

# Disclosure of Complementary and Alternative Medicine Use to Health Care Providers among HIV-Infected Women

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## Abstract

To determine prevalence and predictors of complementary and alternative medicine (CAM) use disclosure to health care providers and whether CAM use disclosure is associated with highly active antiretroviral therapy (HAART) adherence among HIV-infected women, we analyzed longitudinal data collected between October 1994 and March 2002 from HIV-infected CAM-using women enrolled in the Women's Interagency HIV Study. Repeated measures Poisson regression models were constructed to evaluate associations of selected predictors with CAM use disclosure and association between CAM use disclosure and HAART adherence. A total of 1377 HIV-infected women reported CAM use during study follow-up and contributed a total of 4689 CAM-using person visits. The overall prevalence of CAM use disclosure to health care providers was 36% across study visits. Women over 45 years old, with a college education, or with health insurance coverage were more likely to disclose their CAM use to health care providers, whereas women identified as non-Hispanic Black or other ethnicities were less likely to communicate their CAM usage. More health care provider visits, more CAM domains used, and higher health care satisfaction scores had significant relationships with increased levels of CAM use disclosure. Restricting analysis to use of herbal or nonherbal medications only, similar results were obtained. Compared to other CAM domains, mind-body practice had the lowest prevalence of CAM use disclosure. Additionally, CAM use disclosure was significantly associated with higher HAART adherence. From this study, we showed that a high percentage of HIV-infected women did not discuss their CAM use with health care providers. Interventions targeted towards both physicians and patients may enhance communication of CAM use, avoid potential adverse events and drug interactions, and enhance HAART adherence.

## Introduction

**T**HERAPEUTIC APPROACHES to treating disease or illness that fall outside of the realms of conventional medicine are called complementary and alternative medicine (CAM). In the early years of the HIV epidemic, CAM use was prevalent because few standard treatments were available and the available options often had negative side effects.<sup>1,2</sup> With

widespread use of antiretroviral drugs, HIV disease has been transformed into a manageable chronic disease in many developed countries. However, CAM is still used more often in the HIV-infected individuals than non-HIV-infected individuals<sup>3</sup> and CAM usage is still an integral part of HIV therapy as it may be used to reduce disease symptoms or alleviate side effects from conventional treatments.<sup>4</sup> The usage of CAM ranges between 60% and 90% among

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HIV-infected individuals in the era of highly active antiretroviral therapy (HAART),<sup>5-7</sup> with women reporting higher CAM usage<sup>8</sup> and CAM being used almost exclusively as adjunct rather than as alternative therapies to the conventional therapies.<sup>3,9</sup>

While CAM use can benefit HIV-infected patients,<sup>4</sup> potential adverse events or unfavorable interactions with pharmacologic therapies do exist.<sup>10-13</sup> However, not all CAM users communicate their CAM usage with health care providers. One study among HIV-infected individuals in the United States found that approximately one half of the patients who used any type of CAM had not discussed it with their health care providers.<sup>9</sup> Another recent study found only 16% of HIV-infected CAM users in Uganda informed their conventional health care providers about their usage.<sup>14</sup> Because of high prevalence of CAM use and multiple medications in the HIV-infected individuals, possible CAM adverse events and interactions with HIV therapies should be closely monitored by physicians. In addition, given the extreme importance of 95% or more level of HAART adherence,<sup>15</sup> it is of great concern whether nondisclosure of CAM use negatively affects HAART adherence. Unfortunately, very few studies have been conducted among HIV-infected individuals to examine barriers to physician and patient communication of CAM use<sup>14</sup> and to our knowledge no study has been carried out to examine association of CAM use disclosure with HAART adherence.

Our study aimed to determine the extent and predictors of CAM use disclosure to health care providers among HIV-infected women and whether CAM use disclosure was associated with HAART adherence, using data from the Women's Interagency HIV Study (WIHS), the largest HIV/AIDS prospective cohort study of women in the United States.

## Methods

### *Women's Interagency HIV Study*

The WIHS is an ongoing longitudinal study designed to investigate the natural and treated history of HIV disease among women. Its design has been detailed previously.<sup>16</sup> Briefly, 2056 HIV-infected and 569 HIV-uninfected women were enrolled between October 1, 1994 and November 30, 1995 from six study sites in Chicago, Los Angeles, San Francisco, Washington, D.C. and Brooklyn and Bronx in New York City. Standardized face-to-face interviews were conducted semi-annually to collect data on participants' sociodemographic characteristics, behaviors, health care utilization, and medication use. Additionally, physical and obstetric/gynecologic examinations were performed and biologic specimens were collected. The study protocol was approved by an Institutional Review Board at each site and all participants gave informed consent.

