Efficacy of an Educational and Counseling Intervention on Adherence to Highly Active Antiretroviral Therapy: French Prospective Controlled Study

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Purpose: The objective was to evaluate the impact of an intervention for improving adherence to antiretroviral therapies (HAART) in HIV-infected patients. **Method:** We designed a prospective, controlled, randomized trial to assess the impact of an educational and counseling intervention in addition to standard of care. At M0, the study enrolled 244 HAART-treated patients who attended a medical consultation between September and December 1999 who were not included in another protocol. Patients in the intervention group (IG) were offered three individual sessions by trained nurses. The proportions of adherent patients at 6 months follow-up (M6) and the change in HIV RNA between M0 and M6 were measured. **Results:** Between M0 and M6, HIV RNA significantly decreased in the 123 patients of the IG (mean difference = –0.22 log [±0.86], $p = .013$), while it increased (+0.12 log [±0.90], $p = .14$) in the 121 patients of the control group. However, the proportion of patients with HIV RNA <40 copies/mL remained similar in both groups. In an intent-to-treat analysis, the only significant predictor of 100% adherence at M6 was the intervention group ($p = .05$) after adjustment for baseline adherence ($p = .001$). Among the 202 patients with available data on adherence, the proportion of adherent patients was similar in both groups at M0 (58% vs. 63%, $p = .59$) but became higher in the IG at M6 (75% vs. 61%, $p = .04$). **Conclusion:** The educational and counseling intervention was efficient for increasing adherence to HAART and could be implemented in most clinical settings. **Key words:** *adherence, behavioral interventions, HAART*

HIV-infected patients' inadequate adherence can have profound negative implications for the individual and public health effectiveness of highly active antiretroviral therapy (HAART).[1,2] Current data suggest that patients must take a high proportion (95% or more) of antiretroviral drug doses to maintain suppression of viral replication, that failure rates increase as adherence levels decrease,[3] and that a lack of strict adherence is a cofactor in clinical progression to AIDS.[4] Because physicians, even those with the greatest experience of HIV care, may have diverse ways of communicating with patients regarding adherence,[5] formalized psychosocial and behavioral interventions to improve patients' adherence to HAART have been highly recommended.[1,6] Attempts to evaluate such interventions have, however, been limited,[7,8] and attempts to achieve a significant effect on virological replication are sparse.[9] Current methods of improving adherence for chronic health problems are mostly complex and not very effective.[10] However, limited evidence suggests that interventions to improve adherence are most likely to be successful when they are comprehensive and tailored to the individual.[11] In a prospective, controlled, randomized study carried out in a sample of HAART-treated patients from a

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French hospital, we tried to evaluate the impact of an intervention, provided by specially trained nurses, on both measurement of adherence and virological outcomes.

METHOD

Patients and Study Design

All HIV-infected patients who had a medical follow-up consultation at the Nice University Hospital (South-Eastern France) between September and December 1999 were approached for study participation if they fulfilled the eligibility criteria at enrollment: (a) being 18 years of age or more, (b) being treated for at least 1 month by a combination of at least one protease inhibitor (PI) or one nonnucleoside reverse transcriptase inhibitor (NNRTI) or abacavir with two nucleoside reverse transcriptase inhibitors (NRTIs), (c) not having required an hospitalization in the prior month or requiring it at time of the consultation, and (d) not being previously included in another protocol. The patients were asked by their physician if they agreed to give their informed consent to participate in the study according to the standard practice of sociobehavioral research projects funded by the French Agency for AIDS Research (ANRS).

Patients were randomized in an intervention group (IG) and a control group (CG); both groups received the usual clinical follow-up and were offered similar questionnaires at enrollment (M0) and 6 months later (M6). Patients in both groups had a medical consultation every 2 or 3 months depending of the physician's wish and according to the usual standard of care in the clinic. Patients in the IG were offered a program consisting of three individual counseling and educational sessions, one immediately after enrollment (M0) and then every 2 months (M2, M4). Patients in the IG had to voluntarily make appointments for the sessions, which were not necessarily on the same day as their medical consultations, without any reminding calls or financial compensation. One of four specially trained nurses gave the sessions to each patient, on an individual basis.

