HIV SEROSTATUS AND HAVING ACCESS TO A PHYSICIAN FOR REGULAR HEPATITIS C VIRUS CARE AMONG PEOPLE WHO INJECT DRUGS

Tara Beaulieu MIPH[1]; Kanna Hayashi PhD[1,2,3]; Michael J Milloy PhD[1,2,4]; Ekaterina Nosova PhD[1,2]; Kora DeBeck PhD[1,2,5]; Julio Montaner MD[1,4]; Thomas Kerr PhD[1,2,4]; Lianping Ti PhD[1,4]

[1]British Columbia Centre for Excellence in HIV/AIDS, St. Paul's Hospital, 608-1081 Burrard Street, Vancouver, BC, Canada; [2]British Columbia Centre on Substance Use, St. Paul's Hospital, 1081 Burrard Street, Vancouver, BC, Canada; [3]Faculty of Health Sciences, Simon Fraser University, Blusson Hall, 8888 University Drive, Burnaby, BC Canada; [4]Department of Medicine, University of British Columbia, 2775 Laurel Street, Vancouver, BC, Canada; [5]School of Public Policy, Simon Fraser University, 515 West Hastings Street, Vancouver, BC, Canada

Final version published as: Beaulieu T, Hayashi K, Milloy M-J, Nosova E, DeBeck K, Montaner J, Kerr T, Ti L. HIV serostatus and having access to a physician for regular hepatitis C virus care among people who inject drugs. *JAIDS*. 2018 May 1;78(1):93-98.

Correspondence: Lianping Ti, PhD, Research Scientist, B.C. Centre for Excellence in HIV/AIDS, University of British Columbia, St. Paul's Hospital, 608-1081 Burrard Street, Vancouver, B.C., V6Z 1Y6 Canada. **Tel:** 604-682-2344 ext. 66885; **Fax**: 604-806-8464; **Email**: mintti@cfenet.ubc.ca

Conflicts of Interest and Source of Funding: This work was supported by the US National Institutes of Health (VIDUS and ARYS: U01DA038886; ACCESS: R01DA021525) and the Canadian Institutes of Health Research (MOP-286532). This research was undertaken, in part, from funding through a Tier 1 Canada Research Chair in Inner City Medicine. Dr. Kora DeBeck is supported by a Michael Smith Foundation for Health Research (MSFHR) / St. Paul's Hospital Foundation– Providence Health Care Career Scholar Award and a Canadian Institutes of Health Research (CIHR) New Investigator Award. Dr. Kanna Hayashi is supported by a CIHR New Investigator Award (MSH-141971). Dr. M-J Milloy is supported by a CIHR New Investigator Award, an MSFHR Scholar Award and the US NIH (R01-DA0251525). His institution has received an unstructured gift from NG Biomed, Ltd. JM is supported by the British Columbia Ministry of Health and by NIDA at the NIH (grant number R01-DA036307). JM has received limited unrestricted funding, paid to his institution, from Abbvie, Bristol-Myers Squibb, Gilead Sciences, Janssen, Merck and ViiV Healthcare. All authors: No conflicts of interest to disclose.

ABSTRACT

Background: People who inject drugs (PWID) and who are living with HIV and hepatitis C virus (HCV) infection are vulnerable to a range of health-related harms, including liver cirrhosis, hepatocellular carcinoma, and death. There is limited evidence describing how HIV serostatus shapes access to a physician for regular HCV care among PWID.

Setting: Data were collected through the Vancouver Injection Drug Users Study (VIDUS), the AIDS Care Cohort to evaluate Exposure to Survival Services (ACCESS), and the At-Risk Youth Study (ARYS), three prospective cohorts involving people who use illicit drugs in Vancouver, Canada, between 2005 and 2015.

Methods: Using generalized estimating equations, we examined the relationship between HIV-seropositivity and having access to a physician for regular HCV care. We conducted a mediation analysis to examine whether this association was mediated by increased frequency of engagement in healthcare.

