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Hepatitis C Virus Testing and Treatment Among Persons Receiving Buprenorphine in an Office-Based Program for Opioid Use Disorders

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Abstract

Aims—In the United States, hepatitis C virus (HCV) infection is primarily spread through injection drug use. There is an urgent need to improve access to care for HCV among persons with opioid use disorders who inject drugs. The purpose of our study was to determine the prevalence of HCV, patient characteristics, and receipt of appropriate care in a sample of patients treated with buprenorphine for their opioid use disorders in a primary care setting.

Methods—This study used retrospective clinical data from the electronic medical record. The study population included patients receiving buprenorphine in the Office Based Opioid Treatment (OBOT) clinic within the adult primary medicine clinic at Boston Medical Center between October 2003 and August 2013 who received a conclusive HCV antibody (Ab) test within a year of clinic entry. We compared characteristics by HCV serostatus using Pearson's Chi-square and provided numbers/percentages receiving appropriate care.

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Disclosures

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Results—The sample comprised 700 patients. Slightly less than half of all patients (n= 334, 47.7%) were HCV Ab positive, and were significantly more likely to be older, Hispanic or African American, have diagnoses of post-traumatic stress disorder (PTSD) or bipolar disorder, have prior heroin or cocaine use, and be HIV-infected. Among the 334 HCV Ab positive patients, 226 (67.7%) had detectable HCV ribonucleic acid (RNA) indicating chronic HCV infection; only 5 patients (2.21%) with chronic HCV infection ever initiated treatment.

Conclusions—Nearly half of patients (47.7%) receiving office-based treatment with buprenorphine for their opioid use disorder had a positive Hepatitis C Virus antibody screening test although initiation of HCV treatment was nearly non-existent (2.21%).

Keywords

Buprenorphine; HCV Screening; HCV Treatment; Opioid Agonist Therapy

1. Introduction

More than 4 million people in the United States are infected with the hepatitis C virus (HCV) (Ditah et al., 2014). The population most at risk is people who inject drugs (PWID) (Armstrong et al., 2006), where HCV prevalence rates range between 35% and 73% (Amon et al., 2008; Nelson et al., 2011). While HCV treatment regimens have improved significantly, lack of diagnosis (Kwiatkowski, Fortuin Corsi, & Booth, 2002; Volk, Tocco, Saini, & Lok, 2009), lack of individual treatment uptake, and system wide barriers prevent their effective implementation (Bruggmann, 2012; S. H. Mehta et al., 2005). PWID are among those least likely to receive HCV treatment with initiation rates as low as 6% (S. Mehta & Genberg, 2008), despite studies demonstrating a willingness to be treated (Zeremski et al., 2014), successful treatment outcomes (Hellard, Sacks-Davis, & Gold, 2009), and refined national guidelines recommending that HCV treatment be considered for PWID on a case-by-case basis (Ghany, Strader, Thomas, Seeff, & American Association for the Study of Liver Diseases, 2009; “Hepatitis C Guidance: AASLD-IDSA Recommendations for Testing, Managing, and Treating Adults Infected with Hepatitis C Virus.,” 2015).

Less attention has been paid to the specific opportunity that may exist for patients treated with buprenorphine in office-based clinics. Buprenorphine was approved by the Food and Drug Administration (FDA) for treatment of opioid dependence in 2002. Demand for buprenorphine treatment has grown: from 2002 to 2007, total numbers of buprenorphine prescriptions have increased from approximately 50,000 to 5.7 million (Greene, 2010). Patients seeking medication assisted treatment for opioid use disorders may prefer treatment with buprenorphine over methadone (Gryczynski et al., 2013), as it can be prescribed in primary care office-based settings, which may help to increase treatment initiation rates among PWIDs. Given that primary care providers are on the front lines for HCV screening and are likely to have an increased role in HCV treatment in the U.S., there is a unique opportunity to combine treatment for opioid use disorders and HCV in primary care settings. To this effect, the United States Health and Human Services (HHS) department has developed strategic plans which aim to increase HCV screening and treatment in primary care centers and substance abuse programs specifically (Ward, Valdiserri, & Koh, 2012).

The office-based opioid therapy (OBOT) program, established in 2003 within the adult medicine primary care clinic at Boston Medical Center (BMC), offers collaborative care, based on a nurse care management model, to patients seeking both opioid agonist therapy (OAT) and primary care (Alford et al., 2011). It has been highlighted as an innovative state model for achieving treatment-effective and cost-effective results for opioid use disorders (“Medicaid Coverage and Financing of Medications to Treat Alcohol and Opioid Use Disorders |SAMHSA,” 2014). As such, it may provide an ideal opportunity for integrating addiction and HCV treatment within primary care.

