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Hepatitis C treatment completion rates in routine clinical care

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Abstract

Background—Treatment completion rates for hepatitis C virus (HCV) infection in clinical practice settings are unknown.

Methods—We assembled a national cohort of HCV-infected veterans-in-care from 1998 to 2003, using the VA National Patient Care Database for demographical/clinical information, Pharmacy Benefits Management database for pharmacy records and the Decision Support Systems database for laboratory data. We used logistic regression to determine the factors predicting treatment non-completion for HCV.

Results—We identified 134 934 HCV-infected veterans of whom 16 043 [11.9%; 95% confidence interval (CI) 11.7–12.1] were prescribed treatment for HCV. Among the 10 641 veterans with > 1 year of follow-up, 2396 (22.5%; 95% CI 21.7–23.3) completed a 48-week course. Non-completers were more likely to have pre-treatment anaemia, coronary artery disease, depression, substance abuse, used standard interferon, higher comorbidity count, and been treated at a low-volume treatment site (defined as sites initiating HCV treatment for < 200 individuals). In multivariable analyses, treatment completion was positively associated with pegylated interferon use [odds ratio (OR) 1.59, 95% CI 1.40–1.80] and site treatment volume (OR 1.87, 95% CI 1.56–2.24 for sites initiating treatment for > 200 individuals) and negatively associated with pre-treatment anaemia (OR 0.68, 95% CI 0.58–0.80 for haemoglobin 10–14 g/dl) and depression (OR 0.78, 95% CI 0.69–0.89). Human immunodeficiency virus coinfection and minority race were not associated with failing to complete treatment.

Conclusions—Among veterans-in-care with known HCV, 11.9% initiate therapy of whom 22.5% (one in five with known HCV infection) complete a 48-week course of treatment. Higher completion rates among higher volume treatment sites suggest that some factors associated with non-completion (pre-treatment depression and anaemia), may be modifiable with experience.

Keywords

anaemia; depression; hepatitis C; HIV infection; pegylated interferon; practice variation; treatment completion

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Although effective pharmacological therapy for hepatitis C virus (HCV) infection is now available (1–5), only a minority of HCV-infected persons are offered treatment for HCV (6–9). We have previously shown that only 11.8% of HCV monoinfected (6) and 7.2% of HCV–human immunodeficiency virus (HIV)-coinfected (9) veterans ever initiate treatment for HCV. Non-treatment is associated with increasing age, minority race, actual and provider perception of patients' non-adherence, presence of medical and psychiatric comorbidities and alcohol and drug abuse and dependence (6–13). In clinical practice, one reason for failure to initiate HCV treatment may be the impression that the patient will not be able to complete a course of therapy. This possibility is supported by our prior finding that patients deemed 'non-adherent' are less likely to initiate HCV therapy. In clinical trials, 12–14% of HCV-infected persons on treatment discontinue treatment because of adverse events or other reasons (1, 3). However, subjects recruited to clinical trials are carefully screened and their adherence to therapy closely supported. Rates of treatment completion and factors that predict completion in clinical practice settings are not well known. In one small single site study, only 69 of the 130 veterans (53%) completed a full course of treatment (14), while in another study, only 56% of the 380 patients with genotype 1 infection completed a 48-week course of treatment (15). It is important to determine rates of treatment completion in actual clinical settings and the factors that predict completion so that effective intervention strategies may be developed to optimize the routine management of HCV infection.

The Veterans Health Administration Healthcare System (VA) is a unique setting for observational and outcomes studies because of the availability of centralized electronic medical records, ability to follow patients at different VA facilities nationwide, absence of financial incentives (or disincentives) in making treatment decisions and the large number of subjects that can be studied over prolonged periods of time (16). For observational and outcomes research in HCV-infected persons, the VA provides all these advantages, as well as having a large sample size that overcomes concerns about statistical power that might be a problem in randomized clinical trials or smaller, geographically limited studies. We used the Electronically Retrieved Cohort of Hepatitis C Infected Veterans (ERCHIVES), to specifically determine the proportion of HCV-infected veterans who complete a 48-week and 24-week course of treatment among those who were initiated on treatment, and factors associated with completing treatment. We hypothesized that presence of comorbidities at baseline and experience in treating patients would be associated with higher treatment completion rates. While our study time was between 1998 and 2003, and treatment for HCV and management of adverse events may have improved over time with increasing provider experience, we believe that our study still provides important data on this topic.

