Published in final edited form as:
J Assoc Nurses AIDS Care. 2014 ; 25(1): 23–31. doi:10.1016/j.jana.2013.07.004.

Impact of hepatitis C treatment initiation on adherence to concomitant medications

Maria Pizzirusso, MPH [Clinical Research Coordinator],
Icahn School of Medicine at Mount Sinai, New York, NY, USA

Jenny Lin, MD [Associate Professor],
Icahn School of Medicine at Mount Sinai, New York, NY, USA

Cory Head, PhD [Associate Psychologist],
New York City Children's Center, Bronx, NY, USA

Sue M. Marcus, PhD [Associate Professor],
New York State Psychiatric Institute and Columbia College of Physicians and Surgeons, New York, NY, USA

Samia Ahmed, MBBS [Clinical Research Coordinator],
Bronx Veterans Affairs Medical Center, Bronx, NY, USA

Norbert Bräu, MD, MBA [Associate Professor], and
Bronx Veterans Affairs Medical Center and Icahn School of Medicine at Mount Sinai, Bronx, NY, USA

Jeffrey J. Weiss, PhD, MS [Associate Professor]
Icahn School of Medicine at Mount Sinai, New York, NY, USA

Abstract

Our study investigated whether initiating hepatitis C virus (HCV) treatment affected adherence to concomitant medications. Mixed effects linear regression was used to analyze data from 57 patients (29 co-infected with HIV) in a prospective study of HCV treatment-naïve patients initiating HCV treatment. Adherence was assessed using structured self-report at the time of treatment initiation, 12 weeks, and 24 weeks into treatment. There was no change in adherence to concomitant medications over the first 24 weeks of HCV treatment. There was a significant interaction effect such that the change in adherence to concomitant medications between baseline and 12 weeks differed between the HIV-infected and HIV-uninfected patients. Adherence to concomitant medications in the HIV-infected patients was found to decrease, whereas adherence in the HIV-uninfected patients was found to increase. HIV-infected patients may be more at risk for adherence problems in the first 12 weeks of HCV treatment as compared to HIV-uninfected patients.

Corresponding Author: Jeffrey J. Weiss: jeffrey.weiss@mountsinai.org.

Conflict of Interest Statement

Norbert Bräu reports having received research funding from Roche Pharmaceuticals. Jeffrey J. Weiss reports having served as a consultant for Kadmon Corporation LLC and has received research funding from Kadmon Corporation LLC and Teva Pharmaceutical Industries Ltd.

Keywords

adherence; concomitant medications; HCV; HIV; treatment initiation

Standard of care for hepatitis C virus (HCV) infection has, until recently, been a dual medication regimen, pegylated interferon (PEG-IFN) injected subcutaneously once per week and ribavirin (RBV) taken orally, usually twice daily. Although effective in eradicating HCV in some patients, both medications have significant toxicity and can result in numerous side effects including fatigue, headaches, body/muscle/joint aches and pains, depression, irritability, insomnia, diminished appetite, anemia, and neutropenia (Sulkowski et al., 2011). These side effects often require the addition of other medications to manage them and at times necessitate dose reductions or early treatment discontinuation, which decrease the chance of achieving a sustained virologic response (SVR; Mihm, Herrmann, Sarrazin, & Zeuzem, 2006). SVR is achieved when the HCV viral load (HCV RNA) remains undetectable 6 months after the completion of HCV treatment. This is commonly referred to as a cure. The medications used adjunctively to manage side effects include pain relievers, psychotropic agents to treat depression and anxiety, and growth factors (e.g., epoetin alfa, filgrastim) to treat hematologic abnormalities. Studies have reported that a quarter to more than half of patients starting treatment for HCV do not complete the full course of treatment due to side effects and toxicities (Backus, Boothroyd, Phillips, & Mole, 2007; Fumaz et al., 2007).