The purpose of our study was to determine the prevalence of HCV, characteristics of patients HCV, and describe receipt of appropriate care (i.e. the “treatment cascade”) in a sample of opioid dependent patients treated with buprenorphine in a primary care setting, in order to assess their current status of HCV treatment.

2. Materials & Methods

2.1 Study Design

This was a descriptive, observational study of HCV screening, prevalence and receipt of care using retrospective clinical data from electronic medical records.

2.2 Study Population

Our study population was comprised of patients receiving buprenorphine in the OBOT clinic within the adult primary medicine clinic at BMC between October 2003 and August 2013 who received a conclusive HCV Ab screening test within a year before or after clinic entry. Antibody tests prior to clinic entry included HCV Ab testing at other Boston Medical Center clinics with a shared electronic medical record. A complete description of the OBOT clinic, including procedures for patient assessment, stabilization and maintenance has been previously published (Alford et al., 2011). Patient assessment during the 10 year study period included a standardized intake and screening for HCV. Briefly, the OBOT clinic provides medication-assisted treatment (primarily buprenorphine) for opioid use disorders within an adult outpatient primary care setting. The clinic is based on a collaborative care model, utilizing nurse care managers with primary care physicians qualified to prescribe buprenorphine to provide care.

2.3 Data Collection

Data elements were extracted from the BMC clinical data warehouse, which is comprised of clinical and administrative data from the electronic medical record (EMR). We identified the OBOT patient cohort by searching the electronic medical record (EMR) for key words (“OBOT”, “SUBOX”, “SUBUTEX”, etc.) in the summary line of an office visit. All direct Health Insurance Portability and Accountability (HIPAA) identifiers were removed to create an anonymous dataset. Information collected included: demographics, visit dates, International Classification of Diseases (ICD)-9 codes, laboratory testing, medications, initial clinic note information on substance use and HCV specialist referrals.

2.4 Study Outcomes

The outcomes of interest were: 1) HCV Ab serostatus and 2) receipt of appropriate HCV care including confirmatory HCV viral load test, HCV genotype, components of fibrosis (FIB)-4 values (Aspartate Transaminase (AST), Alanine Transaminases (ALT), and platelets), referral to specialist, receipt of HCV treatment, and treatment response. Screening for HCV was part of routine OBOT intake procedures. Further work-up for HCV was left to the discretion of the primary care and OBOT provider. A positive HCV viral load was defined as any value higher than the threshold for detection, and was the basis for defining chronic HCV infection. Specialist referral was defined as a documented referral to an infectious disease (ID) physician or gastroenterologist with HCV documented as a reason for the visit. FIB-4 was calculated using the formula $\text{age}(\text{years}) \times \text{AST}[\text{U/L}] / (\text{platelets}[10^9/\text{L}] \times (\text{ALT}[\text{U/L}]^{1/2}))$ (Vallet-Pichard et al., 2007) with values extrapolated from the tests that occurred closest to the date of the positive HCV RNA test. Receipt of HCV treatment was defined as a prescription that was documented in the EMR for pegylated-interferon and ribavirin, with or without telaprevir or boceprevir. For treated patients, dates and results of viral load tests were assessed relative to prescription dates to determine whether patients were documented to have achieved end-of-treatment response (ETR, i.e. undetectable viral load at the end of treatment) and sustained virologic response (SVR, i.e. undetectable viral load 24 weeks after completion of treatment).

2.5 Other Variables

Other variables that were included in the analyses were: age, race/ethnicity, insurance status, psychiatric co-morbidities, illicit drug use history (heroin, oxycontin, vicodin/percocet, benzodiazepines, alcohol, cocaine, and amphetamines), and injection drug use. Race/ethnicity was separated into Caucasian, Hispanic/Latino, Black/African American and Other. Insurance-type was divided into 4 categories: Medicaid, Medicare, private insurance, and other (worker's comp, self-pay, and free care). Psychiatric co-morbidities of interest were captured using the following ICD-9 codes: schizophrenia (295.0–295.9), bipolar disorder (296.0, 296.1, 296.4–8), depression (296.2, 296.3, 300.4, 311), anxiety (300.0, 300.2, 300.3), and PTSD (309.81). HIV infection was captured using the following ICD-9 codes: 042, V08 and 079.53. Diagnoses and coding occurred at the discretion of the provider. Prior illicit drug use information was collected from the initial telephone screen or in-person intake assessment by a series of pre-populated questions including 'year of first use', 'route of administration', and 'frequency of use' for all drug types. Two additional free text fields summarizing drug use were also used to capture prior illicit drug use by first searching the text fields for key words and then reviewing these text fields to ensure the search terms were not mentioned in the context of abstinence. Although cannabis information is included in the intake and telephone screen forms, it was believed to be underreported (the staff did not consistently screen for its use), and therefore was excluded from the analyses. Smoking status was defined by a question about current smoking in the initial screening note. Prior injection drug use information was collected from the initial telephone screen and/or in-person intake assessment by a series of pre-populated questions including 'route of heroin administration', 'shared needle' and 'needle exchange' and an additional free text field summary.