Methods

The ERCHIVES was assembled from the VA National Patient Care (NPCD) database, the VA Pharmacy Benefits Management (PBM) data and the Decisions Support System (DSS) database between VA fiscal years (FY) 1998–2003 (1 October 1997 through 30 September 2003) (Fig. 1). ERCHIVES is a well-established cohort of HCV-infected veterans and HCV-uninfected controls, and its creation has been described in previous publications (6, 9, 17–20). Briefly, we retrieved demographical and clinical data from the National Patient Care Database, laboratory data from the Decisions Support System, pharmacy data from the Pharmacy Benefits Management database and mortality data from the Beneficiary Information Records Locator System. HCV-infected persons were initially identified based on ICD-9 codes and HCV-uninfected controls were chosen matched on age, race, gender and year of entry into the VA healthcare system. Data from all above sources were merged to form a composite cohort of HCV-infected persons and HCV-uninfected matched controls.

Demographical and clinical data were extracted from the NPCD. The utility and accuracy of the VA administrative and PBM data has been reported previously by our group and others (9, 21–26). The NPCD contains hospitalization records including discharge diagnoses from 1970 onwards. The discharge diagnoses are coded according to the Clinical Modification of International Classification of Diseases, 9th revision (ICD-9-CM). From 1997 onwards, the NPCD also contains outpatient visit records, including diagnoses and clinic visits. The validity of ICD-9 codes have been tested previously for a range of comorbid conditions, and sensitivity, specificity and agreement (κ -values) have been found to correlate well with chart abstractions (22, 25, 27, 28). The PBM database contains records of all medications prescribed to the veterans by any of the VA pharmacies, including the dose, amount and duration prescribed. The DSS database contains selected labs collected from 2000 onwards during routine clinical care of veterans.

For our study, HCV infection was initially identified based on presence of any ICD-9 code for HCV. This was refined to include subjects with at least one inpatient or two outpatient codes. The utility of using at least two outpatient or one inpatient ICD-9 code has been described before (6, 25, 27, 28). Comorbid diagnoses were also retrieved using ICD-9 codes, and subjects were considered to have a comorbid condition if at least one inpatient or two outpatient codes were identified on two separate visits at any time before first prescription date and up to 14 days after. The 14-day post-treatment window was added to account for any delay in diagnosis and coding of these conditions. All comorbidities were retrieved at the creation of ERCHIVES, and we retained clinically relevant comorbidities for our analyses. Diagnosis of anaemia was based on the haemoglobin value preceding and closest to initiation of treatment, and was categorized as 'no anaemia' (haemoglobin > 14 g/dl), 'mild/moderate' (haemoglobin > 10 to < 14 g/dl) and 'severe' (haemoglobin < 10 g/dl). If more than one haemoglobin values were recorded on the same date, the mean of the values was used. Data retrieved from the PBM included prescription of interferon- α , pegylated interferon- α , ribavirin and combinations of either type of interferon with ribavirin. Dates of all prescriptions written, dosages prescribed, the cumulative duration of prescription and the number of refills were obtained. The doses of interferon generally used in the treatment of HCV were retained, whereas high dose interferon- α therapy (> 5 million units per dose given > 3 times per week) was excluded because such high doses of interferon are not the standard doses used to treat HCV infection.

Prescription for HCV was defined as having received a prescription for interferon- α , pegylated interferon- α or a combination of either with ribavirin for any duration of time using the dosing described above. If a subject was prescribed multiple courses of treatment, only the first treatment course was counted. A maximum of 30 days of treatment interruption was allowed to account for transient adverse effects, intolerance or inability to pick up a prescription for any other reason. Because 79–87% of the HCV-infected veterans are infected with genotype 1 (12, 29, 30), for which 48 weeks of treatment is generally recommended (31), we defined a full course of treatment for HCV as 48 weeks of continuous treatment (with the 30-day interruption allowed, as stated above). The duration of treatment was calculated by using the total number of days the aforementioned treatment was prescribed. Because a 24-week course of treatment is recommended for those with genotype 2/3 infection, and because we did not have complete genotype data, we also determined the proportion of subjects who completed a 24-week course of treatment as a secondary outcome.