HCV treatment dose adherence is challenging for patients (Weiss, Brau, Stivala, Swan, & Fishbein, 2009) and patients do, at times, miss medication doses (Smith et al., 2007; Weiss et al., 2008). In addition, patients beginning HCV treatment are often already taking numerous medications for co-morbid medical conditions, such as hypertension, diabetes, hyperlipidemia, HIV infection, and psychiatric disorders (El-Zayadi, 2009; Farrell & Comiskey, 2013). Poor medication adherence to HCV treatment often results in poor health-related outcomes (e.g., inability to achieve SVR, subsequent development of cirrhosis and cancer) and increased health care costs (Katon, Cantrell, Sokol, Chiao, & Gdovin, 2005; Osterberg & Blaschke, 2005). Research on medication adherence has shown that as medication regimens become more complex (due to dosing intervals, pill burden, dietary requirements, etc.), overall medication adherence decreases (Saini, Schoenfeld, Kaulback, & Dubinsky, 2009; Stone et al., 2001).

Given the complexity of HCV treatment, documented side effects, and the addition of medications to manage these side effects, initiation of treatment for HCV may have a negative impact on adherence to other medications the patient is taking (concomitant medications). Depression is a known risk factor for medication non-adherence (DiMatteo, Lepper, & Croghan, 2000). Given that depression is a common side effect of HCV treatment, the risk for non-adherence to concomitant medications is further increased while on HCV treatment. Our study examined whether the initiation of HCV treatment would impact adherence to concomitant medications. We also investigated whether HIV/HCV-co-infected patients differed from HCV-mono-infected patients in this respect. Data collected in a prospective study of treatment-naïve patients initiating HCV treatment were used to explore these aims. We hypothesized that: (a) adherence to concomitant medications would decrease during the course of HCV treatment, and (b) HIV/HCV-co-infected patients would have less decrement in adherence during HCV treatment than HCV-mono-infected patients.

Method

Study Design and Population

Adult patients due to initiate HCV treatment with PEG-IFN/RBV were enrolled in the study if: (a) they were HCV-treatment naïve and (b) their primary language was English or Spanish. Patients were excluded from participation if they had previously received a liver transplant. Patients who were co-infected with HIV were included in the study. Subjects were recruited from three clinical sites at a major academic medical center in New York City and from an affiliated Veterans Affairs Medical Center.

A total of 102 patients who were about to initiate HCV treatment were recruited for participation in this study. Of these 102 subjects, 78 initiated treatment as planned and were followed longitudinally during treatment. For the purposes of our study, longitudinal adherence data were defined as data consisting of a baseline adherence score for a specific medication accompanied by adherence score(s) at another time interval (i.e., 12 and/or 24 weeks) for the same medication. Of the 78 subjects who began treatment, 57 had longitudinal adherence data for at least one of the three medication categories. The other 21 subjects were followed longitudinally in the study, but they did not have longitudinal adherence data for the following reasons: 15 were not on any concomitant medications at baseline and 6 subjects were on concomitant medications at baseline but these were discontinued or changed to a different medication prior to the 12-week interval. We report data on the 57 subjects with longitudinal adherence data.

Ethical Considerations

The institutional review boards of the Icahn School of Medicine at Mount Sinai and the Bronx Veterans Affairs Medical Center approved all study procedures. All participants signed a voluntary informed consent form.

Study Assessments

Study subjects were seen for three study evaluations: (a) within the 2 weeks prior to the initiation of HCV treatment, (b) 12 weeks after HCV treatment initiation, and (c) 24 weeks after HCV treatment initiation. Adherence to all concomitant medications was assessed at all three time points using structured self-report. Subjects were administered a 0–100 visual analog scale (VAS) and asked to estimate adherence to each medication in their prescribed regimen (including HCV medications) for the previous 4 weeks (Giordano, Guzman, Clark, Charlebois, & Bangsberg, 2004). The VAS adherence measure has been validated in numerous studies (Buscher, Hartman, Kallen, & Giordano, 2011; Giordano et al., 2004; Nau et al., 2007). Subjects were also administered the Beck Depression Inventory-II (BDI-II) during each assessment to evaluate the presence of depressive symptoms.