2.6 Statistical Analyses

Descriptive statistics were used to compare characteristics by HCV serostatus (positive versus negative) using Pearson's Chi-square test. Numbers and proportions of patients who received components of HCV care were counted/calculated.

3. Results

We identified 1,192 patients over the age of 18 with at least one OBOT clinic visit. We restricted this sample to include only patients who had been prescribed buprenorphine (n=1,007). We restricted the cohort to patients who had received a HCV Ab test within one year prior to or after their first OBOT visit (n=706). Six patients had an inconclusive HCV Ab test result within the same time period and were excluded from the analyses. Overall, our study sample was comprised of 700 patients with a conclusive HCV Ab test result within one year of OBOT program enrollment. The majority of our study sample were male (63.1%), Caucasian (70.4%) and had a mean age of 36.8 (Table 1). Most reported having a history of heroin use (62.7%), cocaine use (54.3%) and alcohol use (51.0%). Documented diagnoses of depression (61.4%) and anxiety (39.9%) were among the most common psychiatric co-morbidities observed in our sample population. Additional psychiatric co-morbidities, illicit drug use and history of injection drug use are reported in Table 1, with other baseline demographics.

Of the 700 OBOT patients who had been screened within a year of clinic entry, slightly less than half (n = 334, 47.7%) were HCV Ab positive. Compared to those who were HCV Ab negative, HCV Ab positive patients were significantly more likely to be older, Hispanic and African American, have diagnoses of PTSD and bipolar disorder, have prior heroin or cocaine use, be HIV infected and have injected drugs (Table 1). Compared to patients who were HCV Ab positive, HCV Ab negative patients were significantly more likely to have private insurance, to report abuse of Oxycontin and Vicodin/Percocet use, and be a non-smoker.

Among the 334 HCV Ab positive OBOT patients, 295 (88.3%) received confirmatory HCV RNA testing. Of those 295 tested, 226 (76.6%) had a detectable viral load indicating chronic HCV infection. Thus, the overall proportion of patients with chronic HCV infection among our sample population was 67.7% (226/334). Patients with chronic HCV infection who had further follow-up testing were characterized according to their HCV genotype and FIB-4 values (Table 2). Most commonly, patients were genotype 1 (65.9%) and had a FIB-4 value of less than 1.45 (65.5%), indicating they did not have severe fibrosis (Vallet-Pichard et al., 2007).

To assess the receipt of HCV-related care among the 334 HCV Ab positive OBOT clinic patients, completion rates for components of the HCV treatment cascade were measured and reported in Figure 1. Among the 226 OBOT patients with chronic HCV infection, more than half received genotype testing (n=132, 58.4%), while less than half were referred to an HCV-related specialist (n=103, 45.6%). Only a very low number of patients ever initiated treatment (n=5, 2.21%). Among the 5 patients who initiated treatment, 80% (n=4, 1.17% of total sample) achieved SVR.

4. Discussion

In this sample of patients receiving treatment for opioid-use disorders with buprenorphine in a primary care office based setting, we found HCV Ab sero-prevalence to be 48% among patients who were screened within one year before or after the initiation of buprenorphine treatment. The majority (88%) of those patients also received confirmatory viral load testing. Among the patients (n=226) who were diagnosed with chronic HCV infection, less than half had been referred to a specialist and HCV treatment rates were extremely low (2%). These results strongly speak to a need for better systems of care to treat and cure HCV among persons who are receiving office-based treatment for their opioid use disorders with buprenorphine.

The prevalence of HCV observed in our sample is comparable to that reported by another recent study comparing buprenorphine to methadone treated patients, where HCV prevalence rates were found to be 47% (Fingerhood, King, Brooner, & Rastegar, 2014). This is slightly lower to what has been historically reported from methadone maintenance treatment programs, where HCV prevalence ranges from 54%–97% (Crofts, Nigro, Oman, Stevenson, & Sherman, 1997; Fatseas et al., 2012; Hallinan, Byrne, Agho, & Dore, 2007; Novick & Kreek, 2008; Peles & Schreiber, 2011). The lower HCV prevalence in this buprenorphine treated sample may be explained in part by the relatively high proportion of young adults who may have recently initiated their drug use. Considering that nearly half of these patients were HCV negative, yet at high risk for HCV seroconversion, there appear to be opportunities for HCV prevention in this OBOT setting.