The lab values retrieved from the DSS included HCV antibody, HCV RNA, haemoglobin and alanine and aspartate aminotransferase levels. These values have been included in the DSS database from 2000 onwards. To validate the DSS data, we compared data collected in DSS and the Immunology Case Registry (ICR) for 22 647 HIV-positive veterans with an in

or outpatient visit in FY 2002 for nine laboratory tests. For six of the nine laboratory tests, DSS provided laboratory values on more individuals. Overlapping results were nearly perfectly correlated (A. C. Justice, personal communication). We conducted analyses on all HCV-infected persons who were diagnosed on the basis of ICD-9 codes as described above as well as those subjects in whom the diagnosis was confirmed by HCV antibody test or presence of HCV RNA. We did not analyse data separately for HCV RNA-positive vs. HCV RNA-negative subjects because it is assumed that only HCV RNA-positive persons would be prescribed treatment. The overall treatment completion rates were similar in both groups, and in this report we present data on all HCV-infected persons based on ICD-9 codes.

To assess temporal trends, we analysed completion rates per year and by type of interferon used. To assess whether treatment completion rates varied by the number of subjects treated at each site, we created a variable for station size that represents the number of unique HCV-infected subjects who initiated treatment and had at least 1 year of follow-up at each station during our analysis time frame. We categorized station size into eight categories, ranging from < 15 subjects to > 250 subjects initiated on treatment. Treatment completion rates were stable across sites where < 200 subjects were initiated on treatment, so we chose a cutoff of 200 subjects for the bivariate and multivariable model. Additionally, because pegylated interferon- α is currently the standard of care in treatment of HCV-infected persons, we also performed our analysis on the subset who received pegylated interferon alone.

The demographical characteristics were compared using the χ^2 or the t -test as appropriate. We used univariable and multivariable logistic regression analysis to determine the predictors of treatment for HCV in all identified subjects. Logistic regression analyses were conducted on the full dataset and repeated for those who had a confirmed diagnosis of HCV based on HCV antibody test or HCV RNA and for those in whom all clinical as well as lab data were available. Because the results were very similar in all models, we report data on HCV-infected subjects diagnosed using the ICD-9 codes as defined above. For the logistic regression model we report data on subjects with complete laboratory data. We used STATA® (version 9.2, College Station, TX, USA) for statistical analyses.

Sensitivity analyses

Using multivariate logistic analyses, we conducted sensitivity analyses around our choice of treatment completion endpoint (24 vs. 48 weeks) and our selection of HCV treatment (either pegylated interferon or standard therapy). We also conducted analyses restricted to those with HCV diagnoses validated by laboratory data.

Results

We identified 171 660 veterans from VA FY 1998–2003 with at least one ICD-9 diagnostic code for HCV. Of these, 134 934 subjects had at least one inpatient or two outpatient codes for HCV. Treatment was prescribed to 16 043 (11.9%) subjects. Among the 10 641 subjects who had at least 1 year of follow-up, only 2396 (22.5%) completed a 48-week course of treatment (Fig. 2). Overall, 40.1% received < 24 weeks, and 37.4% received between 24 and 48 weeks of treatment. The baseline characteristics and comparison between completers (48-week or 24-week course) and non-completers are reported for the 10 641 subjects prescribed treatment and with at least 1 year of follow-up (Tables 1–3). The mean age was 49.6 years [standard deviation (SD) 6.4] and the majority was white (57.6%) and male (96.2%) (Table 1). Pegylated interferon was used in 26.9% of the subjects, and the mean duration of treatment was 29.0 weeks (SD 20.0). A comparison between those who completed a 48-week course of treatment and non-completers is provided in Table 2, and a similar comparison between those who completed a 24-week course and non-completers is provided in Table 3. The rates of treatment completion by year of treatment initiation and by type of

interferon used are provided in Table 4 to illustrate the change in treatment practice with the introduction of pegylated interferon.

In bivariate analyses, those who did not complete a 48-week course of treatment were more likely to be black, have anaemia at baseline, and have a diagnosis of coronary artery disease, depression and substance abuse or dependence (Table 2). Although a smaller number of subjects were treated with pegylated interferon, they were more likely to complete a full course of treatment. Number of comorbidities was significantly associated with rates of treatment completion (25.4% in those with no comorbidities vs. 15.2% in subjects having three or more comorbidities). There was a 'dose-response' relationship between the severity of anaemia before treatment initiation and treatment completion rates (23.7% in those with a haemoglobin of > 14 g/dl vs. 16.9% and 5.3% in those with a haemoglobin of > 10 to < 14 g/dl and < 10 g/dl respectively). When comparing those who completed a 24-week course of treatment with those who did not complete treatment, the above differences remained significant except type of interferon used, which was not statistically different between the two groups. In addition, those who failed to complete a 24-week course were more likely to have diabetes and HIV coinfection (Table 3).