Calculation of Adherence Scores

For the purposes of these analyses, concomitant medications were grouped into the following three broad categories: *psychotropic medications, HIV antiretroviral (ARV) medications,* and *other medications*. There were too few subjects to do more detailed analyses of specific medication categories such as antihypertensives. The average adherence in each category was calculated by adding all individual scores for each medication in the category and dividing the sum by the number of medications in the category. Additionally, the composite overall adherence of concomitant medication was calculated to capture medication adherence across all medications.

Only patients with longitudinal adherence data were included in these analyses. Medications that were currently prescribed at each interval were used in the calculation of the composite

scores. Total burden of illness was assessed using the Charlson Comorbidity Index (CCI; Charlson, Pompei, Ales, & MacKenzie, 1987; Deyo, Cherkin, & Ciol, 1992), a weighted index that assessed the number of comorbid conditions as well as the individual's age. The CCI was modified for the purposes of this study, such that HIV-infected subjects were assigned a score of 1 for HIV infection rather than 6 for AIDS given the dramatic changes in mortality due to HIV that have occurred since the CCI was developed.

Statistical Analyses

Statistical analyses employed in this study included descriptive statistics and mixed effects models. Mixed effects models were used to examine changes in adherence over time. All statistics were computed using the Statistical Package for Social Sciences (Version 19) and SuperMix.

Results

Sample Characteristics

Table 1 provides the demographic characteristics of our sample. Of the 57 subjects, 46 were male (80.7%); 22 were Caucasian (38.6%), 19 were African American (33.3%), and 16 were Hispanic (28.1%). The mean age was 52.1 years (*SD* = 11.1), and 29 (50.9%) were co-infected with HIV. The mean HCV viral load prior to treatment initiation was 6.22 $\log_{10}$ IU/mL (SD = 0.85). Eighty-four percent (*n* = 48) of subjects had either HCV genotype 1 or 4, and 16% (*n* = 9) had either HCV genotype 2 or 3. Mean $CD4^+$ T cell count for HIV-infected subjects was 452 cells/mm^3 (*SD* = 241) and all HIV-infected subjects had an undetectable HIV viral load (< 400 copies/mL). Subjects had a mean CCI score of 3.3 (*SD* = 1.4). Table 2 illustrates the total medication burden among the 57 subjects at baseline. The median number of concomitant medications in the 57 subjects' baseline regimen was 6 (range = 1 – 17).

The 57 subjects with longitudinal data differed at baseline from the 21 subjects without longitudinal adherence data. Subjects with longitudinal data were more likely to be co-infected with HIV (51% vs. 14%; $p < 0.05$), had HCV genotype 1 or 4 (84% vs. 62%; $p < 0.05$), and had a higher mean number of comorbid medical conditions other than HIV (1.8 vs. 0.8; $p < 0.05$).

The 29 HIV-infected subjects differed in some ways at baseline from the 28 HCV-mono-infected subjects: HIV-infected subjects were younger (mean age of 48.4 vs. 55.8; $p = .01$) and less depressed (mean BDI-II 6.8 vs. 14.1; $p = .01$) than HCV-mono-infected subjects. The HIV-infected subjects were not on more concomitant medications at baseline (mean = 4.6) than HCV-mono-infected subjects (mean 5.2; $p = .51$). The percentage of HIV-infected subjects who completed 24 weeks of HCV treatment (66%) did not differ from that of HCV-mono-infected subjects (57%; $p = .59$).