In the WIHS, information regarding use of CAM therapies, disclosure of CAM use to health care providers and patient's satisfaction with health care was systematically collected at each odd-numbered visit from October 1994 until March 2002 at all sites except for the Brooklyn site because it chose not to collect these data. For this study, we restricted our analyses to study visits where the HIV-infected participants used at least one CAM modality during that study visit interval. The index visit was defined as the first visit a participant reported use of CAM during the follow-up period.

### *Outcome definition*

The participants were asked whether they used certain CAM modalities in the past 6 months and were asked to list other specific CAM modalities they used in open-ended question manner. The CAM modalities reported in this study are detailed in Table 1, which included St. John's wart, ginger, ginseng, algae, zinc, acupuncture/acupressure, yoga, and biofeedback, etc. These specific CAM modalities were then categorized into four CAM domains, i.e., herb medication, non-herb medication, mind-body practice, and body-based manipulative practice. For our analysis, multivitamins, folic acid, and antioxidants were not included in our definition of CAM because HIV primary care providers may routinely prescribe these for their patients. In addition, we also excluded regular exercise from body-based manipulative practice. Among respondents who reported having used at least one form of CAM since the last study visit, we then asked them whether they had discussed this use with their health care providers. The primary outcome was self-reported disclosure of CAM use to health care provider which was dichotomized as "yes/no." The secondary outcome was self-reported 95% or more level of HAART adherence in the past 6 months, with HAART being defined under the guideline by the DHHS/Kaiser Panel.<sup>17</sup>

### *Predictors*

Based on prior studies<sup>9,14,18,19</sup> and data available in WIHS, the following visit-specific time-varying variables (unless otherwise stated) were selected as predictors for CAM disclosure: (1) sociodemographic characteristics included age in years (<35, 35-45 and >45), racial/ethnic identification (non-Hispanic Black, non-Hispanic White, Hispanic and others), and educational level (less than high school, some high school, or college and above) at study index visit, as well as annual income (>\$12,000 or not), employment status, and any medical insurance coverage at each visit; (2) health care utilization indicators included number of health care provider visits (<2, 2-3, 4-5, and 6+), any hospitalization, number of CAM domains (1, 2, 3, and 4) and different type of CAM domain used since last visit; (3) functional status of participants consisted of depressive symptoms (measured by using the Center for Epidemiologic Studies Depression Scale [CESD],<sup>20</sup> with a score 16 or higher defined as depression) and overall health-related quality of life (QOL, measured on a scale from 0 to 100 using a modified version of the MOS-HIV<sup>21</sup> and was categorized using tertiles); (4) patient satisfaction was evaluated using the RAND Patient Satisfaction Questionnaire Short Form (PSQ-18), which has demonstrated validity and reliability among individuals with HIV/AIDS.<sup>22,23</sup> We used the general satisfaction domain (categorized by quartiles) of this instrument to represent participants' overall satisfaction with health care received; (5) clinical variables included CD4<sup>+</sup> T cell counts (measured using standardized three or four color flow cytometry<sup>24</sup>), HIV RNA level (measured using the isothermal nucleic acid sequence based amplification method [bioMérieux, Boxtel, NL]), number of HIV-related symptoms (including fever, memory/ concentration problem, diarrhea, numbness /tingling/burning rash, unintentional weights loss, difficulty with mental tasks, drenching night sweats, and divided into four categories 0, 1, 2, >2), clinical AIDS diagnosis (1993 criteria<sup>25</sup>), as well as use of

TABLE 1. LIST OF COMPLEMENTARY AND ALTERNATIVE MEDICINE MODALITIES REPORTED BY HIV-INFECTED WOMEN IN THE WIHS FROM OCTOBER 1994 TO MARCH 2002