Results: In total, 1627 HCV-positive PWID were eligible for analysis; 582 (35.8%) were HIV-positive at baseline and 31 (1.9%) became HIV-positive during follow-up. In multivariable analyses, after adjusting for a range of confounders, HIV serostatus (adjusted odds ratio [AOR] = 1.99; 95% confidence interval [CI]: 1.77-2.24) was significantly associated with having access to HCV care. Approximately 26% of the effect was due to mediation.

Conclusion: Our results demonstrate a positive relationship between HIV-seropositivity and having access to a physician for regular HCV care, which is partially explained through increased frequency of engagement in healthcare. These findings highlight the need to address patterns of inequality in access to HCV care among PWID.

Word Count: 248

Keywords: HIV; Hepatitis C; physician; linkage to care; Injection drug use

INTRODUCTION

The advent of highly-active antiretroviral therapy (HAART) has led to significant reductions in HIV-related morbidity, mortality and viral transmission.[1–5] However, HCV-related complications have emerged as a greater relative contributor to disease burden among dually-infected individuals.[5] Globally, an estimated 170 million individuals are chronically infected with HCV,[6] of which one-third experience progression to liver fibrosis and cirrhosis over a 20-30 year period.[7] Moreover, an estimated 700,000 deaths each year are attributable to HCV-related complications.[8] Due to shared transmission pathways, recent data suggests that approximately 3-12% of the 36.9 million people living with HIV (PLWH) are co-infected with HCV.[9] Among PLWH who inject drugs, the prevalence of HCV co-infection is significantly higher, with estimates ranging between 50% and 90%.[5]

The HIV Treatment as Prevention (TasP) initiative aims to scale-up access to HAART, dramatically curbing morbidity, mortality and HIV transmission.[3] Endorsed by the UNAIDS 90-90-90 campaign,[10] TasP's efficacy and effectiveness has become increasingly apparent among marginalized populations. Encouragingly, there appear to be broader implications in the context of HCV co-infection.[3] The impact of increased engagement in healthcare on access to HCV care remains largely unexplored.

The advent of direct-acting antivirals (DAAs) for the treatment of HCV infection has resulted in remarkable improvements in rates of sustained virologic response (SVR) across all genotypes and among various populations, including PWID. Unfortunately, access and uptake of DAA therapy among PWID remains very low.[11] A growing body of literature indicates a number of barriers, including patient concerns over possible side effects, high cost of DAAs based therapy, fractured social networks, unstable housing, incarceration, and limited engagement in healthcare.[12,13] Furthermore, these factors may be coupled with reluctance on the part of healthcare professionals to initiate DAAs in active PWID due to concerns over HCV reinfection.[14,15] It is noteworthy that this reluctance may be partially attributed to historical HCV treatment guidelines which have traditionally excluded PWID.[12,16]

Understanding the multifaceted nature of barriers to DAA access among PWID will facilitate treatment scale-up. Although a growing body of literature has explored the patterns and correlates of HAART and DAA accessibility among PWID,[17,18] potential differences between DAA treatment and care among HIV-positive and HIV-negative individuals remains unclear.[19] Thus, in a setting where there are no financial barriers to HIV treatment and care, and where universal access to DAA treatment is occurring,[20] the objective of this study was to assess the effect of HIV serostatus on accessing HCV physician care among PWID in Vancouver, Canada.

METHODS

Study design and population

Data for this study were drawn from the Vancouver Injection Drug Users Study (VIDUS), the AIDS Care Cohort to evaluate Exposure to Survival Services (ACCESS), and the At-Risk Youth Study (ARYS), three prospective cohorts involving people who use illicit drugs in Vancouver, Canada. The methods for these studies have been described elsewhere.[21-25] To be eligible for VIDUS, participants must be ≥18 years of age and report injection drug use at least one month prior to enrollment. ACCESS participants must be ≥18 years of age and report using an illicit drug (other than or in addition to cannabis) in the month prior to enrollment. ARYS participants must be 14-26 years of age, street-involved, and report using an illicit drug other than or in addition to cannabis) in the month prior to enrollment. Recruitment was conducted through self-referral, street outreach, and snowball sampling.

