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Engagement in hepatitis C virus cascade of care and factors associated with testing among people who inject drugs in Iran

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Abstract

Background Understanding the hepatitis C virus (HCV) cascade of care (CoC) and factors associated with engagement is crucial for designing interventions for achieving HCV elimination. However, data on engagement in the HCV CoC among people who inject drugs (PWID) in the Middle East and North Africa remains limited. We examined the HCV CoC and factors associated with testing among Iranian PWID.

Methods We recruited PWID in 14 cities using respondent-driven sampling. PWID completed structured interviews capturing measures on socio-demographics, behaviors, and HCV CoC. We examined the self-reported numbers and proportions of individuals who ever tested for HCV, tested positive for HCV antibody, were diagnosed with HCV, initiated HCV treatment, and achieved sustained virologic response (SVR). Multivariable logistic regression models were built to assess factors associated with HCV antibody testing.

Results Of 2308 PWID, 23.1% had ever received an HCV antibody test, 13.9% received the HCV antibody test in the last year, 3.4% had tested positive for HCV antibodies, and 2.5% had received an HCV diagnosis. Of those diagnosed, 54.4% reported initiating treatment, and 31.6% had achieved SVR. HCV antibody testing was significantly associated with having knowledge about HCV transmission through sharing needle/syringe (adjusted odds ratio [aOR] 8.09; 95% confidence intervals [CI] 5.25, 12.48), living with HIV (aOR 4.15; 1.58, 10.92), no previous history of homelessness (aOR 1.89; 1.31, 2.72), history of arrest/incarceration (aOR 1.83; 1.26, 2.64), history of being diagnosed with any mental health problems (aOR 2.88; 1.79, 4.61), history of non-fatal overdose (aOR 1.51; 1.08, 2.10), receiving needle exchange programs in the last 12 months (aOR 6.20; 3.86, 9.93), opioid agonist treatment in the last six months (aOR 2.10; 1.39, 3.18), and having ever received HBV vaccine (aOR 2.31; 1.59, 3.35).

Conclusions We found a considerably low engagement in HCV CoC among PWID in Iran. Enhancing access to testing services for PWID, especially those with limited awareness of HCV transmission and those encountering structural challenges, is essential as the initial step in the HCV CoC. This improvement is vital for strengthening HCV elimination efforts in Iran.

Keywords Hepatitis C virus, Cascade of care, People who inject drugs, Harm reduction, Iran

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Introduction

The World Health Organization has established a target to eliminate the hepatitis C virus (HCV) as a significant global public health concern through enhancing diagnosis and treatment efforts. This initiative includes achieving an 80% reduction in new HCV infections, ensuring 90% of people living with HCV are diagnosed, providing treatment to 80% of those diagnosed, and reducing HCV-related deaths by 65%, by 2030 [29]. While understanding the HCV cascade of care (CoC) and factors associated with engagement is crucial for achieving the HCV elimination goals [12], data on engagement in the HCV CoC in the Middle East and North Africa (MENA) remains limited.

MENA has the highest prevalence of HCV globally. This region accounts for approximately 20% of all individuals living with chronic HCV infection [30]. Among the affected populations in MENA, PWID are disproportionately impacted. Indeed, the pooled prevalence of HCV antibodies among PWID in the region was estimated to be 49.3% (95% CI 44.4, 54.1), with an estimated 221,704 PWID living with chronic HCV infection. In the MENA, Iran has the largest number of estimated cases, with 68,526 PWID affected [18].