CAM domains	CAM modalities	
Herb medications	St. John's wort (Hypericin)	
	Herbal preps	
	Melatonin	
	Herbs (Chinese/Asian, Native American, South American, Indian/Ayurvedic)	Cat claw
		Chamomile
	Combination Chinese herbs	
	Dandelion	
	Echinacea (with or without goldenseal)	
	Garlic	
	Ginkgo biloba	
	Ginger	
	Ginseng	
	Goldenseal	
	Milk thistle	
	Valerian	
	Woodroot	
	Evening primrose oil	
	Red clover	
	Black cohosh	
	Non-herb medications	DHEA (dehydroepiandrosterone)
		Coenzyme Q-10
		Niacin (Niaspan)
		NAC (N-acetyl-cysteine)
		Amino acids (glutamine)
		Acidophilus
		Alfalfa
		Algae (blue algae, blue-green algae)
		Aloe vera
		Astragalus
		Bee pollen
		beta-carotene
		Chromium
		Cranberry
Megadose vitamins		
Omega-3 type oils		
Protein powder		
Spirulina		
Thymus glandular		
Zinc		
Lecithin		
Cod liver oil		
L-carnitine		
Soy		
Flaxseed (linseed)		
Kemron		
Thymus extract		
Peptide t		
Special diet for health		
Trental		
Enzyme therapies (plant or pancreatic)		
Flower remedies		
Homeopathic remedies		
Body-based practices	Acupuncture	
	Acupressure	
	Massage	
Mind-body practices	Reflexology therapy	
	Spiritual health therapy	
	Hypnosis	
	Biofeedback	
	Image therapy	
	Yoga	

CAM, complementary and alternative medicine; WIHS, Women's Interagency HIV Study.

antiretroviral therapy (no therapy, non-HAART therapy, and HAART).

### Statistical methods

To assess associations of the selected predictors with disclosure of CAM use after taking into account within individual correlation, we used a repeated-measures Poisson regression model (generalized estimating equations method), rather than logistic regression model because CAM use disclosure was not a rare event in our study and estimated odds ratio from logistic regression might be a biased estimate of risk ratio.<sup>26</sup> Univariate associations with CAM disclosure were examined first and only variables with significant associations ( $p < 0.05$ ) were included into the multivariate models to assess their independent associations with disclosure of CAM use. Because use of herbal and non-herbal medications may pose more risk of interaction with antiretroviral therapy than use of other CAM modalities, we conducted a separate analysis to assess whether different predictors are associated with disclosure prevalence of herbal and non-herbal medications. To examine whether types of CAM domains were associated with different disclosure level, a separate multivariate model was fit by restricting analysis to study visits when the participants used only one type of CAM domain and by including the same set of univariately significant predictors as stated above. To assess association of CAM use disclosure with HAART adherence, the same repeated measures Poisson model was used, with the identified significant predictors of CAM use disclosure as covariates in the multivariate model. All analyses were conducted using SAS 9.01 (SAS Institute, Cary, NC).

## Results

### Participant characteristics

One thousand seven hundred forty-five HIV-infected WIHS women were asked their CAM use history from October 1994 to March 2002. A total of 1377 (79%) reported using CAM at least once during this period; these women constituted the current study population and contributed a total of 4689 CAM-using person visits. At the index visit, 16% of the study subjects were older than 45 years and 31% of them had less than a high school education. Among these participants, approximately 54% were non-Hispanic Black and 21% were Hispanic. Of these women, about 40% had been diagnosed with AIDS and 65% used antiretroviral therapy.

### Prevalence of CAM use disclosure

During follow-up visits, the participants used a variety of CAMs, including some CAM medications with confirmed (such as St. John's wort and garlic<sup>10,11</sup>) or potential (such as ginkgo biloba and echinacea<sup>27</sup>) adverse events or interaction with antiretroviral therapies. The average prevalence of CAM use disclosure was 36% across visits (range, 29%–45%) but remained relatively stable over time, which includes both pre- and post-HAART eras. Participants with younger age, non-White race, lower education, lower income, no insurance coverage, or depression symptom had lower prevalence of CAM use disclosure, whereas women with more health care provider visits, higher satisfaction with received health care, or using HAART had higher prevalence of CAM use

disclosure (Table 2). The disclosure prevalence also varied by number of CAM domains used, with 25% for using one CAM domain only and 61% for using all four CAM domains. Restricting analyses to visits where the participants were using only one CAM domain, women using mind-body practice had the lowest disclosure level (18%), while those using non-herbal CAM medication had the highest disclosure level (37%).

