic that serves HIV-infected patients in a large inner-city medical center. All

English- and Spanish-speaking HIV-infected women with children under the age of 18 years were eligible for the study. Trained research assistants approached and explained the study to 134 women in the waiting room; 5 women declined to participate and 1 woman was too cognitively impaired to participate. The remaining 128 women provided written informed consent to participate in the study prior to the interview. Participants were asked initially to participate in two interviews, 4 to 5 months apart. One hundred twenty-eight women completed the baseline interview and 113 completed the first follow-up interview (FU1). With additional funding to conduct a second follow-up interview (FU2), we were able to recruit 97 of the original participants who were then interviewed 8–18 months after FU1. The time between FU1 and FU2 was highly variable because FU2 interviews were not initially planned and participant tracking was difficult because of high mobility and illness-related factors (see participant attrition in the Results section below).

### *Procedure*

Details of study procedures were described in a previous paper that presented baseline findings.<sup>13</sup> In brief, a 1–2-hour individual interview was conducted in English or Spanish to all participants at baseline and both follow-ups. With a few exceptions, the same instruments were administered at baseline and FU2. An abbreviated battery consisting of socio-demographic variables and the outcome measures (adherence to medication and medical appointments) was administered at FU1. An Institutional Review Board approved this study protocol and all participants provided written informed consent.

### *Dependent variables*

Adherence to medication was assessed with a modified self-report procedure developed by the Adult AIDS Clinical Trials Group (AACTG),<sup>27</sup> which is described in detail in the baseline paper.<sup>13</sup> In brief, participants described their antiretroviral medication regimen (e.g., the names/colors/descriptions of all antiretroviral medications, prescribed doses per

day, prescribed number of pills per dose) and the number of missed pills for each medication per day, during the past 2 days (2 days was selected to maximize accurate recall). The primary outcome variable examined in this study was percentage of missed pills in the past two days, defined as the total number of missed pills divided by the total number of pills prescribed across antiretroviral medications. Several studies have now demonstrated that self-reported adherence to antiretroviral medication is a strong predictor of virologic suppression<sup>25,28</sup> and correlates significantly with medical record data on participant viral load response.<sup>29</sup> In the baseline analyses of our data, increased viral load was associated with increased odds of missed pills.<sup>13</sup>

The secondary outcome variable, adherence to medical services, was ascertained by asking participants, "What percent of medical appointments did you attend in the past 6 months: 0%, 25%, 50%, 75%, or 100%?" A dichotomous dependent variable was created (yes = attended 0%–75% of appointments; no = attended 100%).

### *Independent variables*

Presence of a psychiatric disorder was assessed with the Clinical Diagnostic Questionnaire (CDQ),<sup>30</sup> which was described in our baseline paper.<sup>13</sup> Psychiatric disorders that have been found to be prevalent in HIV-infected patients were examined: major depression; other depression; panic; posttraumatic stress disorder; other anxiety disorders; and psychosis. In order to reduce the number of predictor variables in analyses, a dichotomous variable was created based on the presence or absence of any psychiatric disorder in the past 30 days.

Alcohol and drug abuse and dependence disorders were also assessed with the CDQ. Similar to psychiatric disorders, a dichotomous variable was created (i.e., presence or absence of any substance abuse disorder in the past 30 days and in the past 6 months). Excellent sensitivity for the dichotomous substance abuse and psychiatric diagnostic scores described above has been reported (85% and 88%, respectively).<sup>30</sup>

Psychological distress was assessed with 25-items from the Demoralization Scale of the Psychiatric Epidemiology Research Interview, which has been validated with inner-city African American and Latino populations.<sup>31</sup> Items assess self-esteem, hopelessness or helplessness, sense of dread, confused thinking, sadness, and anxiety. A total demoralization score was computed from the sum of all items with high scores reflecting greater psychological distress.

To assess family knowledge of HIV illness (disclosure) each participant identified up to 12 family members, including everyone living in her house, and was asked what each person had been told about her health (e.g., you are ill, you have HIV, you are healthy). The primary variables for these analyses were: (1) percent of the participant's children who knew her HIV status and (2) percent of the participant's family, including adults, who knew her HIV status.

