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Hepatitis C virus status awareness and test results confirmation among people who inject drugs in Ukraine

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Abstract

Background—Among the estimated 340,000 people who inject drugs (PWID) in Ukraine, HCV prevalence is approximately 70%. As HCV treatment availability increases, an assessment of the HCV treatment cascade is needed to guide HCV prevention and treatment strategies.

Methods—Opioid dependent PWID were interviewed and tested for HIV and HCV in five Ukrainian cities from January 2014 to March 2015. Logistic regression was used to examine the independent correlates of two cascade steps: a) anti-HCV positive status awareness; b) chronic HCV confirmation; and of c) annual HCV testing for PWID.

Results—Among 1,613 PWID, 1,002 (62.1%) had anti-HCV positive test result, of which 568 (56.7%) were aware of it before the study and 346 (34.5%) reported previous confirmatory testing for chronic HCV. Independent correlates of being aware they had anti-HCV positivity included: current [AOR: 3.08; 95%CI: 2.16-4.40] or prior [AOR: 1.85; 95%CI: 1.27-2.68] opioid agonistic treatment (OAT) experience, relative to no prior OAT, living in Lviv [AOR: 0.50; 95%CI:

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0.31-0.81] or Odesa [AOR: 2.73; 95%CI: 1.51-4.93] relative to Kyiv and being aware of having HIV [AOR: 4.10; 95%CI: 2.99-5.62]. Independent correlates of confirming HCV infection among those who were aware of their anti-HCV positive status included: current OAT [AOR: 2.00; 95%CI: 1.24-3.23], relative to prior OAT, the middle income category [AOR: 1.74, 95%CI: 1.15-2.63], relative to the lowest, and receiving ART [AOR: 4.54; 95%CI: 2.85-7.23]. Among 1,613 PWID, 918 (56.9%) were either HCV negative or not aware of their HCV positive status, of which 198 (21.6%) reported recent anti-HCV test (during last 12 month). Recent anti-HCV test in this group was associated with current [AOR: 7.17; 95%CI: 4.63-11.13] or prior [AOR: 2.24; 95%CI: 1.32-3.81] OAT experience, relative to no prior OAT.

Conclusion—Encouraging PWID to participate in OAT may be an effective strategy to diagnose and link PWID who are HCV positive to care. Among HIV negative participants, regular HCV testing may be ensured by participation in OAT. More studies are needed to assess HCV treatment utilization among PWID in Ukraine and OAT as a possible way to retain them in treatment.

Keywords

HCV; Ukraine; people who inject drugs (PWID); HCV testing; cascade of care Declaration of interest: none

Background

Globally, an estimated 71 million people have viraemic hepatitis C virus (HCV) infection (“Polaris Observatory, H. C. V. Collaborators. Global prevalence and genotype distribution of hepatitis C virus infection in 2015: a modelling study,” 2017). Over the past 25 years, HCV-associated disability-adjusted life years have more than doubled and HCV-related mortality is increasing (Stanaway et al., 2016). People who inject drugs (PWID) account for most HCV cases in Eastern Europe and Central Asia with global prevalence of HCV among PWID exceeding 52%. (Degenhardt et al., 2017). Ukraine is home to Europe's most devastating drug injection epidemic, with 1.2% of the population injecting opioids (United Nations Office on Drugs and Crime (UNODC), 2016) The national estimate of HCV prevalence among PWID in Ukraine is approximately 70% (Hope, Eramova, Capurro, & Donoghoe, 2014), with more than 240,000 individuals infected with HCV and needing treatment. Despite evidence that HCV testing and treatment are increasing globally (Milne et al., 2015; Smith, Combellick, Jordan, & Hagan, 2015), PWID continue to lack access to effective treatment. Getting tested for antibodies to HCV (anti-HCV)and confirming chronic HCV infection are the necessary steps in the treatment cascade (Meyer et al., 2015). For most patients, the diagnosis is a two-step process: testing for anti-HCV using serological tests followed by confirmation of viremia with polymerase chain reaction (PCR) test that detects HCV RNA in the blood of the patient. Since 14-26% of infected patients clear their HCV and do not become chronically infected, the confirmation of viremia is needed to decide if treatment is necessary (Lauer & Walker 2001).