The data collection instruments and procedures were harmonized across the three cohorts to allow for pooled analyses. At baseline and semi-annually, participants completed an interviewer-administered questionnaire that elicited information on socio-demographic characteristics, drug use patterns, and other relevant exposures and outcomes. Additionally, at each visit, participants provided blood samples for HIV and HCV serologic tests and HIV disease monitoring as appropriate. If participants are

tested positive for HIV and/or HCV, which are reportable diseases, the study team provides post-test counselling and linkage to care. A $30 (CAD) honorarium was offered to participants upon completion of each study visit. All three cohorts have received ethical approval by the University of British Columbia/Providence Health Care Research Ethics Board.

Study sample

For the present analysis, the sample was restricted to those who: 1) were HCV positive at baseline or those who seroconverted between September 2005 and May 2015; 2) completed at least one follow-up visit after the positive HCV test result; 3) tested positive for HCV and reported a history of injection drug use during the same visit; 4) had chronic HCV, defined as not having spontaneously cleared HCV (ascertained through self-report); and 5) did not die during the study period (or up until the date of death confirmed though BC's Vital Statistics database). For participants added to the sample during follow-up (i.e., those who HCV-seroconverted during follow-up), their data following seroconversion was included.

Variable selection

The primary outcome of interest was access to a physician for regular HCV care, defined by any self-reported access to a doctor or a specialist for regular HCV care at

least once in the past six months. We felt that it was important to examine HCV care more broadly, including both access to primary care and specialist physicians given that in BC, treatment guidelines indicate that both practitioner types are allowed to prescribe DAA-based treatments. We did not restrict to treatment access given that fibrosis level restrictions to prescribing DAAs likely limited treatment availability during the study period. Regardless, HCV care linkage remains an important outcome measure. The primary explanatory variable was HIV-seropositivity, defined as a positive HIV antibody test. We also considered a selection of possible confounders, including: age (per year increase); sex (male vs. female); homelessness (yes vs. no); incarceration (yes vs. no); ≥ daily opioid injection drug use (yes vs. no); ≥ daily stimulant injection drug use (yes vs. no); enrollment in methadone maintenance therapy (yes vs. no); and hospitalized (yes vs. no). The potential mediator variable (frequency of engagement in healthcare) was defined as having had access to a doctor, clinic, specialist, jail doctor, healthcare outside of hospital/clinic/doctor's office, or other in the past six months (once vs. once every two-three months vs. once a month vs. every one-two weeks vs > once a week vs. no access). All variables except age and gender were considered as time-updated variables of events reported in the six months prior to interview.

Statistical analyses

As a first step, we examined descriptive and socio-demographic characteristics of the sample, stratified by having had access to a physician for regular HCV care at least once during the study period. Next, we used bivariable generalized estimating equations (GEE) with logit link function and exchangeable working correlation structure to estimate the relationship between the outcome (i.e., access to a physician for regular HCV care) and all explanatory variables, including HIV-seropositivity. Then, a multivariable GEE model was constructed where all secondary variables significant at $p < 0.05$ in bivariable analyses were included. Multicollinearity was also assessed using the variance inflation factor.

As a secondary analysis, we implemented methods developed by Imai, Keele, and Tingley[26] to explore whether the association of interest was mediated by an increased frequency of engagement in healthcare. To begin, we transformed our categorical variable (frequency of engagement) into a numeric variable (i.e., once every six months = 1, once every two-three months = 2, once a month = 3, every one-two weeks = 4, > once a week = 5, no access = 0), to estimate the overall mediation effect. Parameters of interest included: the Average Casual Mediation Effect (ACME), defined as the average mediated effect between the predictor (HIV-seropositivity) and the outcome via mediator (frequency of access); the Average Direct Effect (ADE), defined as the average direct effect of the predictor on the outcome; the Total Effect (TE), which

was the entire effect the predictor had on the outcome (i.e., ACME + ADE); and the Proportion Mediated (PM), which was the proportion of the causal effect of independent variable that was mediated by the mediator (i.e., ACME / TE). Averaged effects were calculated over 50 iterations. Finally, a sensitivity analysis was employed to identify the value of rho at which ACME = 0, which is the correlation between the error terms of the mediator and outcome models. Essentially, the sensitivity analysis was used to probe the plausibility of sequential ignorability (SI). Statistical significance was defined at the 0.05 level. All analyses were performed in RStudio© version 0.99.892 (Foundation for Statistical Computing, Vienna, Austria).