We examined treatment completion rates (48 weeks) by station size, categorized into eight categories (Fig. 3). The treatment completion rate in the smallest category (< 15 patients initiated on treatment) was the lowest (15.5% completed treatment). Treatment completion rates in the next five categories (15–199 patients initiated) were similar, ranging from 19.9 to 22.6%. Treatment completion rates were highest in the two categories with the larger volumes of patients (> 200 patients initiated) at 38.8 and 31.5%. The treatment completion rate in the smallest group was not statistically significant from the treatment completion rates for the next five groups; therefore, for further analyses, we collapsed the first six categories and the last two categories creating a two level variable for stations treatment volume (i.e., < 200 patients vs. > 200 patients).

In a multivariable logistic regression model to determine factors associated with completion of a 48-week course of treatment, pre-treatment anaemia and depression were independently associated with a lower likelihood of completion of a 48-week course of treatment. (Table 5) Pre-treatment anaemia demonstrated a 'dose-response' pattern with more severe anaemia associated with lesser likelihood of completing treatment. Larger site treatment size (> 200 subjects initiated on treatment), use of pegylated interferon and baseline alanine or aspartate aminotransferase levels > 5 times the upper limit of normal were independently associated with a higher likelihood of completing a 48-week course of treatment.

The same factors were associated with completion of a 24-week course of treatment (Table 5). In addition, HIV coinfection and alcohol or drug abuse or dependence were associated with a lower likelihood of completing a 24-week course of treatment. To further understand the impact of type of interferon upon treatment completion, we separately analysed the factors predicting completion of a 24-week and 48-week course of treatment by type of interferon used (Table 6). Pre-treatment anaemia was associated with non-completion of a 24-week and 48-week course regardless of the type of interferon used. Black race was associated with a lower likelihood of completing a 24-week course of pegylated interferon-based treatment, but not with completing a 48-week course. HIV coinfection was not associated with non-completion of treatment in any group. Subjects at sites where 200 or more persons were initiated on treatment were more likely to complete a 48-week course of treatment with either type of interferon, and more likely to complete a 24-week course if pegylated interferon was used. We also analysed the effect of the overall number of HCV-infected persons diagnosed at each facility as a predictor of non-completion of treatment and found no discernable trend (see Appendix A1).

In a sensitivity analyses to determine whether our results depended on the method of identifying those with HCV infection, we confirmed HCV by laboratory test result (antibody or RNA positive) in 12 255 (76.4%) of the 16 043 subjects who initiated treatment. Of those, 7878 subjects had at least 1 year of follow-up. There was no significant difference in age or sex. However, blacks and Hispanics were more likely to have had laboratory confirmed HCV than whites (76.1% and 78.4% vs. 72.4%, $P < 0.001$). The treatment completion rate in this group was 23.3%. We compared the multivariate model shown in Table 4 for the group with an ICD-9 code based diagnosis to the same model but limited to those with a confirmed laboratory test result and results were similar (data not shown). We also compared the models restricted to those on pegylated interferon and results were similar (data not shown).

Discussion

We have demonstrated previously that only a small number of veterans with a diagnosis of HCV were prescribed treatment for HCV (6). In this study, we have shown that only a small proportion of HCV-infected veterans who initiate treatment complete a 48-week course. Determination of treatment completion rate is important independent of the rates of treatment initiation or eligibility, because it may help us identify modifiable factors that could improve treatment completion rates, and clinical outcomes.

Treatment completion rates in clinical trials for HCV range between 86 and 88% (1, 32). However, clinical trials recruit participants who have been carefully screened to exclude significant comorbidity and who are generally well motivated to initiate and complete treatment. Treatment completion rates in clinical practice settings may be quite different. Our study demonstrates that less than one-quarter of the persons initiated on treatment for HCV in a large national cohort of veterans completed a 48-week course of treatment. Those who completed treatment were less likely to have pre-treatment anaemia and depression. Presence of major medical, psychiatric or substance abuse comorbidities are common reasons for not initiating treatment for HCV in both HCV monoinfected as well as HCV–HIV-coinfected persons (6–9, 33), but to our knowledge, they have not been studied as factors influencing treatment completion in a national sample of HCV-infected persons.

In our study, pre-treatment anaemia emerged as an important independent predictor of completion, with the likelihood of completion decreasing with the severity of anaemia. Subjects with most severe anaemia (haemoglobin < 10 g/dl) were only 0.22 times as likely to complete a course of treatment compared with persons with no anaemia (haemoglobin > 14 g/dl). The standard of care for HCV therapy includes ribavirin, which causes a dose-dependent haemolytic anaemia in a significant number of treated subjects. In one study, almost 50% of the subjects treated with 1000–1200 mg/day of ribavirin experienced a haemoglobin drop of > 3.0 g/L (34). Presumably, those with baseline anaemia had a worsening of anaemia on therapy, necessitating treatment interruption or withdrawal. This underscores the need for aggressive evaluation and management of anaemia in patients with HCV when treatment is being contemplated.