The outcome measures of the study were proportion of patients achieving an adherence level of 100% at M6, change in viral load (HIV RNA) between M0 and M6, and percentage of patients achieving plasma HIV-1 RNA levels < 40 copies/mL at M6. To compare our data with the previous study by Tuldra et al.,[7] plasma HIV-1 RNA results were also analyzed using the higher threshold of 400 copies/mL.

Implementation of the Intervention

The intervention combined an educational and a counseling approach and was founded on the principles of motivational psychology[12] and client-centered therapy and the use of an empathic therapeutic to enhance participants' self-efficacy and skills. The contents of the intervention were based on previous consistent findings about cognitive,[13–15] emotional,[16,17] social,[18] and behavioral[19] determinants affecting adherence and were focused on each of these components.

To address the cognitive components, each individual's motivations, expectations, degree of knowledge, personal beliefs, and assumptions about disease and medications were assessed and explored. Obstacles and barriers to the intake of medication were also anticipated. Great attention was paid to the ways and reminder strategies each patient could use to avoid forgetting the schedules of medication.

To address the emotional components, patients' personal concerns and experiences related to being HIV-infected were acknowledged at the present moment. The nurses helped patients to identify fears, anxieties, depressed moods, uncertainties, feelings of loneliness and isolation, desire to give up, and loss of hope. The nurses explored with them how they could increase their self-awareness and develop adaptive or active ways of coping with these negative emotional states. They also addressed personal growth issues such as desire for love and readiness for building new relationships and for having children.

To address the behavioral components, the nurses collected the patients' descriptions of plans that they had established for accomplishing adherence to treatment and the circumstances of the last episode of adherence failure that they had experienced. They also explored each individual's ability to cope with relapse (e.g., changing/stopping medication) to help each patient to develop self-awareness skills to distinguish an occasional lapse ("Last night I almost forgot to take my medica-

tion") from a complete relapse ("I stopped taking my medications a week ago").

To address the social component, the nurses assessed the degree to which the social stigma associated with HIV/AIDS hindered patients from taking their medications in the presence of others. Nurses assessed the availability of supportive significant others who understood and agreed with the treatment regimen, and patients were informed of other available resources such as local support groups and nationwide HIV support hotlines. Nurses' tasks also consisted of identifying patients' economic concerns and other social potential barriers that affected their willingness and ability to receive treatment. In the case of an urgent need requiring immediate action, nurses routinely referred the patients to local resources, assisted them in follow-up if needed, and further assisted them in overcoming the practical barriers they encountered.

Because the randomized research framework necessitated standardization of the intervention, we prepared a manual for nurses and wrote intervention scripts for three individually delivered sessions. For each session (approximately 45 to 60 minutes), we described its purpose and goals and edited guidelines. These guidelines were conceived as a step-by-step guide to help nurses in delivering the sessions. Written tools were also designed to help the nurses record the key features of the sessions, which included evaluation of the participant's needs, referrals made, and follow-up on prior referrals, and keep track of the tasks they had to perform during the sessions. Nurses were flexible in tailoring the sessions to the needs of the individual patient.

Before the implementation of the intervention, four nurses attended a 5-day intensive training course given by psychologists who were participants in the research team. This training focused on adherence theories and on the basic counseling skills needed for the intervention. In addition, each month, each nurse had an in-depth supervision session with psychologists where difficulties she had encountered were identified, discussed, and followed by proposed potential solutions. To guarantee the quality of the intervention, a clinical supervisor was assigned to review regularly the written material filled out by the nurses for each session.

Data Collection

Data collected at M0 and M6 included a medical questionnaire that was filled out by the hospital AIDS specialist at the end of consultation and contained detailed information about the patient's clinical history as well as prescription of antiretroviral drugs. The medical questionnaire also included a physician's evaluation of adverse events associated with HAART (using the French version of the NCI-CTG 5-point toxicity scale).[20] All AIDS-defining events and major (grade 3 and 4) adverse events were diagnosed by the treating physician. Viral load was measured by RT-PCR (Amplicor™; Roche Diagnostic Services, Branchburg, New Jersey, USA) assays with lower limits of detection of HIV-1 RNA 40 copies/mL.