This study demonstrated sub-optimal HCV-related care among patients engaged in treatment for their opioid use disorders with buprenorphine. Interestingly, the patterns of care differed from what was observed in a hospital-wide study conducted at the same institution, where rates of both HCV RNA testing (68%) and HCV genotype testing (37%) were lower compared to OBOT patients, which were 88% and 58% for HCV RNA and HCV genotype testing, respectively. In contrast, specialist referral rates and treatment initiation rates were higher compared to OBOT clinic patients (56 versus 46% and 17 versus 2%, respectively) (Assoumou, Huang, Horsburgh, Mus, & Linas, 2014). These results suggest a need for interventions that expand access to treatment, and highlight the fact that increasing access to specialists may not be adequate for addressing treatment disparities. Our study found that a relatively high proportion of patients with chronic HCV infection had been referred to a specialist (46%), but only a handful of those patients referred were ever treated. Provider biases against treating HCV in PWID are perceived to exist among patients (Zickmund, Campbell, Tirado, Zook, & Weinrieb, 2012), an observation that is supported by studies that demonstrate that patients with a history of injection drug use and substance use are less likely to receive HCV treatment (Butt et al., 2007; Stoové, Gifford, & Dore, 2005).

The integration of HCV screening and treatment within substance use treatment settings has been discussed as a strategy to overcome system and provider barriers for HCV treatment amongst PWID. A recent systematic review demonstrated that drug users who are concurrently engaged in substance abuse treatment are more likely to have successful HCV treatment outcomes (Dimova et al., 2013), supporting the importance of addressing

substance use and HCV simultaneously. An alternative model is to integrate HCV therapy directly into substance abuse treatment settings, such as OBOT. Observational studies demonstrate that integrating HCV treatment within addiction treatment settings is feasible and effective and may even offer patients positive health benefits that extend beyond HCV (i.e. improved substance abuse outcomes (Schäfer et al., 2009)). In the U.S., Litwin et al. demonstrated that providing HCV treatment on-site in methadone clinics in the Bronx resulted in HCV cure rates comparable to those reported in specialty clinics (Litwin, Jr, & Nahvi, 2009). In Australia, investigators in the ETHOS study demonstrated feasibility of providing on-site HCV treatment among OAT clinics that resulted in relatively high treatment initiation rates (22%) (Alavi et al., 2013). Such models of integrated care would fit particularly well in the OBOT setting, which is integrated into the primary care “medical home” model.

The availability of highly effective, directly acting antivirals (DAAs) for HCV has the potential to increase the number of people who are cured of their HCV infection and theoretically eradicate disease. Newer therapies offer the simplicity of all oral medications, shorter duration, and fewer side effects, which may facilitate treatment in non-specialist settings by primary care doctors. This is demonstrated by the number of OBOT patients who were likely eligible for HCV treatment regimens (i.e. have advanced fibrosis), as denoted by patients with FIB-4 values greater than 3.25 (6.6%, n=15), and a subset of patients who had intermediate FIB-4 values (n=60, 26.6%) who may also be determined eligible candidates with additional testing. In addition, because injection drug use accounts for most incident HCV infections in the U.S., reducing the prevalence of infection overall will require a focused effort in curing HCV and preventing re-infection among PWID. Office-based programs offering buprenorphine treatment provide an ideal opportunity for treating PWID as patients are highly motivated to follow-up, monitored for substance use, and have close therapeutic alliances with their providers. Unfortunately, these new treatment opportunities do not offer any sort of resolution to the cost burden posed by the new DDA medications. In fact, some states will only allow Medicaid reimbursement for patients who provide negative urine toxicology screens and proof of drug and alcohol abstinence, despite conflicting guidelines and recommendations from professional organizations. Clearly, the integration and new DDA into office-based treatment programs will not succeed without more consideration and revisions into the current systems of reimbursement (Barua et al., 2015).

Our study has several limitations. Data were collected retrospectively, using EMR records, which may not accurately capture all data elements including injection drug use, illicit drug use, smoking and psychiatric co-morbidities. In particular, prior injection drug use information was collected for less than half (n=302) of our study population, precluding our ability to accurately describe the prevalence of injection drug use among OBOT clinic patients at BMC. In addition, the missing data limits our ability to draw specific conclusions about how the route of drug administration is associated with the likelihood of OBOT patients to complete components of the HCV treatment cascade. The prevalence of illicit drug use and psychiatric co-morbidities were high in this sample, and consistent with what has been shown in other studies of buprenorphine treated samples (Moore et al., 2007; Savant et al., 2013), suggesting that our results are not major underestimates. Our study was not conducted within a closed health system, so it is possible that patients may have received