RESULTS

Baseline descriptive and socio-demographic characteristics, stratified by the outcome are presented in Table 1. Of the 1627 participants eligible for inclusion, 582 (35.8%) were HIV-positive at baseline and an additional 31 (1.9%) became HIV-positive during follow-up. Five hundred seventy-three (35.2%) were female and the median age at baseline was 41 years (interquartile range: 47.4-33.5=13.9 years). Overall, participants contributed a total of 9212 person-years of follow-up. Of the 1627 participants, 943 (58.0%) were engaged in healthcare at least once a month and 274 (16.8%) reported no access to care. Of the 1357 participants with access to a physician for regular HCV care

at least once during the study period, 1161 reported access at baseline, and 525 (38.7%) were HIV-seropositive.

As presented in Table 2, in bivariable analyses, HIV serostatus was significantly and positively associated with access to a physician for regular HCV care (odds ratio [OR] = 2.17; 95% confidence interval [CI]: 1.93-2.44). This association remained largely unchanged in multivariable analysis even after adjusting for a range of possible confounders (adjusted odds ratio [AOR] = 1.99; 95% CI: 1.77-2.24).

Mediation analysis yielded a statistically significant ACME (β = 0.049; 95% [CI]: 0.044-0.054), ADE (β = 0.141; 95% [CI]: 0.111-0.170) and TE (β = 0.190; 95% [CI]: 0.161-1.216), suggesting that for HIV-seropositive participants, an increased frequency of engagement in healthcare resulted in a higher likelihood of accessing HCV physician care, as compared to HIV-seronegative participants. Approximately 26% of the effect was attributable to mediation. As a sensitivity analysis, the mediation analysis was repeated using baseline (first available) follow-up data and results were largely unchanged (data not shown). The value of ρ at which ACME would be zero was 0.2. While this value indicates a seemingly low magnitude of hidden bias due to unobserved confounders, it cannot be calibrated in conjunction with results from studies of a similar construct, which leaves the mediator-outcome association indeterminate.

DISCUSSION

In the present study, we observed a high proportion of participants who reported access to a physician for regular HCV care. We also found a positive and independent relationship between HIV-seropositivity and access to a physician for regular HCV care among PWID, after adjusting for various confounders. Additionally, our findings revealed that an increased frequency of engagement in healthcare mediated this relationship.

Traditionally, PWID were among the least likely to have access to HCV care.[13,27] Encouragingly, our findings suggest a marked shift in HCV care accessibility among co-infected PWID, with 242 (39.48%) of co-infected participants who reported having had access to regular HCV physician care at baseline in the past six months. Of 613 co-infected participants, 554 (90.4%) reported access to a physician for regular HCV care at least once during the study period. It is important to note that while there have been guideline changes to increase accessibility to HCV treatment, DAAs were not covered as part of the PharmaCare drug coverage program until 2015, which took place after the study period. Similarly to other countries that have moved towards universal coverage for HCV medications,[28] in April 2017, the BC government expanded DAA coverage to HIV/HCV co-infected individuals regardless of liver disease severity, and committed to provide universal DAA coverage for all BC residents with chronic HCV infection

starting in early 2018.[29] Future research should seek to assess the impact of policy change on uptake of HCV treatment and care among this population.

That HIV-seropositive PWID were more likely to engage in HCV care may be partially attributable to HIV care facilities which are operating under an integrated care model.[30] Previous research has demonstrated the importance of integrated care models on mitigating barriers to HCV care for HIV-seropositive populations. For example, a recent retrospective review of HIV/HCV co-infected patients in New York found that HCV therapy can be safely integrated into HIV primary care settings with encouraging SVR rates (92%).[31] Similarly, Brunner *et al*. demonstrated the feasibility of offering HCV and HIV care within opioid agonist treatment (OAT) programs. This integrated "one-stop-shop" approach yielded HCV treatment outcomes comparable to those in non-drug using populations.[32] In fact, a true "one-stop-shop" approach will also be pursuant to reducing frequency of healthcare engagement; lessening wasteful time, resources and spending.[33] In response, a number of international health organizations have recommended the integration of infectious disease (e.g., HIV, HCV, HBV) testing, treatment, and care among individuals with comorbid conditions.[34,35] Accordingly, the implementation of integrated care models for HIV/HCV co-infected PWID should be considered globally.[34–36]

That HIV-seronegative PWID were less likely to engage in HCV care reinforces an urgent need to look beyond conventional approaches to healthcare delivery.