Self-Administered Questionnaire

At M0 and M6, a self-administered questionnaire collected in-depth data about patients' sociodemographic characteristics and a 4-day recall of self-reported adherence to HAART. The patients filled out the questionnaire away from any member of the medical staff.

Five questions regarding adherence to HAART were included in the self-administered questionnaires according to the methodology established by the AIDS Clinical Trial Group[21] and validated in the French context.[22,23] Patients were first asked to list, for each drug included in their HAART regimen, the number of pills they had actually taken on each of the 4 days before the visit. Patients who reported taking all of their prescribed doses in the 4 days before the visit were classified as 100% adherent, unless they also reported in subsequent answers that they had skipped a dose during the past weekend or had "almost totally, partially or not at all" followed their HAART regimen, had modified the prescribed scheduling several times, or had taken all their medication at one time, in which case they were classified as nonadherent. Patients were also classified as nonadherent if they reported taking less than 100% of their prescribed doses of HAART in the previous 4-day period.

The self-administered questionnaire also included a 16-item HAART-related symptom scale; patients were asked if they had experienced each listed symptom at least once during the previous 4

weeks. This list of symptoms was based on the various short-term side effects from HIV/AIDS antiretroviral therapies described in the literature and has been validated in previous studies.[22,24]

The self-administered questionnaire also contained four questions concerning current addictive behaviors, including alcohol and tobacco consumption as well as injection behavior, and the prescription of a drug maintenance treatment program. Depressive mood was measured by the French validated translation of the CES-D scale,[25] which was also included in the self-administered questionnaire.

Statistical Analysis

The IG and CG were compared at M0 and M6; a chi-square test was used for categorical variables and a Student *t* test or a Mann-Whitney U test was used for continuous variables. Changes in adherence and HIV RNA level between M0 and M6 in each group were assessed by a Wilcoxon rank sum test or a McNemar test. The impact of the intervention on adherence at M6 was assessed by an odds ratio (OR) and its 95% confidence interval (95% CI) calculated by a logistic regression. This OR was adjusted for baseline adherence. Further factors were entered in the model by a forward procedure based on the likelihood ratio test. To test the effect of the intervention on plasma viral load at M6, after adjustment for other possible cofactors, we used an analysis of covariance (ANCOVA). In this analysis, baseline viral load was entered as a fixed covariable. Least square of type III was used to test the variables in the model. Statistical analyses were performed using SPSS software (SPSS, Inc., Chicago, Illinois, USA).

RESULTS

From September 1999 until December 1999, 962 adult patients (18 years of age) had a medical consultation at the clinic. Of these, 95 patients were not treated by HAART or had started treatment less than 1 month previously, 75 had been hospitalized at least once during the prior month, and 482 had already been included in other clinical trials or cohort studies. Therefore, a total of 310 patients were eligible for the study. These 310 patients did not statistically differ in terms of age, gender, transmission group, and clinical stage from the 652 other patients who had received a medical consultation during the period of enrollment. Among the 310 eligible patients, 246 (79.4%) gave their informed consent to participate; there were 124 in the IG and 122 in the CG, respectively. The 64 patients who refused to participate also did not statistically differ in terms of age, gender, transmission group, and clinical stage from the 246 patients who were included. Two patients died during the study period (one in each group). Finally, 123 patients in the IG and 121 in the CG were compared.

Table 1 shows that no significant difference was found between both groups at M0 for sociodemographic characteristics, self-declared addictive behaviors, CES-D depression scale, and number of self-reported HAART-related symptoms in the prior month. **Table 2** shows that both groups were also similar in terms of clinical, biological, and treatment characteristics. The proportion of patients who were reported by physicians as presenting a toxic adverse event at M0 consultation was similar in both groups (**Table 2**), including three patients in IG and two in CG with severe toxicity (NIH Clinical Trials Group 3).