The best management strategy for pre-treatment anaemia remains to be established. Recently, erythropoietic growth factors have been shown to maintain ribavirin dosing, improve haemoglobin levels and improve health-related quality of life in HCV-infected patients (35, 36). Compared with ribavirin dose reduction to manage anaemia, the cost of epoetin- α per additional quality-adjusted life year was US\$60 600 for genotype 1 infected persons and US\$64 311 for genotype 2 or 3 infected persons (37). However, these potential benefits need to be carefully reassessed in view of recent studies demonstrating no survival

benefit, and possibly an increased mortality risk with correction of anaemia with erythropoietin in certain populations (38–40).

Severe psychiatric illness is associated with a lower rate of treatment prescription for HCV (6, 8). Our current study demonstrates that pre-existing depression is also significantly associated with failure to complete treatment. This finding underscores the need to evaluate and treat HCV-infected patients for depression before treatment initiation. More studies are warranted to determine whether aggressive treatment of depression would improve treatment completion rates in HCV-infected persons.

Substance abuse and dependence have traditionally been considered relative contraindications to treatment for HCV. In the most recent VA guidelines, evaluation of patients with ongoing drug and alcohol use is encouraged, and antiviral therapy recommended for patients enrolled in methadone maintenance programmes. For patients with ongoing alcohol abuse, counseling is recommended while offering them therapy (31). We did not find a statistically significant independent association between alcohol or drug abuse and dependence and treatment completion for HCV, providing further evidence that these patients be evaluated for treatment while appropriately addressing the substance abuse issues.

We found that individuals treated with pegylated interferon were substantially more likely to complete a 48-week course of treatment compared with those on standard interferon. This is likely because of the lesser frequency of administration (once weekly for pegylated interferon vs. thrice weekly for standard interferon). We did not assess whether a difference in the rate of adverse events could account for this difference, but previous clinical trials have not shown major differences in the rates of systemic or laboratory adverse events that would necessitate discontinuation of therapy (1). Because a significant number of interferon-related adverse events are injection related, reduction in injection frequency would be expected to be associated with lesser adverse events, and consequently improved treatment completion rates.

We found a strong and independent association between number of subjects initiated on treatment at each site and rate of treatment completion for HCV. At sites where 200 or more subjects were initiated on treatment during the study duration, rate of treatment completion was 87% higher than among sites with < 200 subjects initiated on treatment. There was no significant association between number of HCV-infected subjects diagnosed at each site and treatment completion, suggesting that experience in treating HCV-infected persons at local level is an important determinant of treatment completion. We hypothesize that providers at high-volume treatment sites may have devised management strategies that ensure better treatment completion rates. Whether there are better support structures at these sites (e.g. dedicated pharmacists, social workers, alcohol and drug abuse counselors) is not known.

Of interest is our finding that HIV coinfection does not appear to be associated with a lower rate of completion of treatment for HCV at 48 weeks. Several studies have demonstrated that HCV–HIV-coinfected subjects have higher prevalence of medical, psychiatric and substance abuse comorbidities, are less likely to be initiated on treatment for HCV, and have poorer response to therapy (9, 19, 41, 42). Our results suggest that, among those selected for treatment, treatment completion is not substantially different by HIV status.

There are many strengths to our study. We used a national sample of HCV-infected persons in a setting where financial incentives or disincentives are minimal. The VA is the largest integrated healthcare system in the USA, and because of the computerized integration of records, and national coverage of eligible veterans, this system is able to track, follow and treat patients even when they move from one geographical area to another. Fully

computerized and comprehensive pharmacy records allow investigators and administrators to track all the prescriptions written, quantity prescribed and the duration of prescriptions. We performed several sensitivity analyses to ensure the stability of our findings across a number of possible assumptions. The general associations and the magnitude were similar in all analyses.