#### *Predictors of CAM use disclosure*

A number of predictors were significantly associated with disclosure of CAM use in univariate analysis (Table 2). With these predictors included in the multivariate model, non-Hispanic Black and other ethnicity women were less likely to disclose CAM use while women over 45 years old, with some college education or health insurance were more likely to disclose. In addition, satisfaction with health care, number of CAM domains used, and number of health care providers visited all had significant dose-response relationships with CAM use disclosure. Restricting analysis to use of herbal and nonherbal medications only, similar results were obtained; all significant predictors in the multivariate analysis with all CAM domains included (original model, see Table 2) remained significant in this separate analysis except for insurance coverage, which became insignificant (prevalence ratio [PR], 1.18; 95% confidence interval [CI], 0.98–1.41;  $p = 0.075$ ) and such slight change might be caused by reduced sample size. Furthermore, compared to mind-body practice, use of herbal medication (PR, 1.51; 95% CI, 1.18–1.93;  $p = 0.0011$ ), non-herbal medication (PR, 1.79; 95% CI, 1.48–2.19;  $p < 0.001$ ) or body-based manipulative practice (PR, 1.67; 95% CI, 1.37–2.05;  $p < 0.0001$ ) was significantly related to higher CAM use disclosure to health care providers, after restricting to visits when only one CAM use was reported and adjusting for the same set of univariately significant covariates as described in Table 2.

#### *Association between CAM use disclosure and HAART adherence*

Univariately, CAM use disclosure was significantly associated with HAART adherence (PR, 1.08; CI, 1.01–1.15;  $p = 0.0252$ ). After adjusting for the above identified significant CAM use disclosure predictors that were also associated with HAART adherence in the multivariate model, the association remained significant (PR, 1.07; 95% CI, 1.00–1.14;  $p = 0.0415$ ).

#### **Discussion**

Our data showed that 79% of HIV-infected women in the WIHS reported CAM use. However, the prevalence of CAM use disclosure averaged only 36%, which was somewhat in between those previously reported.<sup>9,14</sup> In addition, the CAM use disclosure prevalence remained stable over study follow-up time, which included both pre- and post-HAART eras. Given that some HIV-infected WIHS women were using certain CAM medications with confirmed or potential adverse events or interaction with antiretroviral therapies, and that patient's knowledge about safety of CAM is usually limited,<sup>28</sup> such a low prevalence of CAM use disclosure is disturbing. In addition, we showed that CAM use disclosure was related to higher HAART adherence, which is congruent with findings

that better physician-patient relationship, including better communication, can increase adherence to HAART.<sup>29</sup> Therefore, physician-patient communication of CAM use is of critical importance in clinical management of HIV infection, and identification of important predictors of CAM use disclosure is an essential first step for possible improvement.

Two studies have examined predictors of CAM use disclosure among HIV-infected individuals before. As a by-product of their research on CAM use and substitution for conventional therapy, Hsiao et al.<sup>9</sup> found that Latino, no insurance, perceptions of negative attitude of providers toward CAM use, and patients' negative attitude toward antiretroviral medications were individually associated with nondisclosure of CAM use. Unfortunately the independent associations of these predictors were not further evaluated in the multivariate analysis. Recently, Langlois-Klassen et al showed that higher education and more HIV-related symptoms were independently associated with higher CAM use disclosure among HIV-infected individuals in west Uganda.<sup>14</sup> Our analysis confirmed the roles of education and insurance coverage in CAM use disclosure, but had different results for race and number of HIV-related symptoms. These discrepancies might be largely due to different study populations used in examining the association; Hsiao et al.<sup>9</sup> included only patients using CAM with potential adverse events, while the HIV-infected individuals in Africa were simply different from those in the North America because of different prevalence of antiretroviral therapy usage.

From our study, individuals who had more visits to health care providers or used more CAM domains were more likely to disclose their CAM usage. Our findings were similar to those from a study among patients with rheumatologic disease, in which patients using 3 or more types of CAM or with more physician visits were more likely to disclose usage.<sup>19</sup> Health care utilization indicators generally represent disease severity and/or individual health care seeking preference. As we adjusted disease stages in our analyses, these indicators were more likely reflective of the latter. Patients utilizing more health service might be more health conscious; they might be more willing to or might have more chances of communicating with their health care providers.

Although previous studies showed that individuals used CAM not simply because of dissatisfaction with conventional medicine,<sup>30,31</sup> the current study revealed that higher satisfaction with received health care was significantly related to higher disclosure of CAM use. Our results were different from those reported among rheumatology patients, where no significant association was demonstrated.<sup>19</sup> Possible explanations for the difference might include different provider satisfaction forms used, different study settings, or distinct disease populations. In the RAND PSQ-18 form, satisfaction with physician communication is an important dimension, which might help explain our findings.