During the study period, the proportion of patients who switched their HAART regimen was similar between both groups (26% in the IG vs. 23% in the CG, $p = .65$). At M6, no difference was found between both groups in number of self-reported symptoms (median [IQR] = 3.5 [1.0–6.0] in IG vs. 3.5 [2.0–6.0] in CG, $p = .98$); the proportion of patients with medically reported toxic adverse events was also similar at M6 (23.6% vs. 18.2%, $p = .38$), including two patients with a severe event in the IG and one in the CG.

In the IG, 67 (54%) patients had followed all three sessions, whereas 56 (46%) had only partly followed the program (including 17 patients who only participated in the M0 initial session). Patients who were HIV-infected through injecting drug use (IDUs) tended to be less likely to complete all three sessions (43% vs. 59%, $p = .13$).

Two hundred and two (83%) of 244 patients answered the self-administered questionnaires on adherence at M6. The proportion of nonrespondents was similar in both groups (19% vs. 16%, $p = .62$). No statistical differences were found between the 202 respondent patients and the 42 nonrespondent patients in terms of gender, age, clinical stage, antiretroviral naivete, and CD4 level. Moreover, the proportion of adherent patients at baseline was

Table 1. Baseline sociobehavioral characteristics of HAART-treated patients

	Intervention group (*n* = 123)	Control group (*n* = 121)	*p*
	n (%)	*n* (%)	
Median age [IQR]	40 [35–49]	38 [36–45]	.26[a]
Gender			
Male	87 (71%)	91 (75%)	
Female	36 (29%)	30 (25%)	.52[b]
HIV-infected by injecting drug use			
Yes	40 (33%)	35 (30%)	
No	83 (67%)	86 (70%)	.64[b]
High school graduate			
Yes	40 (32%)	36 (30%)	
No	83 (68%)	85 (70%)	.64[b]
Occupational status			
Unemployed	31 (25%)	29 (24%)	
Employed	92 (75%)	92 (76%)	.82[b]
Marital status			
Living in couple	59 (48%)	51 (42%)	
Single	64 (52%)	70 (58%)	.36[b]
Housing conditions			
Stable housing	101 (83%)	94 (78%)	
Unstable housing	21 (17%)	27 (22%)	.30[b]
Tobacco consumption[c]			
≤10 cigarettes/day	63 (53%)	62 (53%)	
>10 cigarettes/day	55 (47%)	56 (48%)	.90[b]
Alcohol consumption[c]			
≤ 1 unit/day	99 (89%)	97 (86%)	
> 1 unit/day	12 (11%)	16 (14%)	.45[b]
Opiate-dependence			
No history	83 (67%)	86 (71%)	
Ex-IDU	27 (22%)	26 (21%)	
Active IDU and/ or DMT	13 (11%)	9 (8%)	.78[b]
Median of depression CES-D scale [IQR]	20.0 [15.0–26.0]	19.0 [15.0–24.5]	.62[a]
Median number of self-reported symptoms in 4 weeks prior to M0 visit [IQR]	4.0 [2.0–7.0]	4.0 [2.0–6.0]	.98[a]

Note: IQR = interquartile range; DMT = drug maintenance treatment; M0 = baseline.
[a]Mann-Whitney test. [b]Chi-square test. [c]Incomplete number corresponds to missing values

Table 2. Baseline clinical characteristics of HAART-treated patients

	Intervention group (*n* = 123)	Control group (*n* = 121)	*p*
Characteristics	*n* (%)	*n* (%)	
CDC clinical stage			
A	65 (53%)	54 (44%)	
B	19 (15%)	31 (26%)	
C	39 (32%)	36 (30%)	.14[a]
Mean plasma HIV RNA, log copies/mL (*SD*)	2.70 (1.23)	2.63 (1.13)	.60[b]
Undetectable viral load	50 (41%)	49 (40%)	.98
Median CD4 cell count/mm^3 [IQR]	340 (170–576)	361 [214–502]	.59[c]
HAART regimen			
Protease inhibitor(s) + 2 NRTIs	102 (83%)	97 (80%)	
NNRTI + 2 NRTIs	17 (14%)	20 (17%)	
3 NRTIs	4 (3%)	4 (3%)	.84[a]
Antiretroviral naive before HAART initiation			
Yes	34 (28%)	35 (29%)	
No	89 (72%)	86 (71%)	.94[a]
Medically reported toxic adverse events at M0 consultation			
None	91 (74%)	84 (69%)	
At least one	32 (26%)	37 (31%)	.52[c]
Median duration of HAART, months [IQR]	28.6 [18.7–35.7]	26.1 [15.6–33.7]	.20[c]