Rates of Adherence During HCV Treatment

Table 3 provides the mean self-reported adherence to medications across all four categories. The mean self-reported adherence to PEG-IFN/RBV on the VAS for subjects who remained on treatment at weeks 12 and 24 was extremely high. At week 12, subjects reported a mean adherence in the previous 4 weeks to PEG-IFN of 97.9% and to RBV of 96.7%. At week 24, subjects reported a mean adherence in the previous 4 weeks to PEG-IFN of 98.4% and a mean adherence to RBV of 97.3%

Of the 57 subjects, 22 (39%) discontinued HCV treatment prior to week 24 (secondary to treatment side effects [*n* = 18] or lack of virologic response [*n* = 4]). Of the 57 subjects, 25

were prescribed growth factors during the course of treatment (16 added epoetin alfa, 1 added filgrastim, and 8 added both). Eight subjects were prescribed psychotropic medications (antidepressants, anxiolytics, or antipsychotics) during the course of treatment to manage psychiatric side effects.

In cases where subjects were on more than one medication at any given time point and did not report 100% adherence for all medications (n = 22/57), it was more common for subjects to report variability in adherence ratings than for them to assign the same adherence rating to all medications (i.e., 14/22 subjects had variability in adherence reports). The variability in adherence reports to different medications have suggested sensitivity to assessing adherence with the VAS in this sample.

Changes in Adherence During HCV Treatment

T-tests were used to compare changes in adherence to concomitant medications between the subjects (n = 11) who discontinued treatment prior to week 12 to those who completed 12 weeks of treatment (n = 46). No differences were found between the groups for adherence to psychotropic, ARV, other, or overall Medications (all p values > 0.05). Similarly, no differences were found in changes in adherence between baseline and 24 weeks between those who discontinued treatment prior to week 24 (n = 22) and those who completed 24 weeks of treatment (n = 35).

We used mixed effects linear regression of Overall Adherence as a function of two time dummy variables (= 1 for 12 weeks, = 0 otherwise; t24 = 1 for 24 weeks, = 0 otherwise), one group dummy variable (HIV = 1 for HIV-infected, = 0 otherwise), and the two time-by-group interactions (t12*HIV, t24*HIV). This model can account for clustering of the 3 repeated measures (at baseline, 12 weeks, and 24 weeks) within each individual (Gibbons et al., 1993) and can incorporate data from subjects who may have one or more missing observations as mixed effects models using maximum likelihood estimation provide valid inferences in the presence of ignorable non-response (Laird, 1988). Only the t12*HIV interaction term was significant in this regression ($Z = -2.56$; p = .01), indicating that the change in overall adherence to concomitant medications between baseline and 12 weeks differed between the HIV-infected and uninfected groups (see Table 4).

Discussion

We prospectively investigated adherence to concomitant medications in a real-world sample of patients who were beginning HCV treatment for the first time. We did not find that adherence to concomitant medications decreased overall in patients who initiated HCV treatment. Patients' self-reported high rates of adherence at baseline were maintained throughout HCV treatment. Patients on treatment for HCV are closely medically monitored during treatment, which might explain the maintenance of high adherence rates to comorbid medications throughout treatment. In our sample, patients saw a medical provider an average of 5 times during the first 12 weeks of treatment and an average of 3 times during the subsequent 12 weeks.

There was an interaction effect between HIV status and overall adherence during the first 12 weeks of treatment. We found that being HIV infected predicted a decline in adherence during the baseline to 12-week interval relative to HCV-mono-infected patients who had an improvement in concomitant medication adherence. HIV-infected patients had higher levels of global adherence at baseline (mean = 95.8) as compared to the HCV-mono-infected patients (mean = 91.4; p = .17), and this difference in change in adherence may simply have reflected a regression to the mean. Alternately, there may have been a reason why adherence patterns of the two groups differed during the first 12 weeks of HCV treatment. Given that

the HCV-mono-infected patients had higher levels of depression at baseline than did the HIV-infected patients, it was unexpected and particularly noteworthy that the adherence to concomitant medications of the HCV-mono-infected patients improved over the first 12 weeks of HCV treatment. A possible explanation for this finding was that patients without HIV infection were less accustomed to frequent medical monitoring than HIV-infected patients and were, therefore, more likely to show an adherence response to the high intensity of medical attention they received during the first 12 weeks of HCV treatment. The patients studied had a high number of comorbid medical illnesses and concomitant medications. The finding applies only to our group of patients and warrants further investigation in larger samples of diverse patient populations.