A 2013 cross-sectional survey of PWID in Ukraine reported that 50% of PWIDs were aware of their anti-HCV positive status (Salyuk & Sazonova, 2015). In this convenience sample, 9.4% of PWID with HCV reported receiving some treatment (Salyuk & Sazonova, 2015). Suboptimal awareness and treatment availability coupled with high financial costs of

treatment are among the main barriers to universal treatment of chronic HCV. In fact, pegylated-interferon and ribavirin treatment was introduced in Ukraine only in 2013 with some state funding which excluded PWID and funding by international donors for 100 PWID on opioid agonist therapy (Luhmann et al., 2015). Treatment with direct acting antiviral (DAA) medications was piloted in a group of 1,500 patients starting in 2015 (A. Mazhnaya et al., 2017). This scale-up project of HCV treatment with DAA for PWID was implemented in community-based settings and was shown to be feasible even for actively injecting participants (A. Mazhnaya et al., 2017). While opportunities for better treatment coverage in Ukraine are being explored, it is critical for program planners to better understand factors related to the hepatitis C testing and treatment cascade in PWID.

Opioid agonist therapy (OAT) with methadone or buprenorphine not only effectively reduces opioid use, but also reduces HIV and HCV transmission (Gowing, Farrell, Bornemann, Sullivan, & Ali, 2011; Roux et al., 2008), and improves engagement in treatment in the HIV cascade of care (Low et al., 2016; Roux et al., 2008). In Ukraine, buprenorphine maintenance treatment became available to a limited number of patients in 2004 and OAT using methadone was introduced in 2008 (Bruce, Dvoryak, Sylla, & Altice, 2007; Schaub, Chtenguelov, Subata, Weiler, & Uchtenhagen, 2010). Despite its documented benefits, OAT is under-scaled due to individual, structural and policy barriers (Bojko et al., 2015; Mazhnaya et al., 2016), resulting in only 2.7% of the estimated 340,000 opioid injectors in Ukraine being on treatment. OAT has demonstrated benefits on the HIV (A Mazhnaya et al., 2017) and TB (Morozova, Dvoryak, & Altice, 2013) treatment cascades in Ukraine, but has yet to be studied for HCV.

This study aimed to examine the first steps in the HCV treatment cascade among PWID in Ukraine and look for the independent correlates associated with: 1) being aware of anti-HCV positive status; 2) receipt of confirmatory HCV testing; and 3) among those with negative or unknown status, the proportion who adhered to HCV testing recommendations (annual testing) (“AASLD and IDSA. HCV Guidance: Recommendations for Testing, Managing, and Treating Hepatitis C,” 2014-2017). Specifically, we hypothesize that, among other factors, OAT is related to higher level of anti-HCV positive status awareness, confirmatory HCV testing and annual anti-HCV testing among HCV negative participants or with unknown status.

Methods

Data collection

The methods for the cross-sectional biobehavioral study involving 1,613 PWID in 5 cities in Ukraine (Kiev, Odesa, Mykolaiv, Dnipro, Lviv) conducted from January 2014 to March 2015 have been previously described (Makarenko et al., 2016). Eligibility included age 18 years or older, ICD-10 criteria for opioid dependence, lived/worked in the city where the survey was conducted, provided informed consent, and agreed to undergo rapid HIV and HCV testing. Three groups of opioid dependent PWID were included: (1) never on OAT; (2) previously on OAT; (3) currently on OAT. For the first group, respondent-driven sampling (RDS) was used, and random selection from the OAT registry was used for the second and the third group. “Seeds” for RDS were recruited at community outreach sites in each city

and included at least one: female, individual aged 18-25, and an individual who had injected less than two years. After completing, a computer-assisted, self-administered instrument (CASI) using Qualtrics®, point-of-care HIV and HCV (CITO TEST HIV 1/2/0, *Pharmasco* and CITO TEST HCV, *Pharmasco*) testing was performed along with pre- and post-test counseling by trained staff. The study was approved by the institutional review boards at Yale University and the Gromashevsky Institute at the National Academy of Medical Sciences, Kyiv, Ukraine.

Measures

The dependent variables were assessed: 1) being aware of having positive anti-HCV status (and confirmed using rapid onsite testing); 2) self-report of confirmatory testing for the subsample already aware of their anti-HCV positive status; and 3) compliance with recommendations for annual HCV testing ("AASLD and IDSA. HCV Guidance: Recommendations for Testing, Managing, and Treating Hepatitis C," 2014-2017) for PWID who are unaware of their HCV status before the study or believe themselves to not have HCV.