Note: IQR = interquartile range; M0 = baseline.
[a]Chi-square test. [b]Student *t* test. [c]Mann-Whitney test.

similar among respondent and nonrespondent patients at M6 (61% vs. 60%, $p = .98$). However, the proportion of patients with an undetectable viral load differed between respondents (44%) and nonrespondents (26%) ($p = .03$). The proportion of patients contaminated through drug use was also higher among nonrespondents (46% vs. 28%, $p = .02$).

When nonrespondent patients at M6 were considered as nonadherent in an intent-to-treat analysis, the only significant predictor of 100% adherence at M6 was the intervention group (OR [95%CI] = 1.7 [1.0-2.8], $p = .05$) after adjustment for baseline adherence (OR [95%CI] = 2.5 [1.4-4.2], $p = .001$). When only the 202 respondent patients were considered (**Figure 1**), the proportion of those who were adherent was similar in both groups at M0 (58% vs. 63%, $p = .59$). The proportion of adherent patients became significantly higher in the IG at M6 (75% vs. 61%, $p = .04$); the increase in the proportion of adherent patients was significant in the IG (McNemar test, $p = .004$). It must be noted that in the IG the proportion of adherent patients at M6 was significantly higher among the 59 patients who had received all three sessions compared to those who had only received one or two sessions (83% vs. 63%, $p = .05$).

In both groups, a significant mean increase ($p < .001$) in CD4+ cell count was observed between M0

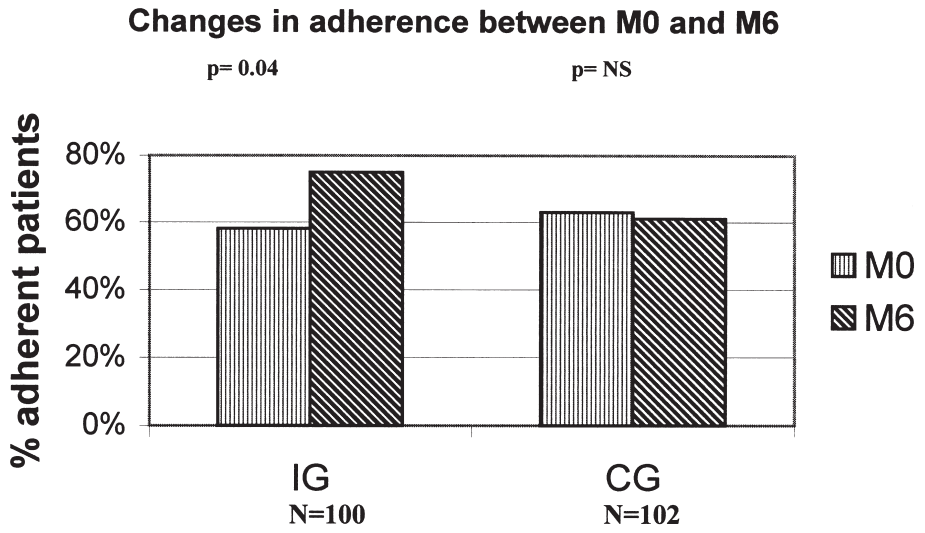

Figure 1. Changes in adherence between M0 and M6 (n = 202) in a prospective, controlled study for evaluation of an intervention to increase adherence (South–Eastern France).

and M6 (37+157 in IG and 43+142 in CG, respectively); but this increase was similar in both groups (p = .75). **Table 3** presents the results of an intent-to-treat analysis (all patients whether or not assessment of adherence was available and whether or not they followed all three sessions in the IG) that compared virological outcomes. It shows that mean HIV-1 RNA significantly decreased in patients in the IG while it increased in patients in the CG between M0 and M6, and the difference in change of HIV RNA was statistically significant between both groups.