services elsewhere. Another study limitation stems from the fact that we were unable to assess whether any failure to complete components of the HCV treatment cascade were attributed to decisions made by patients to refuse further HCV-related care, or decisions made by providers not to offer care, both of which have been shown to largely contribute to low rates of all types of HCV-related care (S. H. Mehta et al., 2005). In addition, our study was conducted during the period prior to the availability of non-interferon based treatment, and the high prevalence of psychiatric co-morbidities may have been a barrier to treatment. Our study was conducted at a single clinic site with a large office-based buprenorphine practice and results therefore may not be representable or broadly generalizable to other patient populations. However, given that the demand for office-based treatment for opioid use disorders with buprenorphine is growing and there is little data to characterize patterns of HCV care in this setting, the results from this study may still be informative.

In summary, this study of patients receiving office-based treatment with buprenorphine for their opioid use disorders found that nearly half (48%) were seropositive for HCV. Although most received confirmatory HCV testing, and almost half of those who had confirmed chronic infection were referred to a specialist, HCV treatment was nearly non-existent (2%). This study points to the need and opportunity for improved systems of delivery of care for HCV in order to increase rates of treatment and cure among persons receiving office-based treatment for their opioid use disorders.

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Glossary

Ab	Antibody
ALT	Alanine Transaminase
AST	Aspartate Transaminase
BMC	Boston Medical Center
DAA	Directly Acting Antivirals
EMR	Electronic Medical Record
ETR	End-Treatment Response
FDA	Food and Drug Administration
FIB-4	Fibrosis-4
HIPAA	Health Insurance Portability and Accountability
HCV	Hepatitis C Virus

HIV	Human Immunodeficiency Virus
ICD	International Classification of Diseases
ID	Infectious Disease
OBOT	Office-Based Opioid Therapy
OAT	Opioid Agonist Treatment
PTSD	Post-Traumatic Stress Disorder
PWID	People Who Inject Drugs
RNA	Ribonucleic Acid
SVR	Sustained Virologic Response

References

- Medicaid Coverage and Financing of Medications to Treat Alcohol and Opioid Use Disorders | SAMHSA. 2014. Retrieved from <http://store.samhsa.gov/product/Medicaid-Coverage-and-Financing-of-Medications-to-Treat-Alcohol-and-Opioid-Use-Disorders/SMA14-4854>
- Alavi M, Grebely J, Micallef M, Dunlop AJ, Balcomb AC, Day CA, ... Dore GJ. Assessment and Treatment of Hepatitis C Virus Infection Among People Who Inject Drugs in the Opioid Substitution Setting: ETHOS Study. *Clinical Infectious Diseases*. 2013; 57(suppl 2):S62–S69. DOI: 10.1093/cid/cit305 [PubMed: 23884068]
- Alford DP, LaBelle CT, Kretsch N, Bergeron A, Winter M, Botticelli M, Samet JH. Five Year Experience with Collaborative Care of Opioid Addicted Patients using Buprenorphine in Primary Care. *Archives of Internal Medicine*. 2011; 171(5):425–431. DOI: 10.1001/archinternmed.2010.541 [PubMed: 21403039]
- Amon JJ, Garfein RS, Ahdieh-Grant L, Armstrong GL, Ouellet LJ, Latka MH, ... Williams IT. Prevalence of hepatitis C virus infection among injection drug users in the United States, 1994–2004. *Clinical Infectious Diseases: An Official Publication of the Infectious Diseases Society of America*. 2008; 46(12):1852–1858. DOI: 10.1086/588297 [PubMed: 18462109]
- Armstrong GL, Wasley A, Simard EP, McQuillan GM, Kuhnert WL, Alter MJ. The Prevalence of Hepatitis C Virus Infection in the United States, 1999 through 2002. *Annals of Internal Medicine*. 2006; 144(10):705–714. DOI: 10.7326/0003-4819-144-10-200605160-00004 [PubMed: 16702586]
- Assoumou SA, Huang W, Horsburgh CR, Mus &, Linas BP. Quality of hepatitis C care at an urban tertiary care medical center. *Journal of Health Care for the Poor and Underserved*. 2014; 25(2):705–16. DOI: 10.1353/hpu.2014.0093 [PubMed: 24858880]
- Barua S, Greenwald R, Grebely J, Dore GJ, Swan T, Taylor LE. Restrictions for Medicaid Reimbursement of Sofosbuvir for the Treatment of Hepatitis C Virus Infection in the United States. *Annals of Internal Medicine*. 2015; 163(3):215–23. DOI: 10.7326/M15-0406 [PubMed: 26120969]
- Bruggmann P. Accessing Hepatitis C patients who are difficult to reach: it is time to overcome barriers. *Journal of Viral Hepatitis*. 2012; 19(12):829–835. DOI: 10.1111/jvh.12008 [PubMed: 23205675]
- Butt AA, Justice AC, Skanderson M, Rigsby MO, Good CB, Kwok CK. Rate and predictors of treatment prescription for hepatitis C. *Gut*. 2007; 56(3):385–9. DOI: 10.1136/gut.2006.099150 [PubMed: 17005764]
- Crofts N, Nigro L, Oman K, Stevenson E, Sherman J. Methadone maintenance and hepatitis C virus infection among injecting drug users. *Addiction (Abingdon, England)*. 1997; 92(8):999–1005. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/9376782>.
- Dimova RB, Zeremski M, Jacobson IM, Hagan H, Des Jarlais DC, Talal AH. Determinants of Hepatitis C Virus Treatment Completion and Efficacy in Drug Users Assessed by Meta-analysis.