Definitions of independent variables: Key among our hypotheses is that patients on OAT would have higher engagement in the HCV treatment cascade. Being on OAT was confirmed by chart review of patients randomly sampled at OAT sites. Participants who were previously on OAT were confirmed by chart review and could not have taken OAT in the previous 10 days. Based on the review of the previous studies of OAT implementation in Ukraine (Makarenko et al., 2017; Makarenko et al., 2016) in addition to standard socio-demographic characteristics we measured duration of injection drug use, rapid HIV test results and HIV status self-report, and current antiretroviral treatment based on self-report. Cohabitation with sexual partner, presence of children in the household, and importance of religion (measured in Likert scale) were characteristics indicating the presence of social support which was found to be an important correlate in previous studies of PWID (Artenie et al., 2015; Solomon et al., 2015; Ti et al., 2013). Income level was categorized into: <1200 UAH (150 USD), 1200-3500 (150-437 USD) and >3500 (437USD) based on minimum poverty level and average monthly wage for Ukraine in 2014. Educational attainment was categorized as (1) high school drop-out, (2) completion of high school (including vocational school), (3) some college or higher education. Alcohol use was assessed using the AUDIT, with scores ≥8 for men and ≥4 for women defining an harmful or hazardous drinking (Saunders, Aasland, Babor, De la Fuente, & Grant, 1993). Addiction severity was measured using the DAST-10 (Yudko, Lozhkina, & Fouts, 2007). Scores ≤5 were indicative of low to moderate addiction, whereas scores >5 indicated substantial to severe addiction. Depression was assessed using the CES-D-10, with scores >10 classified as moderate to severe depression (Zhang et al., 2012).

Statistical analysis

A diagram of the subject disposition for the analytical sample is displayed in Figure 1. First, we examined the frequency distributions of categorical variables and mean (or median) of continuous variables. Then, we conducted bivariate analyses of the associations between the independent variables and study outcomes. Pearson's Chi-square tests were used to assess

the statistical significance of associations between two categorical variables, while t-tests were used to compare mean values of continuous variables.

Univariate logistic regression models were used to estimate unadjusted odds ratios (OR) for the association between OAT (currently on OAT/ previously on OAT / never on OAT) and outcomes: aware of positive anti-HCV status, ever undergone confirmatory testing for HCV in a medical institution, and been tested for hepatitis C during last 12 months preceding the interview. A multivariate logistic regression model was fit for each of the outcomes to compute the adjusted OR (AOR). Variables with associations at p-value<0.2 in bivariate analyses were initially put into multivariate regression models. A backward elimination approach was used to determine the final set of variables in each model. A significance level of $p<0.05$ based on Wald test results was chosen as a cut-off to keep each variable in the model. To further verify that no important covariates were missing, variables that were discarded with $p>0.05$ were put back into the model and retained if the exposure effect estimate changed by ≥10%. Hosmer and Lemeshow and Pearson goodness of fit tests were used to verify the model choice. All analyses were conducted using SAS software, Version 9.4 of the SAS System for Windows.

Results

Among the 1613 participants tested for HCV, 1002 (62.1%) were anti-HCV positive. Among this 1002 person sub-sample, 568 (56.7%) were aware of their positive anti-HCV status and only 346 (34.5%) had reported previous confirmatory testing. A stratified analysis based on their OAT status (Figure 2) suggested significantly higher levels for those on OAT, relative to those previously and never on OAT, for being both aware of their anti-HCV positive status, but also in terms of confirmatory HCV testing. Among 1,613 PWID, 918 (56.9%) were either HCV negative or were not aware of their anti-HCV positive status prior to the study. In this subsample who should be tested annually, 198 (21.6%) reported recent HCV testing (during the last 12 months).

The characteristics of the total sample of PWID, along with those with and without reactive anti-HCV subsamples are summarized in Table 1. Most participants were in their mid-thirties (mean: 36 years), male (76.4%) had completed high school (63.1%) and injected on average 17 years. A substantial proportion of the sample was not employed (37.6%), lived with a spouse or partner (35.6%), and had previously (55.8%) or currently (26.9%) received OAT. Almost half of the sample (46.9%) met criteria for harmful or hazardous drinking and had moderate to severe addiction. Overall, 668 (41.4%) tested positive for HIV, of which 573 (85.8%) were previously diagnosed and aware of their HIV positive status.

Independent correlates of anti-HCV positive status awareness and confirmation of chronic HCV among anti-HCV positive PWID

Among the 1002 participants with anti-HCV positive test, 568 (56.7%) were aware of their anti-HCV status. Correlates of being aware of anti-HCV status in those with documented infection are presented in Table 2. Independent correlates of being aware of anti-HCV positive status included: current or prior OAT experience, residing in Lviv or Odesa, being aware of having HIV, co-habitation with a spouse/partner, duration of injection, and harmful

or hazardous drinking. Correlates of having confirmed chronic HCV infection in those 568 participants aware of their anti-HCV positive serostatus are presented in Table 2. Independent correlates of confirming chronic HCV infection included: current OAT enrollment, residence in Dnipro, higher income status, having children and receiving ART.