Despite the strengths of our analyses, some limitations of large database analyses, and the VA data need to be understood. Some veterans may have received additional treatment outside the VA, though this number is expected to be minimal because of costs. In addition, some veterans may have received treatment in clinical trials settings. However, the VA generally requires drugs to be prescribed through local pharmacies and that is likely to be captured in the PBM database. We defined a full course of treatment as 48 weeks of treatment. However, patients infected with HCV genotype 2 or 3 require only a 24-week course of treatment according to the current guidelines. As pointed out earlier, 79–87% of HCV-infected veterans are infected with HCV genotype 1, which requires a 48-week course of therapy. Because we did not have complete genotype information, this may have led to a misclassification in subjects with genotype 2/3 infection. We did not assess the adherence to therapy in our study. The comorbidity diagnoses (except anaemia) were based on ICD-9 codes, and while our group and others have validated them and found to be quite accurate, we did not perform an independent chart review validation. We studied treatment completion between 1998 and 2003, and it may be argued that treatment for HCV was less well accepted in that time frame. However, since we are studying treatment completion rates among those who already initiated treatment, we believe that our study is still valid. The management of treatment adverse events and provider comfort may have increased with experience, and we did not assess these factors. Another limitation of analysing such large database is finding statistical significance when no true clinical relevance exists.

It has been argued that the veterans in care are a non-representative sample for the US population in general. This is true when comparing all veterans in care with the US population since veterans are predominantly male, and older. However, with the exception of women, the HCV epidemic among veterans in care is largely representative of the national epidemic. According to the estimates from the Centers for Disease Control and Prevention, most HCV-infected persons in the US are between 30 and 49 years old, are more likely to be black and have a higher rate of drug use. Further, the prevalence of HCV is about twice as high in men as women. Thus, the HCV epidemic in the veterans is not much different from the general population of HCV-infected men (43).

In conclusion, less than one-quarter of HCV-infected veterans who are initiated on treatment complete a 48-week course of treatment. Non-completion is associated with pre-treatment anaemia, depression and a smaller number of treated patients at the site. Strategies to address these comorbidities should be instituted before universal advocacy of HCV treatment for every infected person, if therapeutic success at the population level is to be achieved. Effect of consolidating services to higher volume centers experienced in such treatment, or enhanced training of the healthcare providers at lower volume center need further study.

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Appendix 1

Table A1

The effect the volume of hepatitis C virus-infected patients seen at each site upon completion of a 48-week course of treatment for hepatitis C virus across the Veterans Health Administration facilities ($n = 146$ for our analysis) in the USA

Site size *	% completing a 48-week course
< 350	22.5
350–699	24.0
700–999	20.2
1000–1299	21.4
1300–1599	23.1
1600–1899	24.9
1900–2199	20.0
> 2200	23.0

* Site size refers to the number of unique HCV-infected persons identified/diagnosed at each site.

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Fig. 1.

Sources of data for Electronically Retrieved Cohort of Hepatitis C Infected Veterans (ERCHIVES).

Fig. 2.
A flow sheet of analysis for the current study in Electronically Retrieved Cohort of Hepatitis C Infected Veterans (ERCHIVES).

Fig. 3. The effect of site size upon completion of a 48-week course of treatment for hepatitis C virus across the Veterans Health Administration facilities ($n = 146$ for our analysis) in the USA.

Table 1

Baseline Characteristics of hepatitis C virus-infected persons who initiated treatment for hepatitis C virus ($N = 10\,641$)

Mean age, years (SD)	49.6 (6.4)
% Male	96.2
Race (%)	
White, non-hispanic	57.6
Black, non-hispanic	16.7
Hispanic	6.5
Others/unknown	19.1
Type of interferon used for first round	
Pegylated	26.9
Standard	73.1
Completed treatment for	
< 24 weeks	40.1
> 24– < 48 weeks	37.4
> 48 weeks	22.5
Mean duration of treatment, weeks (SD)	29.0 (20.0)

Table 2

Baseline characteristics of hepatitis C virus-infected persons who completed a 48-week course of treatment for hepatitis C virus ($N = 10\ 641$)

	Completed % $n = 2396$	Not completed % $n = 8245$	<i>P</i> -value
Mean age (SD)	49.4 (6.2)	49.6 (6.5)	0.2
Male sex	96.5	96.1	0.4
Race			< 0.001
White	55.7	58.2	
Black	14.5	17.4	
Hispanic	7.5	6.2	
Other/unknown	22.3	18.2	
Pretreatment anaemia*			< 0.001
None (haemoglobin > 14 g/dl)	86.0	79.7	
Mild/moderate (haemoglobin 10–14 g/dl)	13.9	19.7	
Severe (haemoglobin < 10 g/dl)	0.1	0.6	
Coronary artery disease	5.4	7.1	0.005
Diabetes	14.1	15.2	0.2
Hepatitis B	4.7	4.5	0.7
Stroke	1.3	1.5	0.5
HIV	2.1	2.3	0.6
Depression	31.7	36.9	< 0.001
Alcohol or drug abuse/dependence	24.0	28.1	< 0.001
Type of interferon used			< 0.001
Pegylated	33.0	25.1	
Standard	67.0	74.9	
AST or ALT > 5 × ULN	46.2	43.6	0.06
Number of comorbidities			< 0.001
None	43.8	37.4	
1	31.6	32.7	
2	19.8	22.1	
3 or more	4.8	7.8	
Site size (number of persons initiated on treatment)			< 0.001