Similarly to what was proposed previously, the integration of OAT and HIV-related services impacts positively on access to HIV care, adherence, and health outcomes, and this approach has been endorsed by the World Health Organization.[37,38] A growing body of evidence positions the integration of OAT and HCV related services as an advantageous undertaking in part, given its ability to remove barriers to HCV care among individuals who do not seek traditional healthcare services.[39,40] The availability of HCV-related services within OAT clinics eliminates the requirement for referrals to an HCV specialist and allows for the provision of immediate patient care.[40] Other successful low-threshold models of HCV care include healthcare delivery through community-based clinics, peer-based models of treatment and task shifting.[41,42] Researchers should seek to explore the impact of these diverse and innovative delivery strategies to improve uptake of HCV care for HCV monoinfected PWID.

Our study had several limitations. First, although HIV/HCV results were ascertained by laboratory assays, measurement of the outcome and confounder variables were reliant on self-reported data, which is susceptible to social desirability and recall bias. Second, despite adjusting models for known confounders, results may be subject to underlying residual and unmeasured confounding. Third, due to the observational nature of the VIDUS, ACCESS and ARYS studies, we were unable to definitively establish causation. Finally, this is a nonrandom sample that is not

representative of a larger population and therefore, the extent to which these results may be generalized beyond our sample is unclear.

Overall, our findings demonstrate an essential need for scaling-up equitable access to HCV therapies, with services delivery models tailored to the needs of PWID. A sustained commitment to address these contextual differences will be essential to mitigate the alarming rates of preventable HCV-related morbidity and mortality experienced among PWID.

ACKNOWLEDGMENTS

The authors thank the study participants for their contribution to the research, as well as current and past researchers and staff.

REFERENCES

1. Montaner JS, Hogg R, Wood E, et al. The case for expanding access to highly active antiretroviral therapy to curb the growth of the HIV epidemic. The Lancet. 2006;368(9534):531–536.
2. Ti L, Milloy M-J, Shannon K, et al. Suboptimal Plasma HIV-1 RNA Suppression and Adherence Among Sex Workers who use Illicit Drugs in a Canadian Setting: An Observational Cohort Study. Sex Transm Infect. 2014;90(5):418–422.
3. Montaner JSG, Lima VD, Harrigan PR, et al. Expansion of HAART Coverage Is Associated with Sustained Decreases in HIV/AIDS Morbidity, Mortality and HIV Transmission: The "HIV Treatment as Prevention" Experience in a Canadian Setting. PLOS ONE. 2014;9(2):e87872.
4. Wood E, Hogg RS, Lima VD, et al. Highly Active Antiretroviral Therapy and Survival in HIV-Infected Injection Drug Users. JAMA. 2008;300(5):550–554.
5. Hull M, Shafran S, Wong A, et al. CIHR Canadian HIV Trials Network Coinfection and Concurrent Diseases Core Research Group: 2016 Updated Canadian HIV/Hepatitis C Adult Guidelines for Management and Treatment. Can J Infect Dis Med Microbiol. 2016;2016:4385643.
6. Mohamed AA, Elbedewy TA, El-Serafy M, El-Toukhy N, Ahmed W, Ali El Din Z. Hepatitis C virus: A global view. World J Hepatol. 2015;7(26):2676–2680.

7. Leone N, Rizzetto M. Natural history of hepatitis C virus infection: from chronic hepatitis to cirrhosis, to hepatocellular carcinoma. Minerva Gastroenterol Dietol. 2005;51(1):31–46.