PWID currently enrolled into OAT [AOR: 3.08; 95%CI: 2.16-4.40] or having prior experience with OAT [AOR: 1.85; 95%CI: 1.27-2.68] have higher odds of being aware of positive anti-HCV status compared to those who had never been on OAT. Furthermore, PWID who are currently on OAT had 2.00 [95%CI: 1.24-3.23] higher odds of confirming chronic HCV infection compared to those with prior OAT experience.

PWID who were aware of their HIV positive status had 4.10 [95%CI: 2.99-5.62] higher odds of knowing that they are anti-HCV positive. Duration of injection was associated with being aware of positive anti-HCV status and confirmatory testing [AOR: 1.02; 95%CI: 1.00-1.04 and AOR: 1.03; 95% CI: 1.0-1.05, respectively].

PWID in Odessa had 2.73 [95%CI: 1.51-4.93] higher odds and PWID in Lviv had 0.50 [95%CI: 0.31-0.81] lower odds of HCV status awareness compared to PWID in Kyiv. PWID living in Dnipro had lower odds to confirm their HCV status compared to PWID in Kyiv [AOR: 0.39; 95%CI: 0.22-0.68].

Living with a spouse or partner and harmful or hazardous drinking were each associated with slightly higher odds of being aware of anti-HCV status [AOR: 1.51; 95%CI: 1.13-2.03 and AOR: 1.44; 95%CI: 1.08-1.93, respectively]. PWID ranking religion as fairly or extremely important had ~70% higher odds of being aware of their positive anti-HCV status [AOR: 1.70; 95%CI: 1.18-2.45 and AOR: 1.52; 95%CI: 1.02-2.27, respectively], compared to those stating that religion is not important.

PWID with dependent children had a higher odds of confirmatory HCV testing [AOR: 1.57; 95%CI: 1.08-2.27], compared to childless participants. Income was also associated with confirmatory testing: AOR: 1.74 [95%CI: 1.15-2.63], comparing middle to low income. Current prescribed ART was associated with confirmatory HCV testing [AOR: 4.54; 95%CI: 2.85-7.23].

Independent correlates of recent HCV testing among PWID who are either HCV negative or not aware of their anti-HCV positive status prior to the study

Independent correlates of recent anti-HCV testing (during the 12 month prior to the interview), as recommended by guidelines for hepatitis C testing (“AASLD and IDSA. HCV Guidance: Recommendations for Testing, Managing, and Treating Hepatitis C,” 2014-2017), analyzed among PWID who were either HCV negative or were not aware of their HCV positive status included: current or prior OAT experience, residence in Odesa, longer injection duration, harmful or hazardous drinking, and female gender. Having previously (AOR: 2.24; 95%CI: 1.32-3.81] and presently (AOR: 7.17; 95%CI: 4.63-11.13) being on OAT was associated with recent anti-HCV testing while residing in Odessa was associated with 3.45 higher odds of recent anti-HCV testing (95%CI: 1.99-5.99] compared to Kyiv. Other independent correlates of recent anti-HCV testing included harmful or hazardous

drinking [AOR: 1.56; (95%CI: 1.09-2.23], shorter injection duration [AOR: 0.98; 95%CI: 0.96-1.00], and female gender [AOR: 1.61; 95%CI: 1.08-2.41].

Discussion

Several key lessons emerged from this study where the HCV treatment cascade was used to as a framework for determining gaps that are crucial for curbing the HCV epidemic. First, similar to other studies (Hope et al., 2014; Salyuk & Sazonova, 2015), anti-HCV prevalence in randomly selected PWID is 62%, with most of these (56.7%) being aware of being infected. Important among these findings is that being prescribed OAT was independently the strongest correlate of both anti-HCV testing, but also HCV confirmation. PWID currently on OAT were significantly more likely to be aware and complete confirmatory testing. To our knowledge, this is the first study examining the early elements of the HCV treatment (and prevention) cascade in Ukraine and has important implications for future intervention. This study, combined with a recent study of treatment completion rates in PWID treated for HCV as part of a pilot study (A. Mazhnaya et al., 2017) begins to provide a glimpse into the future HCV landscape.

The HCV prevalence assessment, limited to five cities but recruited using random selection, is similar to a nationwide but unpublished study of HCV prevalence in PWID where anti-HCV prevalence was 55% and anti-HCV awareness was 50% (Salyuk & Sazonova, 2015). The slightly higher prevalence and awareness status may be explained in part by the current study being restricted to five regions and ones most impacted by HIV. The high prevalence estimates of HIV (41.4%) in our sample may be explained by choice of regions for study as well as preferential acceptance of HIV positive individuals to OAT programs in Ukraine.