In the HAART era, maintaining high adherence to HAART and maximizing quality of life are two major goals in the management of HIV-infected patients. From our analysis, CAM use disclosure is related to both goals. According to the above identified predictors, intervention programs may be developed toward both patients and physicians to improve CAM use disclosure. From the patients' perspective, targeted education programs toward those who are young, minority, with lower education or no insurance coverage should be

TABLE 2. PREDICTORS OF COMPLEMENTARY AND ALTERNATIVE MEDICINE USE DISCLOSURE TO HEALTH CARE PROVIDERS AMONG HIV-INFECTED WOMEN

Variable	Study subjects n = 1377	Person visits n = 4689	Disclosure prevalence %	Statistical associations			
				Univariate		Multivariate	
				PR	95% CI	PR	95% CI
<b>Social demographics</b>							
Age							
<35	472	1066	29.74	1.00		1.00	
35–45	682	2503	35.96	1.21	(1.06, 1.38) <sup>a</sup>	1.13	(0.99, 1.28)
>45	223	1099	41.95	1.41	(1.22, 1.63) <sup>b</sup>	1.25	(1.09, 1.44) <sup>a</sup>
Ethnicity							
White, non-Hispanic	301	1109	42.83	1.00		1.00	
Black, non-Hispanic	741	2461	33.56	0.78	(0.70, 0.88) <sup>b</sup>	0.87	(0.78, 0.97) <sup>c</sup>
Hispanic	294	953	35.26	0.85	(0.73, 0.98) <sup>a</sup>	0.94	(0.81, 1.08)
Other	41	145	28.28	0.66	(0.45, 0.97) <sup>c</sup>	0.70	(0.50, 0.99) <sup>c</sup>
Education							
Less than high school	430	1286	29.24	1.00		1.00	
High school	437	1351	34.12	1.17	(1.01, 1.35) <sup>c</sup>	1.05	(0.91, 1.20)
Some college	510	2031	41.41	1.41	(1.25, 1.61) <sup>b</sup>	1.15	(1.01, 1.32) <sup>c</sup>
Income > \$12,000 per year	529	2107	37.97	1.10	(1.00, 1.20) <sup>c</sup>	0.98	(0.89, 1.07)
Currently Employment	322	1480	38.04	1.09	(0.98, 1.20)		
Insurance	1144	4125	37.31	1.45	(1.22, 1.72) <sup>b</sup>	1.26	(1.06, 1.48) <sup>a</sup>
<b>Health care utilization</b>							
Being hospitalized	296	920	37.72	1.06	(0.96, 1.17)		
Number of health care provider visits							
<2	971	1447	28.82	1.00		1.00	
2–3	147	1135	35.95	1.25	(1.11, 1.40) <sup>a</sup>	1.21	(1.07, 1.35) <sup>a</sup>
4–5	85	685	38.83	1.35	(1.18, 1.53) <sup>b</sup>	1.26	(1.11, 1.43) <sup>a</sup>
6+	174	1401	41.90	1.45	(1.31, 1.62) <sup>b</sup>	1.34	(1.20, 1.49) <sup>b</sup>
Number of CAM modalities							
1	769	2206	24.71	1.00		1.00	
2	331	1267	38.20	1.55	(1.37, 1.71) <sup>b</sup>	1.50	(1.35, 1.66) <sup>b</sup>
3	182	777	50.45	2.04	(1.83, 2.28) <sup>b</sup>	1.96	(1.76, 2.19) <sup>b</sup>
4	95	418	61.48	2.49	(2.22, 2.81) <sup>b</sup>	2.35	(2.09, 2.64) <sup>b</sup>
<b>Functional status</b>							
Quality of life							
<52	500	1542	35.73	1.00			
52–73	462	1526	35.52	0.99	(0.89, 1.11)		
>73	411	1596	36.59	1.02	(0.91, 1.15)		
Depression	730	2270	33.74	0.89	(0.81, 0.97) <sup>c</sup>	0.98	(0.90, 1.07)
<b>Health care general satisfaction score</b>							
<3.0	258	745	30.07	1.00		1.00	
3.0–4.0	311	1015	34.19	1.14	(0.98, 1.31)	1.19	(1.03, 1.37) <sup>c</sup>
4.0–4.5	447	1609	35.92	1.19	(1.04, 1.37) <sup>c</sup>	1.27	(1.11, 1.45) <sup>a</sup>
>4.5	350	1284	40.89	1.36	(1.18, 1.57) <sup>b</sup>	1.39	(1.22, 1.59) <sup>b</sup>
<b>Clinical disease stages</b>							
AIDS diagnosis							
CD4 <sup>+</sup> T cell count (per mm <sup>3</sup> )	555	2271	37.65	1.10	(0.99, 1.21)		
>500	348	1398	36.05	1.00			
350–500	279	995	34.97	0.97	(0.86, 1.10)		
<350	717	2240	36.47	1.01	(0.91, 1.13)		
<b>HIV viral load (per μL)</b>							
<81	83	898	38.64	1.00			
81–4000	487	1865	35.44	0.92	(0.82, 1.03)		
>4000	785	1882	35.23	0.91	(0.80, 1.03)		
<b>Number of HIV-related symptoms</b>							
0	564	2095	34.94	1.00			
1	321	1094	37.48	1.07	(0.97, 1.19)		
2	208	670	37.31	1.06	(0.94, 1.21)		
>2	283	808	35.40	1.01	(0.89, 1.15)		
<b>Antiretroviral therapy</b>							
No therapy (reference)	486	1522	33.71	1.00		1.00	
Non-HAART therapy	735	1416	35.45	1.05	(0.94, 1.18)	1.09	(0.98, 1.22)
HAART therapy	155	1729	38.35	1.13	(1.02, 1.27) <sup>c</sup>	1.01	(0.91, 1.12)