Parenting stress was assessed with the 11-item Perceived Parenting Competence scale from the Parenting Stress Index—2nd edition (PSI), an extensively used instrument with well-documented psychometric properties.<sup>32</sup> Parents rate on a five-point scale how strongly they agree or disagree with items describing their parenting experiences. Low scores indicate more parenting stress (less perceived parenting competence).

The occurrence and effect of stressful life events was assessed with the Psychiatric Epidemiology Interview.<sup>31</sup> This instrument consists of a list of stressors related to family, relationships, health, income, work, housing, and basic living needs, and has been validated on an urban multi-ethnic population.<sup>31</sup> The first author previously modified the instrument to include HIV-related stressors and ratings of the impact of stressors (e.g., positive, negative, or neutral).<sup>33</sup> A total negative events score was computed by summing all events rated by participants as having a negative impact.

Adherence self-efficacy was measured by a 35-item procedure developed by Chesney et al.<sup>27</sup> to assess HIV-seropositive patients' intentions and confidence in carrying out health-related behaviors (e.g., asking questions, keeping appointments, adhering to medication regimens). Respondents were asked to rate their

level of confidence on a 10-point Likert scale (0 = cannot do; 10 = very certain can do).

CD4 lymphocyte cell count and HIV RNA viral load were obtained from the participants' medical charts. For the purposes of data analyses and clarity in clinical interpretation, each CD4 lymphocyte count was recoded into 1 of 6 categories (e.g., 0–50; 51–100; 101–200; 201–400; 401–500; and >501). A similar procedure was used for HIV RNA viral loads (e.g., 0–400; 401–5000; 5001–20,000; 20,001–75,000; 75,001–150,000; >150,000).

### *Statistical methods*

Binomial logistic regression models were used to examine the association of baseline independent variables (demographics, mental health, substance abuse, family functioning, parenting competence, disclosure of HIV status, and health functioning) and medical treatment adherence at FU1 and FU2 (number of missed pills in the past 2 days and missed medical appointments in the past 6 months). An overdispersion parameter was included to account for heterogeneity between subjects. In addition, the generalized estimating equation (GEE) methodology was used to account for within subject correlation across collection points.<sup>34</sup> While results of FU1 will be presented, the focus of this paper is on baseline predictors of FU2. Given that the length of time between FU1 and FU2 interview varied considerably (8–18 months), the interval between interviews was entered into the analysis model as a covariate. When the length of time between FU1 and FU2 was entered into the model as a covariate, there were no significant effects of the time interval on the results. Therefore, we excluded time between interviews as a covariate in the final set of analyses.

## RESULTS

### *Participant attrition*

Among the 128 mothers who participated in the study, 113 completed interviews (88%) at FU1 and 97 (76%) at FU2. Reasons for attrition at FU2 included death ( $n = 7$ ), refusal ( $n = 3$ ), and inability to make contact ( $n = 21$ ). Mothers

who completed the baseline interview only and those who completed FU2 did not differ in sociodemographic characteristics, rates of psychiatric disorder or substance abuse, level of psychological distress, and health status, with one exception; women with more people living in their households were more likely to discontinue the study,  $t(125) = 2.084, p < 0.05$ .

#### *Baseline participant characteristics*

Detailed baseline characteristics are described elsewhere.<sup>13</sup> In brief, participants in the study were African American (58%) and Latina (35%), had a mean age of 38 years, had completed 10 years of education, and were unemployed, single caregivers, living below the poverty line. Ninety of the women lived with their children, 13 of whom were HIV-infected. The majority of participants (88%) received some form of government financial assistance (e.g., welfare or disability). The mean length of known HIV diagnosis was 5 years with half of the women having known their diagnosis for less than 5 years. Based on medical chart abstractions ( $n = 111$ ), participants' mean CD4 lymphocyte cell count was 376 cells/mm<sup>3</sup> (range, 0–1013) and the median viral load (HIV RNA level) was 3130 copies per milliliter plasma (range, <400–750,000). Based on the CDQ, 50% of the participants ( $n = 63$ ) met the screening criteria for a current psychiatric disorder, 25% ( $n = 32$ ) for a substance abuse disorder in the past 6 months, and 17% ( $n = 21$ ) for a substance abuse disorder in the past 30 days. Nine percent ( $n = 12$ ) of the participants met criteria for both psychiatric and substance abuse disorder.