The association of OAT and HCV continuum of care is similar to the case of HIV where being on OAT in Ukraine was associated with each step of the HIV continuum of care, including HIV testing (A Mazhnaya et al., 2017). Though HCV treatment has been introduced solely as a pilot study, a systematic review of the influence of OAT on the distal part of the HIV cascade are similarly supportive of OAT's role at increasing access to and utilization of clinical care (Low et al., 2016).

Concerning in this study is the finding that while HCV prevalence itself was high, only half of those with HCV had completed confirmatory testing. This is an especially important step since only those with chronic HCV infection, verified through confirmatory testing, would be eligible for treatment as new therapies become available. One explanation for low confirmatory testing is that since HCV treatments are uncommon, there is no urgency for further assessment. The geographic differences in HCV confirmatory testing need further examination, though, they may be explained by case management teams that facilitate the confirmatory testing for HCV/HIV positive individual by referring him to private laboratories for testing, supporting with the information about HCV, and subsidizing the cost of testing. The finding that participants with the higher income are more likely to complete confirmatory testing suggests that the major barrier to this step is the need for resources to cover this testing. One of the key implementation findings from the pilot HCV treatment

project in Ukraine found that subsidizing HCV testing costs was a key factor associated with treatment scale-up (A. Mazhnaya et al., 2017).

Several key findings regarding one's awareness of anti-HCV positivity merit further discussion, including the association with HIV status and ART receipt. A likely explanation for this is integrated care sites evolving through Ukraine that integrate OAT, HIV and TB treatment (Bachireddy et al., 2014; Sylla, Bruce, Kamarulzaman, & Altice, 2007). Integrating multiple services for PWID with HIV increases their access to ART compared to those receiving OAT on non-co-located settings (Bachireddy et al., 2014). So, our study indirectly supports the hypothesis that engaging HIV-positive PWID into OAT at integrated care sites also increases their chance to receive anti-HCV test. These results give the additional support to the model of health care delivery that is able to integrate different health care services for the key populations and thereby improve individual and public health. This is especially important since the presence of HIV accelerates progression of HCV to end-stage liver disease (Thein, Yi, Dore, & Krahn, 2008) and HCV treatment for this group should be prioritized (Soto et al., 1997), especially as liver disease has become the leading cause of death among patients with HIV (“Antiretroviral Therapy Cohort Collaboration. Causes of death in HIV-1–infected patients treated with antiretroviral therapy, 1996–2006: collaborative analysis of 13 HIV cohort studies,” 2010; Ioannou et al., 2013; Weber et al., 2013). Since full correction of the adverse effect of HIV infection on HCV prognosis was not observed as a result of ART, HIV/HCV co-infected patients have faster progression of fibrosis and should consider earlier initiation of HCV treatment (Thein et al., 2008). In Ukraine, with estimated HIV prevalence of 26% among PWID with chronic HCV infection (estimated 197,000) (Hope et al., 2014; Salyuk & Sazonova, 2015), an estimated total of 51,200 PWID with HIV/HCV co-infection would need treatment for both conditions.

Higher awareness of HCV positive status among PWID in Lviv and Odessa can be explained by activity of local non-governmental organizations who are more actively engaged into rising awareness of the anti-HCV status among local population of PWID, compared to the other cities (“ICF “Alliance for Public Health” Annual report, 2015,” 2016). The rapid testing for anti-HCV is provided for key populations at the offices of these NGO free of charge due to the support of international donor organizations (“ICF “Alliance for Public Health” Annual report, 2015,” 2016).

Living with a spouse or partner, importance of religion, or harmful or hazardous drinking were all associated with being aware of positive anti-HCV status. The findings of having a spouse or emphasizing the importance of religion are likely associated with the presence of social support. Social support, either intrinsically available or provided through peer interventions, have been associated with high levels of engagement in healthcare (Artenie et al., 2015). Importantly, harmful or hazardous drinking and its association with being aware of anti-HCV status is crucial since it provides opportunities to counsel about the synergistic and negative influences of alcohol use on HCV infection (Tsui et al., 2007). More importantly, these patients should be prioritized, similar to the case of HIV, for early HCV treatment.

The participants with dependent children, longer duration of injection and high relative income were also more likely to confirm chronic HCV infection in this study. Since usually women take care of children in Ukraine, higher uptake of health care by women may explain the association between having children and confirmatory testing (Artenie et al., 2015). The high cost of confirmatory HCV testing, and need for out-of-pocket payments for it may explain the association between higher income and chronic HCV confirmation. Although the constitution of Ukraine guarantees free healthcare for all citizens, out-of-pocket payments are common and often required for gaining access to medical services (Stepurko, Pavlova, Gryga, & Groot, 2013; Stepurko, Pavlova, Gryga, Murauskiene, & Groot, 2015).