In a study of patients on antidepressants and medication for comorbid medical conditions, Katon et al. (2005) found a positive association between antidepressant adherence and adherence to medications for chronic comorbid diseases. Subjects in our study exhibited satisfactory levels of adherence to prescribed psychotropic medications (i.e., mean above 80%) at the 24-week interval. It is possible that adherence to psychotropic medications served as a protective factor against non-adherence to concomitant medications in our sample.

Recent research and drug development have focused on creating targeted therapies that inhibit HCV proteins that are essential for intracellular replication (Bacon et al., 2011; Bacon & Khalid, 2011). The first generation of protease inhibitors used to treat HCV has demonstrated improvement in SVR rates when combined with PEG-IFN/RBV treatment over PEG-IFN/RBV alone (Bacon et al., 2011). However, it has been demonstrated that addition of these agents adds to the well-documented toxicities of PEG-INF and RBV (Hezode et al., 2009; McHutchison et al., 2010; Poordad et al., 2011; Thompson & McHutchison, 2009) as well as to the adherence burden (Weiss, Alcorn, Rabkin, & Dieterich, 2012), given that the two new HCV protease inhibitors are prescribed to be taken three times daily with food.

Furthermore, due to drug interactions, it is at times necessary to make changes in a patient's existing medication regimen prior to initiating treatment with an HCV protease inhibitor, adding further complexity to adherence challenges. Future research should focus on the potential impact these new agents may have, not only on a participant's ability to adhere to the HCV regimen but also to their concomitant medications as well.

A major limitation of our study was that the measurement of adherence was restricted to self-report, which is well known to overestimate actual adherence (Liu et al., 2001). Future studies should use more rigorous methods of assessing adherence such as electronic monitoring, pharmacy refill data, or pill counts. Other limitations of this study included the small sample size, the limited number of patient evaluations during the 24-week period, and that our study design did not allow for evaluation of medication adherence at the specific time of discontinuation of HCV treatment. Future studies should examine the effect of early HCV treatment discontinuation on overall medication adherence.

We observed a decrease in ARV adherence in HIV-infected participants between the baseline and 12-week interval. It should be noted that the mean adherence in this subsample did remain above 90% across the interval and that this level of adherence may be deemed adequate in clinical practice. It is possible that the small sample size hindered the observation of a more dramatic decline in adherence. Future studies should be conducted using larger samples to more accurately assess decreases in adherence.

Conclusion

In conclusion, in the setting of HCV care, the clinical focus is most often on patient adherence to the HCV regimen and not on adherence to concomitant medications. While evidence exists to support that the comorbid medication burden negatively impacts adherence to long-term therapies (for hypertension and hyperlipidemia, for example; Benner et al., 2009), this study investigated this concern for time-limited HCV treatment. We were reassured to find that, in our population of HCV-treatment naïve patients receiving intensive on-treatment monitoring, the initiation of HCV treatment did not appear to adversely impact adherence to concomitant medications in the overall sample. Future research should focus on HCV treatment adherence in the context of a patient's comorbid illnesses and concomitant medications and should assess overall health-related outcomes resulting from poor adherence as well as the specific role of HIV-co-infection in this process.

Acknowledgments

This study was funded by the National Institute of Mental Health of the National Institutes of Health, grant number MH071177. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institute of Mental Health or the National Institutes of Health.