#### *Medication and appointment adherence*

At baseline, 88 women (69%) reported taking antiretroviral medication: 16 on monotherapy, 72 on two or more medications, and 44 on protease inhibitors. Seventeen of these women (20%) reported missing pills in the past 2 days. At FU1, 69 of 113 women (61%) reported taking HIV antiretrovirals and 28% of the 69 women taking medication reported missing pills in the past 2 days. At FU2, 62 of 97 women (64%) reported taking antiretrovirals 14% of

these 62 women reported missing pills in the past 2 days.

There was consistent use of medications over time. Fifty-one percent of the 97 women who completed both follow-ups were taking medications at all three time points and 23% were not taking medication at all three time points. Fourteen women who took antiretroviral medication at baseline stopped by FU2. Alternatively, 7 women who were not taking medications at baseline were on a medication regimen by FU2.

Thirty-five women who were not taking antiretroviral medications at FU2 reported that the three most common reasons for not being on antiretroviral medications were: (1) side effects of the medications (e.g., weight gain, sleep disturbance); (2) other adverse health conditions (e.g., liver failure or lipodystrophy), and (3) personal decisions (e.g., too many pills, feeling healthy, belief that medication stopped working).

More women reported missing medical appointments in the past 6 months than missing pills in the past 2 days; 43% of the baseline sample ( $n = 128$ ), 27% of the FU1 sample ( $n = 113$ ), and 27% of the FU2 sample ( $n = 97$ ) reported missing medical appointments in the past year.

Baseline demographic characteristics (e.g., ethnicity, marital status, child's HIV status, employment, income, and education) were not associated with missed pills or missed medical appointments at FU1 or FU2, with two exceptions. The odds of missing pills at FU2 decreased as age at baseline increased (odds ratio [OR] = 0.83, 95% confidence interval [CI] = 0.73–0.94,  $p = 0.003$ ) and as the number of people living in the home at baseline decreased (OR = 1.49; 95% CI = 1.09–2.04,  $p = 0.013$ ). Also, note that missed pills was not significantly correlated with medical appointment attendance and there were no significant associations among the missed pills variables at each time point.

*Baseline predictors of FU1 adherence to pills and medication.* Only two baseline variables were associated with adherence to pills at FU1; CD4 lymphocyte counts and negative stress. Women with higher CD4 lymphocyte counts (OR = 1.67, 95% CI = 1.09–2.53,  $p = 0.02$ ) and

higher levels of stress (OR = 1.27, 95% CI = 1.09–1.49,  $p < 0.01$ ) at baseline were more likely to report missing pills in the past 2 days at FU1.

Stress was the only baseline predictor of FU1 adherence to medical appointments. Higher levels of baseline parenting stress (OR = 0.94, 95% CI = 0.88–1.00,  $p = 0.05$ ) and baseline negative stressful life events (OR = 0.78, 95% CI = 0.66–0.90,  $p < 0.01$ ) were associated with worse attendance at medical appointments in between baseline and FU1.

All other predictors including the number of pills taken per day, length of time since HIV diagnosis, HIV RNA viral load, adherence self-efficacy, disclosure to family members, psychiatric functioning and demoralization, and substance abuse were not significantly associated with reported missed pills or missed medical appointments at FU1.

*Baseline predictors of FU2 adherence to pills and medical appointments.* Baseline predictors of FU2 adherence to medication were much more similar to our cross sectional baseline findings, with results presented in Table 1. That is, baseline mental health and substance abuse were significantly associated with adherence to pills at FU2. Mothers meeting criteria for psychiatric or substance abuse disorders at baseline were more likely than mothers who didn't meet diagnostic criteria to report missing pills at FU2. In addition, the odds of missing pills increased as parenting stress and general negative stress increased. Baseline health status indicators (e.g., the number of pills taken per day, length of time since HIV diagnosis, CD4 lymphocyte

count, and HIV RNA viral load), adherence self-efficacy, disclosure to family members, and demoralization were not significantly associated with missed pills at FU2.

Similar to the data on missed pills, presence of a psychiatric disorder and higher levels of negative stressful life events at baseline were significantly associated with more missed medical appointments in the 6 months prior to FU2 (Table 2). Also, similar to our cross-sectional baseline results, adherence to medical appointments at FU2 was associated with baseline rates of disclosure. That is, less disclosure to children about maternal HIV status at baseline was associated with poorer attendance to medical appointments in the 6 months prior to FU2. Note that baseline substance abuse, all health status indicators, adherence self-efficacy, and psychological distress were not associated with missed medical appointments at FU2.