<sup>a</sup>p < 0.01.

<sup>b</sup>p < 0.0001.

<sup>c</sup>p < 0.05.

CAM, complementary and alternative medicine; PR, prevalence ratio; HAART, highly active antiretroviral therapy; CI, confidence interval.

carried out to increase their health consciousness and awareness of the importance of disclosing CAM use to health care providers.<sup>32</sup>

Given the demonstrated effectiveness of HAART and potential risk associated with CAM use nondisclosure, physicians should take a leading role in discussing with patients about CAM usage. Specifically, effective intervention programs should be developed for physicians to increase their knowledge about CAM, take initiative in communicating CAM use and incorporate CAM use inquiry into routine inquiries about patients' medical histories, antiretroviral therapy adherence and other aspects of care. For instance, as evidenced by a previous study in Canada, asking specifically about CAM use by physicians was a strong predictor for CAM use disclosure.<sup>18</sup>

Compared to the two previous studies, our study has some additional strength. Both studies utilized a cross-sectional design. Hsiao et al did not examine the independent associations of the predictors with CAM use disclosure, while the study by Langlois-Klassen et al.<sup>14</sup> used a relatively small number of patients attending medical clinics. Our study adopted a prospective cohort design, had a large sample size and thus improved external validity. However, some limitations in this study should also be noted. First, we used self-reported disclosure prevalence and HAART adherence. However, previous WIHS research has shown self-reported outcomes such as medication adherence to be consistent with objective measures of HIV outcomes, such as CD4<sup>+</sup> T cell count, and HIV viral load.<sup>33</sup> Second, we did not evaluate information on comorbidities, which could affect both CAM use and disclosure of CAM use to health care providers. However, certain covariates such as functional status might reflect some effects of potential comorbidities. Third, although we tried to be inclusive in assessing predictors for disclosure of CAM use, some unmeasured predictors might not have been included.

## Conclusion

HIV-infected women in the WIHS had a high prevalence of CAM use, but a low prevalence of disclosing it to their health care providers. We identified important predictors for CAM use disclosure in this study and our findings have critical clinical implications because possible interventions based on these predictors may help improve CAM use disclosure, avoid adverse events and/or drug interactions, and enhance HAART adherence.

## Acknowledgments

Data in this manuscript were collected by the Women's Interagency HIV Study (WIHS) Collaborative Study Group with centers (Principal Investigators) at New York City/Bronx Consortium (Kathryn Anastos); Brooklyn, New York (Howard Minkoff); Washington, D.C. Metropolitan Consortium (Mary Young); The Connie Wofsy Study Consortium of Northern California (Ruth Greenblatt); Los Angeles County/Southern California Consortium (Alexandra Levine); Chicago Consortium (Mardge Cohen); Data Coordinating Center (Stephen Gange). WIHS is funded by the National Institute of Allergy and Infectious Diseases with supplemental funding from the National Cancer Institute and the National Institute on Drug Abuse (UO1-AI-35004, UO1-AI-31834, UO1-AI-

34994, UO1-AI-34989, UO1-AI-34993, and UO1-AI-42590). Funding is also provided by the National Institute of Child Health and Human Development (UO1-HD-32632) and the National Center for Research Resources (MO1-RR-00071, MO1-RR-00079, MO1-RR-00083).

## Author Disclosure Statement

No competing financial interests exist.

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