Clinical Infectious Diseases. 2013; 56(6):806–816. DOI: 10.1093/cid/cis1007 [PubMed: 23223596]

- Ditah I, Ditah F, Devaki P, Ewelukwa O, Ditah C, Njei B, ... Charlton M. The changing epidemiology of hepatitis C virus infection in the United States: National Health and Nutrition Examination Survey 2001 through 2010. *Journal of Hepatology*. 2014; 60(4):691–698. DOI: 10.1016/j.jhep.2013.11.014 [PubMed: 24291324]
- Fatseas M, Denis C, Serre F, Dubernet J, Daulouède JP, Auriacombe M. Change in HIV-HCV risk-taking behavior and seroprevalence among opiate users seeking treatment over an 11-year period and harm reduction policy. *AIDS and Behavior*. 2012; 16(7):2082–2090. DOI: 10.1007/s10461-011-0054-4 [PubMed: 21983799]
- Fingerhood MI, King VL, Brooner RK, Rastegar DA. A comparison of characteristics and outcomes of opioid-dependent patients initiating office-based buprenorphine or methadone maintenance treatment. *Substance Abuse : Official Publication of the Association for Medical Education and Research in Substance Abuse*. 2014; 35(2):122–6. DOI: 10.1080/08897077.2013.819828
- Ghany MG, Strader DB, Thomas DL, Seeff LB. American Association for the Study of Liver Diseases. Diagnosis, management, and treatment of hepatitis C: an update. *Hepatology (Baltimore, Md)*. 2009; 49(4):1335–1374. DOI: 10.1002/hep.22759
- Greene, P. Outpatient Drug Utilization Trends for Buprenorphine Years 2002–2009. 2010. Retrieved from http://buprenorphine.samhsa.gov/bwns/2010_presentations_pdf/09_Greene_508.pdf
- Gryczynski J, Jaffe JH, Schwartz RP, Dušek KA, Gugs N, Monroe CL, ... Mitchell SG. Patient perspectives on choosing buprenorphine over methadone in an urban, equal-access system. *The American Journal on Addictions/American Academy of Psychiatrists in Alcoholism and Addictions*. 2013; 22(3):285–291. DOI: 10.1111/j.1521-0391.2012.12004.x
- Hallinan R, Byrne A, Agho K, Dore GJ. Referral for chronic hepatitis C treatment from a drug dependency treatment setting. *Drug and Alcohol Dependence*. 2007; 88(1):49–53. DOI: 10.1016/j.drugalcdep.2006.09.018 [PubMed: 17067763]
- Hellard M, Sacks-Davis R, Gold J. Hepatitis C treatment for injection drug users: a review of the available evidence. *Clinical Infectious Diseases : An Official Publication of the Infectious Diseases Society of America*. 2009; 49(4):561–73. DOI: 10.1086/600304 [PubMed: 19589081]
- Hepatitis C Guidance: AASLD-IDS Recommendations for Testing Managing, and Treating Adults Infected with Hepatitis C Virus. *Hepatology (Baltimore, Md)*. 2015; 62(3):932–54. DOI: 10.1002/hep.27950
- Kwiatkowski CF, Fortuin Corsi K, Booth RE. The association between knowledge of hepatitis C virus status and risk behaviors in injection drug users. *Addiction*. 2002; 97(10):1289–1294. DOI: 10.1046/j.1360-0443.2002.00208.x [PubMed: 12359033]
- Litwin A Jr, KH, Nahvi S. Successful treatment of chronic hepatitis C with pegylated interferon in combination with ribavirin in a methadone maintenance treatment program. ... *Abuse Treatment*. 2009; 37(1):32–40. DOI: 10.1016/j.jsat.2008.09.009
- Mehta S, Genberg B. Limited uptake of hepatitis C treatment among injection drug users. *Journal of Community ...*. 2008; 33(3):126–133. DOI: 10.1007/s10900-007-9083-3
- Mehta, SH.; Thomas, DL.; Sulkowski, MS.; Safaein, M.; Vlahov, D.; Strathdee, SA. A framework for understanding factors that affect access and utilization of treatment for hepatitis C virus infection among HCV-mono-infected and HIV/HCV-co-infected injection drug users. [Miscellaneous Article]. *AIDS*. 2005 Oct. Retrieved from <http://ovidsp.ovid.com/ovidweb.cgi?T=JS&CSC=Y&NEWS=N&PAGE=fulltext&D=ovfth&AN=00002030-200510003-00027>
- Moore BA, Fiellin DA, Barry DT, Sullivan LE, Chawarski MC, O'Connor PG, Schottenfeld RS. Primary care office-based buprenorphine treatment: comparison of heroin and prescription opioid dependent patients. *Journal of General Internal Medicine*. 2007; 22(4):527–30. DOI: 10.1007/s11606-007-0129-0 [PubMed: 17372805]
- Nelson PK, Mathers BM, Cowie B, Hagan H, Des Jarlais D, Horyniak D, Degenhardt L. Global epidemiology of hepatitis B and hepatitis C in people who inject drugs: results of systematic reviews. *Lancet*. 2011; 378(9791):571–583. DOI: 10.1016/S0140-6736(11)61097-0 [PubMed: 21802134]