References

Backus LI, Boothroyd DB, Phillips BR, Mole LA. Predictors of response of US veterans to treatment for the hepatitis C virus. Hepatology. 2007; 46(1):37–47.10.1002/hep.21662 [PubMed: 17567830]

Bacon BR, Gordon SC, Lawitz E, Marcellin P, Vierling JM, Zeuzem S, Esteban R. Boceprevir for previously treated chronic HCV genotype 1 infection. New England Journal of Medicine. 2011; 364(13):1207–1217.10.1056/NEJMoa1009482 [PubMed: 21449784]

Bacon BR, Khalid O. New therapies for hepatitis C virus infection. Missouri Medicine. 2011; 108(4): 255–259.10.186/595848 [PubMed: 21905441]

Benner JS, Chapman RH, Petrilla AA, Tang SS, Rosenberg N, Schwartz JS. Association between prescription burden and medication adherence in patients initiating antihypertensive and lipid-lowering therapy. American Journal of Health-System Pharmacy. 2009; 66(16):1471–1477.10.2146/ajhp080238 [PubMed: 19667004]

Buscher A, Hartman C, Kallen MA, Giordano TP. Validity of self-report measures in assessing antiretroviral adherence of newly diagnosed, HAART-naive, HIV patients. HIV Clinical Trials. 2011; 12(5):244–254.10.1310/hct1205-244 [PubMed: 22180522]

Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: Development and validation. Journal of Chronic Diseases. 1987; 40(5):373–383.10.1016/0021-9681(87)90171-8 [PubMed: 3558716]

Deyo RA, Cherkin DC, Ciol MA. Adapting a clinical comorbidity index for use with ICD-9-CM administrative databases. Journal of Clinical Epidemiology. 1992; 45(6):613–619.10.1016/0895-4356(92)90133-8 [PubMed: 1607900]

DiMatteo MR, Lepper HS, Croghan TW. Depression is a risk factor for noncompliance with medical treatment: Meta-analysis of the effects of anxiety and depression on patient adherence. Archives of Internal Medicine. 2000; 160(14):2101–2107.10.1001/archinte.160.14.2101 [PubMed: 10904452]

El-Zayadi AR. Hepatitis C comorbidities affecting the course and response to therapy. World Journal of Gastroenterology. 2009; 15(40):4993–4999.10.3748/wjg.15.4993 [PubMed: 19859990]

Farrell G, Comiskey C. Dualities of living with HIV/HCV co-infection: Patients' perspectives from those who are ineligible for or nonresponsive to treatment. Journal of the Association of Nurses in AIDS Care. 2013 Advance Online Publication. 10.1016/j.jana.2012.10.005

Fumaz CR, Munoz-Moreno JA, Ballesteros AL, Paredes R, Ferrer MJ, Salas A, Clotet B. Influence of the type of pegylated interferon on the onset of depressive and neuropsychiatric symptoms in HIV-HCV coinfected patients. AIDS Care. 2007; 19(1):138–145.10.1080/09540120600645539 [PubMed: 17129869]

Gibbons RD, Hedeker D, Elkin I, Waternaux C, Kraemer HC, Greenhouse JB, Watkins JT. Some conceptual and statistical issues in analysis of longitudinal psychiatric data. Application to the NIMH treatment of Depression Collaborative Research Program dataset. Archives of General Psychiatry. 1993; 50(9):739–750.10.1001/archpsyc.1993.01820210073009 [PubMed: 8357299]

Giordano TP, Guzman D, Clark R, Charlebois ED, Bangsberg DR. Measuring adherence to antiretroviral therapy in a diverse population using a visual analogue scale. HIV Clinical Trials. 2004; 5(2):74–79.10.1310/JFXH-G3X2-EYM6-D6UG [PubMed: 15116282]

Hezode C, Forestier N, Dusheiko G, Ferenci P, Pol S, Goeser T, Zeuzem S. Telaprevir and peginterferon with or without ribavirin for chronic HCV infection. New England Journal of Medicine. 2009; 360(18):1839–1850.10.1056/NEJMoa0807650 [PubMed: 19403903]