8. WHO | Hepatitis C. WHO; 2017. Available at: http://www.who.int/mediacentre/factsheets/fs164/en/. Accessed April 3, 2017.

9. Platt L, Easterbrook P, Gower E, et al. Prevalence and burden of HCV co-infection in people living with HIV: a global systematic review and meta-analysis. Lancet Infect Dis. 2016;16(7):797–808.

10. 90–90–90 - An ambitious treatment target to help end the AIDS epidemic | UNAIDS. Available at: http://www.unaids.org/en/resources/documents/2017/90-90-90. Accessed May 12, 2017.

11. Grebely J, Raffa JD, Lai C, et al. Impact of hepatitis C virus infection on all-cause and liver-related mortality in a large community-based cohort of inner city residents. J Viral Hepat. 2011;18:32–41.

12. Socías M, Ti L, Dong H, et al. High prevalence of willingness to use direct-acting antiviral-based regimens for hepatitis C virus (HCV) infection among HIV/HCV coinfected people who use drugs. HIV Med. 2017;18:647-654.

13. Taylor LE, Swan T, Matthews GV. Management of Hepatitis C Virus/HIV Coinfection Among People Who Use Drugs in the Era of Direct-Acting

Antiviral–Based Therapy. Clin Infect Dis Off Publ Infect Dis Soc Am. 2013;57(Suppl 2):S118–S124.

14. Myles A, Mugford GJ, Zhao J, Krahn M, Wang PP. Physicians' attitudes and practice toward treating injection drug users infected with hepatitis C virus: Results from a national specialist survey in Canada. Can J Gastroenterol. 2011;25(3):135–139.

15. Cousien A, Leclerc P, Morissette C, et al. The need for treatment scale-up to impact HCV transmission in people who inject drugs in Montréal, Canada: a modelling study. BMC Infect Dis. 2017; 2017;17:162.

16. Grebely J, Robaeys G, Bruggmann P, et al. Recommendations for the management of hepatitis C virus infection among people who inject drugs. Int J Drug Policy. 2015;26(10):1028–1038.

17. Wiessing L, Ferri M, Grady B, et al. Hepatitis C Virus Infection Epidemiology among People Who Inject Drugs in Europe: A Systematic Review of Data for Scaling Up Treatment and Prevention. PLoS ONE. 2014; 9:e103345.

18. Harris M, Rhodes T. Hepatitis C treatment access and uptake for people who inject drugs: a review mapping the role of social factors. Harm Reduct J. 2013;10:7.

19. Nosyk B, Montaner JSG, Colley G, et al. The cascade of HIV care in British Columbia, Canada, 1996-2011: a population-based retrospective cohort study. Lancet Infect Dis. 2014;14(1):40–49.

20. Wide Use of New HCV Drugs Prevents New Cases. 2017. Available at: https://www.medpagetoday.com/MeetingCoverage/CROI/63242. Accessed April 15, 2017.

21. Strathdee SA, Palepu A, Cornelisse PGA, et al. Barriers to Use of Free Antiretroviral Therapy in Injection Drug Users. JAMA. 1998;280(6):547–549.

22. Ti L, Wood E, Shannon K, Feng C, Kerr T. Police confrontations among street-involved youth in a Canadian setting. Int J Drug Policy. 2013;24(1):46–51.

23. Strathdee SA, Patrick DM, Currie SL, et al. Needle exchange is not enough: lessons from the Vancouver injecting drug use study. AIDS Lond Engl. 1997;11(8):F59-F65.

24. Wood E, Stoltz J-A, Montaner JS, Kerr T. Evaluating methamphetamine use and risks of injection initiation among street youth: the ARYS study. Harm Reduct J. 2006;3:18.

25. Lake S, Milloy M-J, Dong H, et al. Initiation into prescription opioid injection and associated trends in heroin use among people who use illicit drugs. Drug Alcohol Depend. 2016;169:73–79.

26. Imai K, Keele L, Tingley D. A general approach to causal mediation analysis. Psychol Methods. 2010;15(4):309–334.

27. Grebely J, Oser M, Taylor LE, Dore GJ. Breaking Down the Barriers to Hepatitis C Virus (HCV) Treatment Among Individuals With HCV/HIV Coinfection: Action Required at the System, Provider, and Patient Levels. J Infect Dis. 2013;207:S19–S25.