	Completed % n = 2396	Not completed % n = 8245	P-value
< 200	87.6	93.4	
> 200	12.4	6.6	

*

7435 had haemoglobin data.

ALT, alanine aminotransferase; AST, aspartate aminotransferase; HIV, human immunodeficiency syndrome; ULN, upper limit of normal.

Table 3

Baseline characteristics of hepatitis C virus-infected persons who completed a 24-week course of treatment for hepatitis C virus

	Completed % <i>n</i> = 6376	Not completed % <i>n</i> = 4265	<i>P</i> -value
Mean age (SD)	49.5 (6.3)	49.7 (6.7)	0.08
Male sex	96.4	95.9	0.29
Race			< 0.001
White	57.8	57.4	
Black	15.1	19.2	
Hispanic	6.5	6.5	
Other/unknown	20.6	16.9	
Pretreatment anaemia *			< 0.001
None (haemoglobin > 14 g/dl)	85.2	74.6	
Mild/moderate (haemoglobin 10–14 g/dl)	14.6	24.4	
Severe (haemoglobin < 10 g/dl)	0.2	1.0	
Coronary artery disease	5.9	7.8	< 0.001
Diabetes	14.3	15.9	0.02
Hepatitis B	4.5	4.7	0.60
Stroke	1.4	1.7	0.21
HIV	1.9	2.7	0.008
Depression	34.4	37.8	< 0.001
Alcohol or drug abuse/dependence	25.4	29.9	< 0.001
Type of interferon used			0.17
Pegylated	26.4	27.6	
Standard	73.6	72.4	
AST or ALT > 5 × ULN	46.1	41.0	< 0.001
Number of comorbidities			< 0.001
None	41.7	34.6	
1	32.1	32.9	
2	20.2	23.7	
3 or more	6.0	8.8	
Site size (number of persons initiated on treatment)			< 0.001

	Completed % n = 6376	Not completed % n = 4265	P-value
< 200	90.9	93.9	
> 200	9.1	6.1	

*

7435 had haemoglobin data.

ALT, alanine aminotransferase; AST, aspartate aminotransferase; HIV, human immunodeficiency syndrome; ULN, upper limit of normal.

Completion of a 48-week course of treatment for hepatitis C virus by fiscal year of treatment initiation and by type of interferon used

Table 4

FY	Number initiated on treatment	% completing treatment	% who received standard interferon	% on standard interferon completing treatment	% who received pegylated interferon only *	% on pegylated interferon completing treatment
1998	605	15.2	99.7	14.9	0	–
1999	1888	25.0	99.9	25.0	0	–
2000	2608	23.2	99.4	22.9	0	–
2001	2799	21.6	73.3	18.1	26.7	31.0
2002	2741	22.7	23.6	12.4	76.4	25.9

* Two subjects in 1998, one subject in 1999, and 17 subjects in 2000 received both standard and pegylated interferon, and are not included in this analysis.

Table 5
Factors predicting completion of a 24-week and a 48-week course of treatment for hepatitis C virus ($N = 6838$)