- Novick DM, Kreek MJ. Critical issues in the treatment of hepatitis C virus infection in methadone maintenance patients. *Addiction* (Abingdon, England). 2008; 103(6):905–18. DOI: 10.1111/j.1360-0443.2008.02188.x
- Peles E, Schreiber S. Low risk for hepatitis C seroconversion in methadone maintenance treatment. *Journal of Addiction* 2011; 5(3):214–220. DOI: 10.1097/ADM.0b013e31820e13dd
- Savant JD, Barry DT, Cutter CJ, Joy MT, Dinh A, Schottenfeld RS, Fiellin DA. Prevalence of mood and substance use disorders among patients seeking primary care office-based buprenorphine/naloxone treatment. *Drug and Alcohol Dependence*. 2013; 127(1–3):243–247. DOI: 10.1016/j.drugalcdep.2012.06.020 [PubMed: 22771144]
- Schäfer A, Wittchen HU, Backmund M, Soyka M, Götz J, Siegert J, ... Kraus MR. Psychopathological changes and quality of life in hepatitis C virus-infected, opioid-dependent patients during maintenance therapy. *Addiction* (Abingdon, England). 2009; 104(4):630–40. DOI: 10.1111/j.1360-0443.2009.02509.x
- Stoové MA, Gifford SM, Dore GJ. The impact of injecting drug use status on hepatitis C-related referral and treatment. *Drug and Alcohol Dependence*. 2005; 77(1):81–6. DOI: 10.1016/j.drugalcdep.2004.07.002 [PubMed: 15607844]
- Vallet-Pichard A, Mallet V, Nalpas B, Verkarre V, Nalpas A, Dhalluin-Venier V, ... Pol S. FIB-4: an inexpensive and accurate marker of fibrosis in HCV infection. comparison with liver biopsy and fibrotest. *Hepatology* (Baltimore, Md). 2007; 46(1):32–6. DOI: 10.1002/hep.21669
- Volk ML, Tocco R, Saini S, Lok ASF. Public health impact of antiviral therapy for hepatitis C in the United States. *Hepatology*. 2009; 50(6):1750–1755. DOI: 10.1002/hep.23220 [PubMed: 19824079]
- Ward JW, Valdiserri RO, Koh HK. Hepatitis C virus prevention, care, and treatment: from policy to practice. *Clinical Infectious Diseases : An Official Publication of the Infectious Diseases Society of America*. 2012; 55(Suppl 1):S58–63. DOI: 10.1093/cid/cis392 [PubMed: 22715216]
- Zeremski M, Dimova RB, Zavala R, Kritz S, Lin M, Smith BD, ... Talal AH. Hepatitis C Virus-Related Knowledge and Willingness to Receive Treatment Among Patients on Methadone Maintenance. *Journal of Addiction Medicine*. 2014; doi: 10.1097/ADM.0000000000000041
- Zickmund SL, Campbell SA, Tirado CF, Zook CL, Weinrieb RM. Perceived barriers to hepatitis C therapy for patients receiving opioid agonist treatment. *Journal of Addiction Medicine*. 2012; 6(3): 233–239. DOI: 10.1097/ADM.0b013e31825f491b [PubMed: 22790464]

Highlights

- The HCV prevalence was 48% among these buprenorphine treated patients.
- Only 2% of patients engaged in a buprenorphine program received HCV treatment.
- The OBOT care model could provide integrated substance abuse and HCV treatment.