Given the importance of negative stress as a predictor of adherence at FU1 and FU2, we examined which stressors were experienced the most frequently by this sample; 35% of the women at baseline identified unstable housing as an event that adversely changed their lives, and 39% of the women at FU2 reported illness within the family as a stressful event.

## DISCUSSION

Continued advances in antiretroviral treatment of HIV/AIDS have prolonged the life expectancy and improved the quality of life for countless persons living with HIV disease in

TABLE 1. BASELINE PREDICTORS OF PERCENTAGE OF MISSED PILLS (IN PAST 2 DAYS) AT FU2

<i>Baseline predictors</i>	<i>Odds ratio</i>	<i>p value</i>	<i>CI</i>
Presence of psychiatric diagnosis	14.30	< 0.01	2.88–71.00
Presence of substance abuse in past 30 days	7.32	0.01	1.55–34.45
Negative stressful events	1.28	0.02	1.05–1.57
Parenting stress	0.86	0.02	0.76–0.98
Number of people in the home	1.49	0.01	1.09–2.04
Age	0.83	< 0.01	0.73–0.94
Disclosure of HIV to family	0.35	0.49	0.02–6.75
Self-efficacy	1.07	0.71	0.74–1.55
CD4 counts	1.43	0.42	0.60–3.42
Viral load	1.09	0.79	0.57–2.14
Length of time since last diagnosis	0.90	0.43	0.68–1.18

FU2, second follow-up interview; CI, confidence interval.

TABLE 2. BASELINE PREDICTORS OF MISSED MEDICAL APPOINTMENTS (IN PAST 6 MONTHS) AT FU2

<i>Baseline predictors</i>	<i>Odds ratio</i>	<i>p value</i>	<i>CI</i>
Presence of psychiatric diagnosis	0.33	0.02	0.13–0.81
Disclosure of HIV to family	6.62	0.04	1.11–39.38
Negative stressful events	0.86	0.03	0.75–0.98
Presence of substance abuse in past 30 days	1.25	0.74	0.34–4.52
Parenting stress	0.95	0.21	0.88–1.03
Number of people in the home	0.99	0.91	0.76–1.28
Self-efficacy	1.05	0.65	0.84–1.31
CD4 counts	1.00	0.99	0.72–1.39
Viral load	1.01	0.95	0.73–1.40
Length of time since last diagnosis	1.09	0.22	0.95–1.26

FU2, second follow-up interview; CI, confidence interval.

the United States. However, achieving optimal adherence to antiretroviral medication and medical services for HIV-seropositive mothers is a formidable challenge. Supporting our baseline findings, this follow-up study found that HIV-infected mothers with poor mental health status at baseline were less likely to adhere to their medication regimens and medical appointments at the second follow-up. Also, participants with a current drug or alcohol abuse diagnosis at baseline were less likely to adhere to medications. Representing one of the few longitudinal studies to date, the results add to the recent literature suggesting that mental health functioning and substance use are critical predictors of nonadherence to medical treatment in HIV-infected adults over time, particularly for women with children.<sup>11,12,35</sup>

These data suggest that integrating mental health, substance abuse, and medical care may be an important strategy for promoting adherence to medical treatment. Unfortunately, few interventions to date have adopted an integrated approach to addressing mental health, substance abuse, and HIV medical treatment adherence issues. Randomized controlled interventions designed to improve adherence to antiretroviral medication have typically focused on (1) increasing self-efficacy to take medications and attend medical appointments,<sup>36</sup> (2) imparting HIV and treatment knowledge,<sup>37</sup> (3) broadening social support networks,<sup>38</sup> and (4) integrating medical adherence into one’s daily activities.<sup>39</sup> Our findings suggest that although knowledge- and motivation-based intervention strategies may be important for improving adherence, they may be

insufficient for HIV-seropositive mothers with current or lifetime psychiatric and substance abuse disorders. Self-efficacy to adhere to medications and medical appointments was not associated with either variable in this study. Rather, the findings suggest that assessment of mental health and substance abuse problems at the point of entry into medical care, followed by appropriate treatment may substantially improve the long-term medical treatment adherence of HIV-infected mothers.