Katon W, Cantrell CR, Sokol MC, Chiao E, Gdovin JM. Impact of antidepressant drug adherence on comorbid medication use and resource utilization. Archives of Internal Medicine. 2005; 165:2497–2503.10.1001/archinte.165.21.2497 [PubMed: 16314547]

Laird NM. Missing data in longitudinal studies. Statistics in Medicine. 1988; 7(1–2):305–315.10.1002/sim.4780070131 [PubMed: 3353609]

Liu H, Golin CE, Miller LG, Hays RD, Beck CK, Sanandaji S, Wenger NS. A comparison study of multiple measures of adherence to HIV protease inhibitors. Annals of Internal Medicine. 2001; 134(10):968–977.10.7326/0003-4819-134-10-200105150-00011 [PubMed: 11352698]

McHutchison JG, Manns MP, Muir AJ, Terrault NA, Jacobson IM, Afdhal NH, Di Bisceglie AM. Telaprevir for previously treated chronic HCV infection. New England Journal of Medicine. 2010; 362(14):1292–1303.10.1056/NEJMoa0908014 [PubMed: 20375406]

Mihm U, Herrmann E, Sarrazin C, Zeuzem S. Predicting response in hepatitis C virus therapy. Alimentary Pharmacology & Therapeutics. 2006; 23(8):1043–1054.10.1111/j.1365-2036.2006.02863.x [PubMed: 16611264]

Nau DP, Steinke DT, Williams LK, Austin R, Lafata JE, Divine G, Pladevall M. Adherence analysis using visual analog scale versus claims-based estimation. The Annals of Pharmacotherapy. 2007; 41(11):1792–1797.10.1345/aph.1K264 [PubMed: 17925497]

Osterberg L, Blaschke T. Adherence to medication. New Englnd Journal of Medicine. 2005; 353(5):487–497.10.1056/NEJMra050100

Poordad F, McCone J Jr, Bacon BR, Bruno S, Manns MP, Sulkowski MS, Bronowicki JP. Boceprevir for untreated chronic HCV genotype 1 infection. New England Journal of Medicine. 2011; 364(13):1195–1206.10.1056/NEJMoa1010494 [PubMed: 21449783]

Saini SD, Schoenfeld P, Kaulback K, Dubinsky MC. Effect of medication dosing frequency on adherence in chronic diseases. American Journal of Managed Care. 2009; 15(6):E22–E33. [PubMed: 19514806]

Smith SR, Wahed AS, Kelley SS, Conjeevaram HS, Robuck PR, Fried MW. Assessing the validity of self-reported medication adherence in hepatitis C treatment. The Annals of Pharmacotherapy. 2007; 41(7):1116–1123.10.1345/aph.1K024 [PubMed: 17519299]

Stone VE, Hogan JW, Schuman P, Rompalo AM, Howard AA, Korkontzelou C, Smith DK. Antiretroviral regimen complexity, self-reported adherence, and HIV patients' understanding of their regimens: Survey of women in the HER study. Journal of Acquired Immune Deficiency Syndromes. 2001; 28(2):124–131. [PubMed: 11588505]

Sulkowski MS, Cooper C, Hunyady B, Jia J, Ogurtsov P, Peck-Radosavljevic M, Dalgard O. Management of adverse effects of Peg-IFN and ribavirin therapy for hepatitis C. Nature Reviews Gastroenterology & Hepatology. 2011; 8(4):212–223.10.1038/nrgastro.2011.21

Thompson AJ, McHutchison JG. Investigational agents for chronic hepatitis C. Alimentary Pharmacology & Therapeutics. 2009; 29(7):689–705.10.1111/j.1365-2036.2009.03927.x [PubMed: 19183149]

Weiss JJ, Alcorn MC, Rabkin JG, Dieterich DT. The critical role of medication adherence in the success of boceprevir and telaprevir in clinical practice. Journal of Hepatology. 2012; 56(2):503–504.10.1016/j.jhep.2011.05.014 [PubMed: 21718669]