	24 weeks	48 weeks
Demographics		
Age (per year increase)	1.00 (0.99–1.00)	1.00 (0.99–1.01)
Male sex	1.01 (0.78–1.32)	1.14 (0.82–1.58)
Race		
White	1.00	1.00
Black	0.85 (0.74–0.97)	1.00 (0.85–1.18)
Hispanic	0.88 (0.71–1.09)	1.00 (0.78–1.27)
Other/unknown	1.07 (0.93–1.22)	1.18 (1.01–1.37)
Comorbidities		
Pretreatment anaemia		
None (haemoglobin > 14 g/dl) (comparator)	1.00	1.00
Mild/moderate (haemoglobin 10–14 g/dl)	0.56 (0.50–0.64)	0.68 (0.58–0.80)
Severe (haemoglobin < 10 g/dl)	0.15 (0.06–0.34)	0.22 (0.05–0.95)
Coronary artery disease	0.77 (0.64–0.94)	0.80 (0.62–1.03)
Diabetes	0.96 (0.83–1.10)	0.95 (0.80–1.12)
Hepatitis B	1.14 (0.89–1.45)	1.06 (0.81–1.40)
Stroke	0.96 (0.65–1.42)	0.99 (0.61–1.60)
HIV	0.68 (0.50–0.94)	1.00 (0.69–1.46)
Depression	0.88 (0.79–0.98)	0.78 (0.69–0.89)
Alcohol or drug abuse/dependence	0.84 (0.75–0.95)	0.92 (0.80–1.06)
Others		
Pegylated interferon (compared with standard interferon)	0.90 (0.80–1.00)	1.59 (1.40–1.80)
AST or AST > 5 × ULN	1.15 (1.03–1.28)	1.16 (1.03–1.32)
Site size (number of persons initiated on treatment: > 200 compared with < 200)	1.45 (1.20–1.74)	1.87 (1.56–2.24)

ALT, alanine aminotransferase; AST, aspartate aminotransferase; ULN, upper limit of normal.

Table 6

Factors predicting completion of a 24-week or 48-week course of treatment for hepatitis C virus in subjects treated with pegylated interferon and standard interferon

	24 weeks		48 weeks	
	Pegylated interferon	Standard interferon	Pegylated interferon	Standard interferon
Demographics				
Age (per year increase)	1.01 (0.99–1.02)	0.99 (0.98–1.00)	1.00 (0.99–1.02)	0.99 (0.98–1.00)
Male sex	1.08 (0.70–1.66)	0.96 (0.69–1.34)	1.26 (0.74–2.14)	1.06 (0.70–1.62)
Race				
White	1.00	1.00	1.00	1.00
Black	0.75 (0.59–0.95)	0.90 (0.76–1.07)	0.83 (0.63–1.10)	1.12 (0.91–1.38)
Hispanic	0.80 (0.54–1.16)	0.92 (0.71–1.20)	1.01 (0.68–1.50)	0.97 (0.71–1.33)
Other/unknown	1.22 (0.98–1.52)	0.98 (0.82–1.16)	1.16 (0.92–1.46)	1.19 (0.98–1.45)
Comorbidities				
Pretreatment anaemia				
None (haemoglobin > 14 g/dl)	1.00	1.00	1.00	1.00
Mild/moderate (haemoglobin 10–14 g/dl)	0.76 (0.61–0.95)	0.47 (0.40–0.56)	0.77 (0.59–0.99)	0.62 (0.50–0.78)
Severe (haemoglobin < 10 g/dl)	0.33 (0.10–1.12)	0.07 (0.02–0.25)	0.55 (0.12–2.56)	Too few subjects (23)
Coronary artery disease	0.62 (0.45–0.86)	0.87 (0.68–1.12)	0.63 (0.42–0.95)	0.94 (0.69–1.29)
Diabetes	1.11 (0.88–1.40)	0.88 (0.74–1.05)	1.07 (0.84–1.38)	0.87 (0.70–1.89)
Hepatitis B	1.26 (0.80–2.00)	1.10 (0.82–1.46)	0.91 (0.55–1.49)	1.16 (0.84–1.61)
Stroke	0.65 (0.32–1.32)	1.18 (0.73–1.92)	0.83 (0.35–1.98)	1.08 (0.61–1.56)
HIV	0.66 (0.37–1.17)	0.69 (0.47–1.01)	1.04 (0.55–1.98)	0.98 (0.61–1.56)
Depression	0.84 (0.70–1.00)	0.88 (0.77–1.01)	0.71 (0.058–0.86)	0.83 (0.70–0.98)
Alcohol or drug abuse/dependence	1.05 (0.85–1.29)	0.76 (0.66–0.87)	0.92 (0.73–1.17)	0.91 (0.76–1.08)
Others				
AST or AST > 5 × ULN	0.94 (0.74–1.17)	1.16 (1.02–1.32)	0.95 (0.74–1.22)	1.21 (1.04–1.44)
Site size (number of persons initiated on treatment: > 200 compared with < 200)	2.31 (1.68–3.19)	1.11 (0.88–1.41)	2.40 (1.77–3.27)	1.66 (1.30–2.13)

Treatment was initiated with pegylated interferon in 2370 subjects and with standard interferon in 4445 subjects.

ALT, alanine aminotransferase; AST, aspartate aminotransferase; HIV, human immunodeficiency syndrome; ULN, upper limit of normal.