28. World Health Organization. Global report on access to hepatitis C treatment. Focus on overcoming barriers. 2016. Available at: http://apps.who.int/iris/handle/10665/250625. Accessed April 2, 2017.

29. Deal reduces price of life-saving hepatitis C drugs for Canadians. Globe Mail. 2017. Available at: http://www.theglobeandmail.com/news/national/deal-reduces-price-of-life-saving-hepatitis-c-drugs-for-canadians/article34107225/. Accessed April 2, 2017.

30. Collins AB, Parashar S, Hogg RS, et al. Integrated HIV care and service engagement among people living with HIV who use drugs in a setting with a community-wide treatment as prevention initiative: a qualitative study in Vancouver, Canada. J Int AIDS Soc 2017;20:21407.

31. Choudhary M, Gilroy S, Faragon J, Kingsley Z, Cirabisi J, Ells P. Outcome of Chronic Hepatitis C Infection in Human Immunodeficiency Virus Co-Infected With Sofosbuvir Containing Regimens in HIV Primary Care Setting With

Integration of New York State Department of Health Funding Support. Open Forum Infect Dis. 2016;3. Available at: https://academic.oup.com/ofid/article/3/suppl_1/471/2636832/Outcome-of-Chronic-Hepatitis-C-Infection-in-Human. Accessed April 20, 2017.

32. Brunner N, Senn O, Rosemann T, Falcato L, Bruggmann P. Hepatitis C treatment for multimorbid patients with substance use disorder in a primary care-based integrated treatment centre: a retrospective analysis. Eur J Gastroenterol Hepatol. 2013;25(11):1300–1307.

33. Clarke JL, Bourn S, Skoufalos A, Beck EH, Castillo DJ. An Innovative Approach to Health Care Delivery for Patients with Chronic Conditions. Popul Health Manag. 2017;20(1):23–30.

34. WHO | Guidelines for the screening, care and treatment of persons with chronic hepatitis C infection. WHO. 2017. Available at: http://www.who.int/hepatitis/publications/hepatitis-c-guidelines-2016/en/. Accessed April 15, 2017.

35. Zero draft 2016 Political Declaration | UNAIDS. Available at: http://www.unaids.org/en/resources/documents/2016/HLM_zero_draft. Accessed April 26, 2017.

36. American Association for the Study of Liver Disease, Infectious Diseases Society of America. Recommendations for Testing, Managing, and Treating Hepatitis C.

2017. Available at: http://www.hcvguidelines.org/full-report-view. Accessed April 26, 2017.

37. Palepu A, Tyndall MW, Joy R, et al. Antiretroviral adherence and HIV treatment outcomes among HIV/HCV co-infected injection drug users: The role of methadone maintenance therapy. Drug Alcohol Depend. 2006;84(2):188–194.

38. Go VF, Morales GJ, Mai NT, Brownson RC, Ha TV, Miller WC. Finding what works: identification of implementation strategies for the integration of methadone maintenance therapy and HIV services in Vietnam. Implement Sci IS. 2016; 11:54.

39. Harris KA, Arnsten JH, Litwin AH. Successful Integration of Hepatitis C Evaluation and Treatment Services With Methadone Maintenance. J Addict Med. 2010;4(1):20–26.

40. Bruggmann P, Litwin AH. Models of care for the management of hepatitis C virus among people who inject drugs: one size does not fit all. Clin Infect Dis. 2013;57(suppl 2):S56–S61.

41. Grebely J, Knight E, Genoway KA, et al. Optimizing assessment and treatment for hepatitis C virus infection in illicit drug users: a novel model incorporating multidisciplinary care and peer support. Eur J Gastroenterol Hepatol. 2010;22:270–277.

42. Jayasekera CR, Arora S, Ahmed A. Hepatitis C Treatment Delivery Mandates Optimizing Available Health Care Human Resources: A Case for Task Shifting. JAMA. 2016;315(18):1947–1948.