In addition, our findings suggest that treatment adherence interventions must address stressful circumstances that compete for the potentially limited resources of HIV-infected mothers. Mothers are often forced to make difficult choices between attending to their immediate needs such as housing and caregiving for sick family members, and adhering to their own medical treatment. Social instability (e.g., lack of housing, unstable relationships, living on welfare) has been associated with adherence problems in HIV-infected adults with substance use histories.<sup>40</sup> A recent longitudinal study of 557 HIV-positive adults in New York City found that specific supportive services such as case management, housing assistance, and transportation, in addition to mental health and substance abuse treatment, can facilitate consistent engagement of patients into medical care.<sup>41</sup> Thus, adherence interventions may be more successful if they help HIV-infected mothers cope with the stressors of unanticipated or uncircumventable life/social circumstances.

A specific parental stressor that rendered adherence to medical treatment a challenge for

the mothers in this study was self-disclosure of HIV-status to children. Women who had disclosed to more of their children at baseline were more likely to attend their medical appointments at the second follow-up. Decisions regarding whether, when, and how to disclose maternal serostatus to one's children is an additional stressor that may interfere with mothers' ability to care for themselves. Understandably, attending health care appointments may be difficult if a mother has not disclosed her serostatus and she must bring her children to appointments or make excuses for where she is going. Recent studies of HIV-infected mothers have shown that many withhold information about their diagnosis until their children reach adolescence.<sup>42</sup>

Interestingly, descriptive analyses of the stressful life events reported by participants indicated that 23% of the mothers at baseline identified disclosure of their own or child's HIV-serostatus as an event that brought about a positive change in their lives. Future interventions aimed at improving medical adherence should assist mothers in making informed decisions about disclosure of their serostatus to their children, addressing barriers to optimal family communication, and expanding mothers' capacity to cope with the possible negative consequences of their decisions. As we noted in our cross-sectional baseline study, disclosure of maternal HIV status is not always possible or in the best interests of the family at a particular time,<sup>43</sup> necessitating some mothers to obtain health care in the context of maintaining the privacy of their HIV diagnosis.

The percentage of women taking antiretroviral medications at each time point was relatively consistent. The most common reasons for not being on an antiretroviral regimen were: side effects, personal decisions, and other adverse health conditions. While not the focus of this study, it is critical to gain a clearer understanding of factors that underlie women's treatment decisions, including possible shifts in treatment access or antiretroviral guidelines for initiating medication regimens, or uncircumventable life circumstances that interfere with antiretroviral treatment. This highlights the importance of conceptualizing antiretroviral treatment access and adherence, particularly

among HIV-seropositive mothers, as a dynamic rather than static decision-making process, influenced by individual and system level factors.<sup>44</sup> As such, regular and ongoing assessment of patients' adherence to antiretrovirals is an important component of medical treatment.

Several aspects of this study design warrant cautious interpretation of the findings. First, participants were recruited in a hospital waiting room during their medical visits. This self-selection bias may limit the generalizability of the findings to mothers who are unconnected with medical services. Furthermore, we were unable to complete follow-up interviews with all of the participants, and the time between FU1 and FU2 interviews was highly variable, given that the second follow-up was not planned in the original study design. Also, we utilized self-report measures that are affected by issues of social desirability and recall, such that problems with adherence are underestimated.<sup>45,46</sup> Notwithstanding these limitations, this longitudinal study clearly highlights long-term and consistent influences of mental health, substance abuse, and stressful life circumstances on adherence to medical treatment. While there were some differences in which predictors were significantly associated with adherence at the three time points, it is clear that mental health, substance abuse, and stress have a consistent influence on antiretroviral treatment over time.

In conclusion, given that long term adherence has been shown to be a critical predictor of survival in HIV-infected patients,<sup>1</sup> effective interventions that help individuals improve or maintain adherence are urgently needed. Information and education-based interventions that overlook contextual and social factors may fail to address formidable barriers to adherence. For women, there is a need to develop models of health behavior that focus on family, social, and other contextual factors in addition to individual cognitive processes. Interventions that integrate mental health, substance abuse, family support, and medical care are essential to improving the medical adherence and health of mothers living with HIV illness, particularly in multistressed populations with substantial caregiving and other life demands.

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