Weiss JJ, Bhatti L, Dieterich DT, Edlin BR, Fishbein DA, Goetz MB, Wagner GJ. Hepatitis C patients' self-reported adherence to pegylated interferon and ribavirin. Alimentary Pharmacology & Therapeutics. 2008; 28(3):289–293.10.1111/j.1365-2036.2008.03718.x [PubMed: 19086329]

Weiss JJ, Brau N, Stivala A, Swan T, Fishbein D. Adherence to medication for chronic hepatitis C - building on the model of human immunodeficiency virus antiretroviral adherence research. Alimentary Pharmacology & Therapeutics. 2009; 30(1):14–27.10.1111/j.1365-2036.2009.04004.x [PubMed: 19416131]

Table 1

Study Sample Characteristics

	Subjects with Longitudinal Data (*n* = 57)
Mean Age (SD)	52.1 years (11.1)
Gender, *n* (%)	
Male	46 (80.7)
Female	11 (19.3)
Mean HCV Viral Load (log_{10} IU/mL, SD)	6.22 (0.85)
HIV diagnosis, *n* (%)	29 (50.9)
Race, *n* (%)	
Black	19 (33.3)
Hispanic	16 (28.1)
White	22 (38.6)
HCV Genotype, *n* (%)	
Type 1 or 4	48 (84.2)
Type 2 or 3	9 (15.8)
Stage of Liver Disease, *n* (%)	
No biopsy/staging done	7 (12.3)
1–2 (no bridging fibrosis/cirrhosis)	22 (38.6)
3–4 (bridging fibrosis/cirrhosis)	28 (49.1)
CCI Score[a]	3.25 (1.4)

Note. HCV = hepatitis C virus; CCI = Charlson Comorbidity Index.

[a]Calculated using the Charlson Comorbidity Index (CCI) with modification for HIV-infection (score of 1)

Table 2

Number of Concomitant Medications at Study Baseline

Number of Medications	*N*	Percent
1	3	5.3
2	4	7.0
3	5	8.8
4	11	19.3
5	3	5.3
6	9	15.8
7 or more	22	38.5

Table 3

Subject Adherence Rates

	N	Mean Adherence	Standard Deviation	Range
Overall Adherence Baseline	57	93.65	12.02	40–100
Overall Adherence 12-weeks	53	93.59	12.17	40–100
Overall Adherence 24-weeks	48	95.85	6.92	68.5–100
Psychotropic Baseline	24	91.42	14.60	40–100
Psychotropic 12-weeks	22	92.73	15.18	50–100
Psychotropic 24-weeks	20	91.50	16.31	50–100
ARV Baseline	26	95.91	10.16	50–100
ARV 12-weeks	24	92.28	15.58	40–100
ARV 24-weeks	25	96.61	6.43	80–100
Other Baseline	45	94.25	11.55	40–100
Other 12-weeks	40	96.35	8.47	60–100
Other 24-weeks	35	96.78	8.50	65–100
PEG-INF Adherence 12-weeks	47	97.87	7.05	75–100
PEG-INF Adherence 24-weeks	31	98.39	8.98	50–100
RBV Adherence 12-weeks	47	96.70	7.42	70–100
RBV Adherence 24-weeks	31	97.26	7.73	60–100

Note. ARV = antiretroviral; PEG-INF = pegylated interferon; RBV = ribavirin.

Table 4

Linear Regression on Overall Adherence

Variable	Estimate	SE	Z-value	*p*-value
Intercept	91.38889	2.01159	45.43112	< 0.00001
T12	3.46188	2.05858	1.68168	0.09263
T24	4.16825	2.19109	1.90237	0.05712
T12*HIV	−7.31026	2.84854	−2.56632	0.01028
T24*HIV	−3.61084	2.96220	−1.21897	0.22285
HIV	4.44559	2.82019	1.57635	0.11495