Findings associated with the HCV prevention cascade provide insights for future prevention services. Key among them was the finding that current and previous OAT was correlated with recommended annual anti-HCV testing for those who do not know themselves to be HCV-infected. Being on chronic treatment for an opioid use disorder allows patients to more fully engage in HCV prevention and treatment services. Importantly, this study found that those who may be at increased risk for HCV: in particular women (Fitzgerald, Lundgren, & Chassler, 2007), those with shorter duration of injection (Folch et al., 2016) and with drinking problems had higher odds to have been recently tested. This may represent that either these PWID perceived themselves to be at highest risk, or that there was targeted testing for those at higher risk. Women may be more vulnerable to HCV when in the sexual partnerships because of paraphernalia sharing and injecting after their partners (Shulga, 2012). There is the need to account for relationships in couples when designing and implementation of HCV testing and treatment with gender and empowerment components.

Though there are many important findings from this study, it is not without limitations. First, anti-HCV prevalence and other characteristics were based on RDS for those never on OAT and may be not accurate estimates for the all PWID never on OAT in these cities. The estimates obtained in those currently or previously on OAT, however, are truly random and may be useful for program planners, as proportion estimates for that group are generalizable to the five cities where the study was conducted. Second, we relied on self-report for confirmatory HCV testing, which may be overestimated because participants might not fully understand the approach to HCV diagnostics that include two different test types. Therefore, they may perceive the repeated test for anti-HCV as confirmatory test. While this is a common strategy in many studies, having had confirmation of prior HCV testing would have been a less biased method. Studies with longitudinal design, detection of chronic HCV infection and HCV treatment uptake among PWID are warranted.

In conclusion, apart from well establish health benefits that OAT participation brings to an individual, it can improve outcomes related to HCV cascade of care, including awareness of HCV status, confirmation of chronic HCV infection and adherence to recommended HCV testing. Continuing the efforts to expand OAT and ensure the high retention rate for the enrolled participants of OAT programs should pay off not only by controlling the opioid use epidemic and reducing HIV transmission but also by ensuring higher rates of anti-HCV status awareness and confirmation. As international donor organizations will not be able to support the OAT programs in Ukraine in the near future, the commitment of state to maintaining the current infrastructure and funding for OAT is especially important to reduce

the burden of diseases associated with injection drug use, including HIV and HCV. As HCV treatment is scaled up, there may become increased recognition of the importance of treatment and increasing proportions of patients with or at risk for HCV will be tested, confirmed and ultimately treated.

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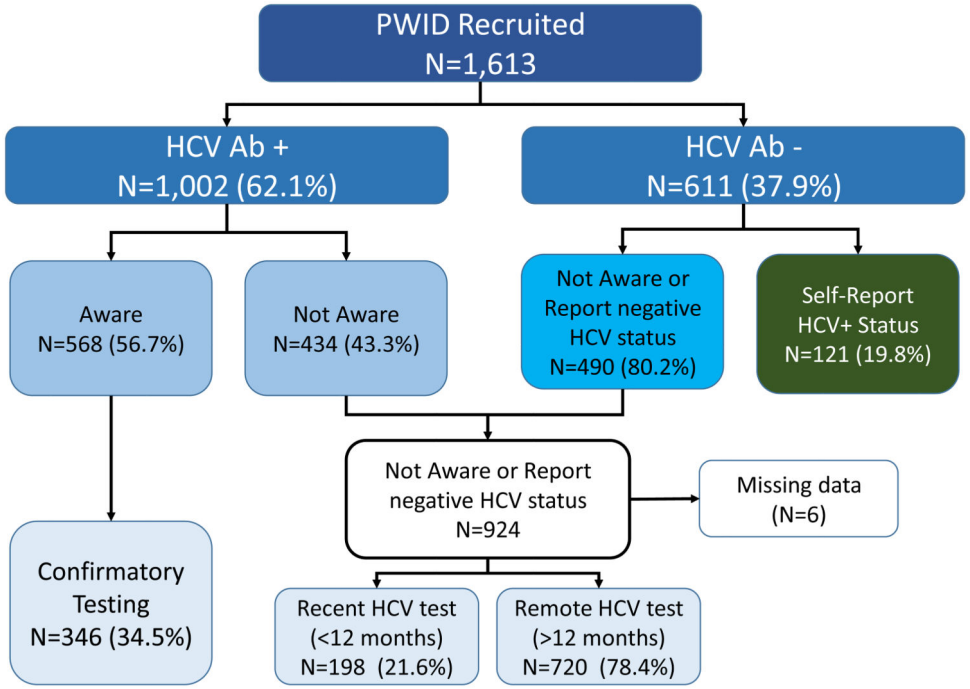

Fig. 1.