However, the proportion of patients with an HIV-1 RNA level lower than 40 copies/mL remained similar. When a higher threshold (< 400 copies/mL) was used, the proportion of patients below this value became higher in the IG; but this difference did not reach statistical significance. Finally, in an ANCOVA model, being in the IG (p = .004), having a lower baseline viral load (p < .001), and having switched regimens between M0 and M6 were independently associated with a lower viral load at M6.

When the analysis was focused on the subgroup of patients with detectable HIV-1 RNA (40 copies/mL) at M0 (n = 146), **Table 3** shows significantly lower HIV RNA measures at M6 in the IG. In that subgroup, the proportion of patients with HIV RNA < 40 copies/mL or HIV RNA < 400 copies/mL was higher in the IG, although this difference only became significant when the higher 400 copies/mL threshold was used.

DISCUSSION

Although the number of controlled studies has remained limited, sociobehavioral interventions have been proven to be effective for increasing adherence to therapeutic regimens for various chronic illnesses.[26–28] In the pre-HAART era, it had been shown that such interventions could improve the quality of life and health status of HIV-infected patients.[29] However, to our knowledge, only one controlled study from Tuldra et al.,[7] carried out at initiation of first- or second-line prescription of HAART, had previously demonstrated that significant improvements in adherence and HIV RNA could be obtained among HIV-infected patients who received a psychoeducative intervention. Our study is the first to show similar positive results from an adherence to psychosocial and behavioral intervention in a sample of patients who were HAART treated, regardless of the timing and type of their antiretroviral therapy.

Our results point out some of the limitations of our educational and counseling intervention per se. A significant reduction of HIV RNA was obtained in patients who benefited from the intervention, particularly in patients with detectable HIV RNA (> 40 copies/mL) at baseline. This result is

Table 3. Virological outcomes at 6 months follow-up in HAART-treated patients

Total sample (*N* = 244)	Intervention group (*n* = 123)	Control group (*n* = 121)	*p*
Mean difference of HIV RNA between M6 and M0, log copies/mL (*SD*)	– 0.22 (0.86)*	+ 0.12 (0.90)**	.002[a]
Mean HIV RNA at M6, log copies/mL (*SD*) Median [IQR]	2.48 (1.16) 1.70 [1.59–3.28]	2.75 (1.34) 1.85 [1.59–3.85]	.32[a]
Patients with HIV RNA < 40 copies/mL at M6	58 (47%)	58 (48%)	1.00[b]
Patients with HIV RNA < 400 copies/mL at M6	79 (64%)	65 (54%)	.12[b]
Subsample of patients with HIV RNA > 40 copies/mL at M0 (n = 146)	**Intervention group (*n* = 73)**	**Control group (*n* = 73)**	***p***
Mean difference of HIV RNA between M6 and M0, log copies/mL (*SD*)	– 0.48 (0.96)***	+ 0.15 (1.13)****	.001[a]
Mean HIV-RNA at M6, log copies/mL (*SD*) Median [IQR]	2.99 (1.22) 3.08 [1.59–3.81]	3.49 (1.27) 3.70 [2.30–4.26]	.014[a]
Patients with HIV RNA < 40 copies/mL at M6	19 (26%)	11 (16%)	.15[b]
Patients with HIV RNA < 400 copies/mL at M6	31 (42%)	18 (25%)	.036[b]

Note: IQR = interquartile range; M6 = month 6; M0 = baseline.
[a]Mann-Whitney U test. [b]Chi-square test.
*p = .013. **p = .14. ***p < .001. ****p = .25. (Wilcoxon rank sum test)

based on an intention-to-treat analysis that takes into account the variability among patients in adherence toward the intervention itself. However, the proportion of patients who reached HIV RNA levels below 40 copies/mL was not significantly different between groups. Because data suggest that it is necessary to always take a high proportion (95% or more) of drug doses to reach and maintain undetectable HIV RNA,[3] the improvement in adherence facilitated by the intervention may not have been sufficient to obtain such complete inhibition of viral replication. This could also explain the lack of difference of CD4+ cell increase between the two groups. Although another explanation might be the well-established difference of time trends between plasma HIV RNA and CD4+ cell counts.[30]