Figure 1.
Completion Rates for Components of the HCV Treatment Cascade Among OBOT Patients Who Were HCV Ab Positive (n=334).

Table 1

Baseline Demographics of OBOT Patients (n=700).

Variable	Number (%)			p-value
	Total n = 700	HCV Ab+ n=334	HCV Ab- n=366	
Age, mean, SD	36.80 ± 0.41	38.85 ± 0.59	34.93 ± 0.54	<.001
<30	216 (30.9)	80 (24.0)	136 (37.2)	
30–49	387 (55.3)	189 (56.6)	198 (54.1)	
>49	97 (13.9)	65 (19.5)	32 (8.7)	
Gender				0.08
Male	442 (63.1)	222 (66.5)	220 (60.1)	
Female	258 (36.9)	112 (33.5)	146 (39.9)	
Race/Ethnicity				<.001
Caucasian	493 (70.4)	205 (61.4)	288 (78.7)	
Hispanic/Latino	101 (14.4)	73 (21.9)	28 (7.7)	
Black/African American	87 (12.4)	47 (14.1)	40 (10.9)	
Other/Unspecified	19 (2.7)	9 (2.7)	10 (2.7)	
Primary Insurance				0.002
Medicaid	460 (65.7)	229 (68.6)	231 (63.1)	
Medicare	100 (14.3)	56 (16.8)	44 (12.0)	
Private	80 (11.4)	24 (7.2)	56 (15.3)	
Other	60 (8.6)	25 (7.5)	35 (9.6)	
Psychiatric Co-morbidities ^a				
Depression	430 (61.4)	210 (62.9)	220 (60.1)	0.45
Post Traumatic Stress Disorder	179 (25.6)	103 (30.8)	76 (20.8)	0.002
Schizophrenia	12 (1.7)	8 (2.4)	4 (1.1)	0.19
Bipolar Disorder	119 (17.0)	68 (20.4)	51 (13.9)	0.02
Anxiety	279 (39.9)	137 (41.0)	142 (38.8)	0.55
HIV Infected	35 (5.0)	26 (7.8)	9 (2.5)	0.001
Prior Illicit Drug Use ^a				
Heroin	439 (62.7)	237 (71.0)	202 (55.2)	<.001

Variable	Number (%)			p-value
	Total n = 700	HCV Ab+ n=334	HCV Ab- n=366	
Oxycontin	261 (37.3)	96 (28.7)	165 (45.1)	<.001
Vicodin/Percocet	283 (40.4)	105 (31.4)	178 (48.6)	<.001
Benzodiazepines	222 (31.7)	101 (30.2)	121 (33.1)	0.42
Alcohol	357 (51.0)	172 (51.5)	185 (50.5)	0.8
Cocaine	380 (54.3)	193 (57.8)	187 (51.1)	0.08
Amphetamines	28 (4.0)	13 (3.9)	15 (4.1)	0.89
Smoker				0.001
Yes	529 (75.6)	246 (73.7)	283 (77.3)	
No	66 (9.4)	23 (6.9)	43 (11.7)	
Missing	105 (15.0)	65 (19.5)	40 (10.9)	
Injection Drug Use				
Yes	257 (36.7)	181 (54.2)	76 (20.8)	<0.001
No	45 (6.4)	3 (0.9)	42 (11.5)	<0.001
Missing	398 (56.9)	150 (44.9)	248 (67.8)	

^aNot mutually exclusive events

Hepatitis C Virus (HCV)

Human Immunodeficiency Virus (HIV)

Standard Deviation (SD)

Table 2

Disease Characteristics of OBOT Patients with Chronic HCV (N=226).

Variable	Number/%
Genotype Test	132/226 (58.4%)
1	87/132 (65.9%)
1a	50/132 (37.9%)
1b	16/132 (12.1%)
1a/ab	21/132 (15.9%)
2	12/132 (9.1%)
2a	1/132 (0.8%)
2b	11/132 (8.3%)
3	28/132 (21.2%)
3a	28/132 (21.2%)
4 ^{**}	2/132 (1.5%)
Mixed [*]	1/132 (0.8%)
Indeterminate Genotype	2/132 (1.5%)
FIB4 Value	
<1.45	148/226 (65.5%)
1.45–3.25	60/226 (26.5%)
>3.25	15/266 (6.6%)
Missing	3/266 (1.3%)

* Represents one individual with a 1a/2b genotype.

** Indeterminate subtype.