The diagram of subject disposition for the analytical sample of PWID. The anti-HCV test result was provided to the participant after he comleted the questionnaire regarding his previous anti-HCV tests results and HCV status confirmation.

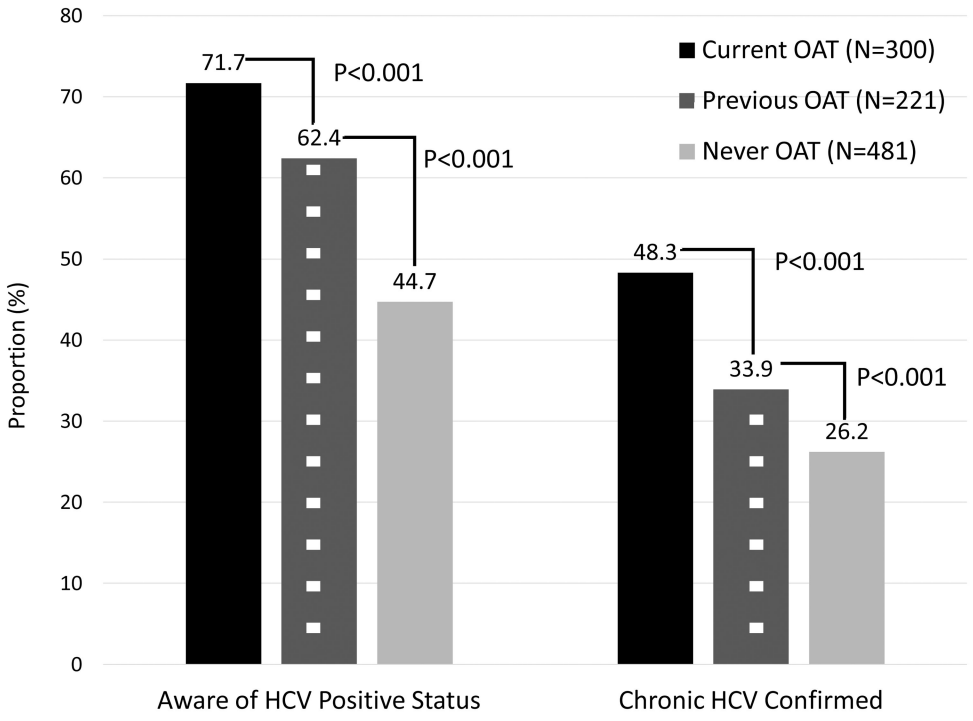

Fig. 2. The HCV Treatment Cascade for PWID infected with HCV in Ukraine (N=1,002), stratified by their prior experience with opioid agonist therapies

Table 1
Comparison of HCV status among people who inject drugs (N=1613)

Characteristic	Total sample (N=1613)	Anti-HCV positive (N=1002)	Anti-HCV negative (N=611)	p-value
	N (%)	N (%)	N (%)	
Male gender	1233 (76.4)	766 (76.5)	467 (76.4)	0.995
Age - mean (SD)	36 (8.3)	36.8 (8.0)	35.4 (8.7)	0.002
Living with spouse/partner	574 (35.6)	370 (36.9)	204 (33.4)	0.150
Have dependent children	840 (52.1)	542 (54.1)	298 (48.8)	0.038
Importance of religion				0.239
Not important	354 (22)	207 (20.7)	147 (24.1)	
Fairly important	783 (48.5)	499 (49.8)	284 (46.5)	
Extremely important	476 (29.5)	296 (29.5)	180 (29.5)	
Education level				0.840
Less than high school	249 (15.4)	151 (15.1)	98 (16.0)	
High school (including vocational schools)	1018 (63.1)	633 (63.2)	385 (63.0)	
Some university education or higher	346 (21.5)	218 (21.8)	128 (21.0)	
Employment				0.107
Full time/part time permanent job	752 (46.6)	453 (45.2)	299 (48.9)	
Temporary/ Seasonal/ Day laborer	254 (15.8)	152 (15.2)	102 (16.7)	
Not employed	607 (37.6)	397 (39.6)	210 (34.4)	
Income				0.445
<1200 UAH	551 (34.2)	354 (35.3)	197 (32.2)	
1200-3499 UAH	746 (46.3)	456 (45.5)	290 (47.5)	
>=3500 UAH	316 (19.6)	192 (19.2)	124 (20.3)	
City of residence				<0.001
Kyiv	413 (25.6)	356 (35.5)	57 (9.3)	
Odessa	215 (13.3)	93 (9.3)	122 (20)	
Mykolaiv	344 (21.3)	222 (22.2)	122 (20)	
Dnipro	368 (22.8)	213 (21.3)	155 (25.4)	
Lviv	273 (16.9)	118 (11.8)	155 (25.4)	
OAT experience				<0.001
Never on OAT	900 (55.8)	481 (48.0)	419 (68.6)	
Previously on OAT	279 (17.3)	221 (22.1)	58 (9.5)	
Currently on OAT	434 (26.9)	300 (29.9)	134 (21.9)	
Years of injection – mean (SD)	17 (9)	18.1 (8.6)	15.5 (9.9)	<0.001
Addiction severity (moderate to severe)	1376 (85.3)	872 (87.0)	504 (82.5)	0.013
Moderate to severe depression	968 (60.0)	602 (60.1)	366 (59.9)	0.944
Harmful or hazardous drinking	756 (46.9)	481 (48.0)	275 (45.0)	0.242
Aware of positive HIV status	573 (35.5)	395 (39.4)	178 (29.1)	<0.001
Positive HIV test result (rapid test)	668 (41.4)	441 (44.0)	227 (37.2)	0.007