The intervention was more effective in the subgroup of patients who completed the three planned sessions. This may be due partly to the specific design of our intervention. According to our experience with interventions in other patient groups,[31,32] our approach was implemented outside the context of the clinical interaction between the patient and his/her prescribing physician; was typically multicomponent, including both behavioral and educational elements; and was explicitly based on cognitive-behavioral models. However, our intervention was delivered through individual counseling by health care professionals (nurses) who were known by the patients to be part of the medical staff in charge of their care. Alternative designs, which use group sessions and/or peer-

driven interventions,[33] may be more successful in targeting some patients' groups, like IDUs, who seem reluctant to participate in an educational program such as ours.

The study population was rather heterogeneous and included patients who differed in previous history of antiretroviral treatment. The study sample, however, did not differ in basic characteristics from the global clientele of the clinic in which the intervention took place. Of course, because the main reason for noneligibility was participation in other clinical protocols, we cannot totally exclude the possibility that the study had selected a specific subset of patients who had more problems of adherence and who consequently had not previously been selected to participate in a clinical trial or cohort. Indeed, the consulting physician's anticipation of future good adherence is often a criterion in selecting patients for such protocols.[34] In any case, our study corresponds to the real-life situation that most clinical settings that deliver HIV care would encounter if they introduced formalized interventions about adherence.

Some limitations of this study that may affect the generalizability of our findings have to be acknowledged. First, the follow-up period was limited to 6 months. It remains to be seen if the positive effect of the intervention will persist during a longer period beyond the time of the sessions. Psychosocial research had already pointed out the dynamic character of HAART-treated patients' adherence behaviors, which are influenced by multiple factors varying over time.[31,35] To confirm the impact of educational and counseling interventions on adherence, further longer term investigation is needed. Second, this study shares with many other studies the general methodological problems related to adherence assessment based on patients' self-reports, which may be affected by social desirability and recall bias.[36] The sole use of self-report may overestimate adherence. Nevertheless, the algorithm used in this study is based on the proportion of missed doses in the previous 4 days and a set of additional categorical questions. Although this algorithm did not allow the use of adherence data as continuous measures, it minimized the risk of overestimation of adherence.[23] Furthermore, most studies of HAART-treated patients have confirmed that self-reports on adherence are reasonably reliable and correlate well with plasma PI levels[37–39] and virologic outcomes.[40,41] Moreover, we cannot exclude the possibility that social desirability could be different between groups, because patients who benefited from the intervention could be more tempted to overestimate adherence. A third limitation is the lack of information about intermediate virological measures between enrollment and the final endpoint at M6. A monthly follow-up of HIV RNA levels would have allowed a detailed analysis of the impact of each session in the IG. We cannot therefore totally exclude the possibility that attendance to sessions may not have been the sole explanation for observed changes in adherence and HIV RNA. Finally, quality assurance methods and the fidelity of the intervention are important in this type of study. Although considerable efforts were made to standardize the intervention (written scripts and manuals for the nurses), we cannot ensure that there was not some variability due to the nurse.

Despite these limitations, the controlled design of this study has guaranteed that most characteristics that could influence HIV RNA independent from the intervention itself were similar among patients enrolled in both groups. Data collection also discovered that most sociodemographic and behavioral characteristics that had been found to influence adherence[35] were similar in both randomized groups. Furthermore, the occurrence of events that could dramatically influence the outcomes at M6, such as drug toxicity or switching regimen, was also similar in both groups.

Although the generalizability of our findings needs further confirmation, our study presents evidence in favor of the feasibility and efficacy of psychosocial and behavioral interventions to increase adherence to HAART that could be easily implemented with limited additional resources in most clinical settings.

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