Characteristic	Total sample (N=1613)	Anti-HCV positive (N=1002)	Anti-HCV negative (N=611)	p-value
	N (%)	N (%)	N (%)	
Currently prescribed ART	314 (19.5)	218 (21.8)	96 (15.7)	0.003
Have ever been tested for hepatitis C and received the result	1011 (62.7)	685 (68.4)	326 (53.4)	<0.001
Aware of positive hepatitis C status	-	568 (56.7)	-	-
Have undergone confirmatory testing for hepatitis C	-	346 (34.5)	-	-

ART – antiretroviral therapy, SD – standard deviation.

Table 2

Correlates of being aware of anti-HCV positive status and getting confirmatory HCV test, among anti-HCV positive PWID

	Aware of anti-HCV positive status (N=1,002)		Have undergone testing for hepatitis C confirmatory (N=568)	
	AOR (95% CI)	P-value	AOR (95% CI)	P-value
OAT experience				
Never on OAT	1.00		1.43 (0.89-2.30)	0.144
Previously on OAT	1.85 (1.27-2.68)	<0.001	1.00	
Currently on OAT	3.08 (2.16-4.40)	<0.001	2.00 (1.24-3.23)	0.004
City of residence				
Kyiv	1.00		1.00	
Odessa	2.73 (1.51-4.93)	<.001	0.69 (0.37-1.29)	0.237
Mykolaiv	0.85 (0.58-1.26)	0.422	0.75 (0.45-1.25)	0.269
Dnipro	0.72 (0.47-1.10)	0.127	0.39 (0.22-0.68)	0.001
Lviv	0.50 (0.31-0.81)	0.005	1.34 (0.62-2.91)	0.460
Have dependent children	-		1.57 (1.08-2.27)	0.017
Living with spouse/partner	1.51 (1.13-2.03)	0.006	-	-
Income				
<1200 UAH	-	-	1.00	
1200-3499 UAH	-	-	1.74 (1.15-2.63)	0.009
>=3500 UAH	-	-	1.64 (0.98-2.73)	0.059
Years of injection	1.02 (1.00-1.04)	0.08	1.03 (1.00-1.05)	0.066
Harmful or hazardous drinking	1.44 (1.08-1.93)	0.015	-	
Importance of religion				
Not important	1.00		-	-
Fairly important	1.70 (1.18-2.45)	0.005	-	-
Extremely important	1.52 (1.02-2.27)	.04	-	-
Aware of positive HIV status	4.10 (2.99-5.62)	<.001		
Currently prescribed ART	-	-	4.54 (2.85-7.23)	<.001

Table 3

Correlates of anti-HCV testing during the previous 12 months among PWID that are either HCV negative or not aware of their anti-HCV positive status (N=918)

	HCV test during last 12	month (N=198)
	AOR(95% CI)	**P-value**
OAT experience		
Never on OAT	1.00	
Previously on OAT	2.24 (1.32-3.81)	0.003
Currently on OAT	7.17 (4.63-11.13)	<0.001
City of residence		
Kyiv	1.00	
Odessa	3.45 (1.99-5.99)	<0.001
Mykolaiv	1.09 (0.65-1.81)	0.747
Dnipro	0.97 (0.58-1.64)	0.922
Lviv	0.63 (0.35-1.11)	0.108
Gender (female)	1.61 (1.08-2.41)	0.019
Harmful or hazardous drinking	1.56 (1.09-2.23)	0.015
Injection duration	0.98 (0.96-1.00)	0.025