Recent population size estimation studies suggest that 345,308 PWID are living in Iran [22]. Over the past two decades, various efforts within the healthcare system and research have been made to address the unmet health and social needs of PWID in Iran. For example, there has been an expansion of harm reduction services, such as opioid agonist treatment (OAT), needle and syringe programs (NSP), HIV testing, counselling and treatment through voluntary counselling and testing centers and drop-in centers [9]. Encouragingly, several favorable outcomes have been observed among PWID in Iran, including a reduction in HIV prevalence and high-risk behaviors. From 2010 to 2020, there was a significant decline in the prevalence of HIV among PWID, decreasing from 15.1 to 3.5%. Receptive needle sharing also decreased from 25.2 to 3.9%, and unprotected sex decreased from 79.4 to 65.2% [17]. A meta-analysis has also demonstrated a decrease in HIV prevalence among PWID [21], which could be related to the extension of harm reduction programs in the country [9]. The observed reductions suggest that extending harm reduction services and healthcare access to this population can yield positive outcomes, with PWID likely to respond favorably to such efforts. In addition to these trends, the landscape of drug use patterns among PWID in Iran has shifted over the last decade. While heroin remains the most commonly used drug (rising from 64% in 2010 to 73% in 2020), opium use has declined (from 10% in 2010 to 7% in 2020), and methamphetamine use has increased significantly (from 17% in 2010 to 47% in 2020) [15].

Despite these achievements, the HCV care landscape in Iran remains underdeveloped. Iran lacks a publicly funded HCV program, with HCV testing, diagnostic, and treatment services primarily restricted to public tertiary healthcare centers [1]. These services are not universally accessible, and costs vary, further limiting engagement among marginalized populations. While harm reduction services like OAT and NSP exist, they do not consistently offer linkages to HCV services, creating a gap in the cascade of care. Limited research on HCV among PWID further compounds these challenges. Although intervention studies in Tehran and Kerman have shown promise in improving HCV CoC engagement [1, 20], national studies to identify factors associated with engagement in the HCV CoC among PWID in Iran remain limited.

Given the estimated HCV antibody prevalence of 26% (95% CI 24.4, 27.7) among PWID in Iran [16], understanding engagement at all phases of the HCV CoC—from testing to treatment adherence—is crucial for developing effective elimination strategies. Moreover, prioritizing PWID for screening could be the pivotal step in controlling HCV in the MENA [6]. Given HCV antibody testing among PWID is an essential component of the cascade of care, facilitating early detection, linkage to care, treatment initiation, prevention of transmission, and ultimately, improving public health outcomes related to HCV in Iran, we aimed to examine the HCV CoC and factors associated with testing, as the first point of entry into the HCV CoC, among a large and nationally representative sample of PWID in Iran.

Methods

Study design and participants

We recruited PWID as part of the fifth national HIV bio-behavioral surveillance survey in Iran. We enlisted participants from 14 cities in Iran, encompassing Tehran (central north), Karaj (central north), Tabriz (northwest), Sari (north), Mashhad (northeast), Yazd (central), Kermanshah (west), Khorramabad (west), Dorud (west), Ahvaz (southwest), Shiraz (south), Kerman (southeast), Saravan (southeast), and Zahedan (southeast). These cities were chosen in collaboration with Iran's Ministry of Health and Medical Education to ensure the representation of various geographical regions across the nation. The criteria for participation included: (1) being at least 18 years of age, (2) self-reporting injection of any drugs within the past year, and (3) possessing a valid referral voucher in accordance with the study's methodology.

Sampling and data collection

Between May and August 2023, we followed a respondent-driven sampling (RDS) approach, a method commonly employed in HIV research to reach marginalized communities such as PWID [26]. We started by recruiting initial participants, also known as seeds, who belonged to different PWID subgroups and possessed extensive social networks. Each seed was given three coupons to distribute to their peers within their social networks, with a deadline of three weeks for their use. Participants were compensated for participating in interviews and undergoing the HIV rapid test (approximately 1.5 USD per session), and they received additional incentives (around 1 USD) for successfully referring peers to the study.

Using a standardized pilot-tested interviewer-administered questionnaire, face-to-face interviews were conducted to gather participant's data, such as sociodemographic information, social network characteristics, drug use behaviors, use of harm reduction and drug treatment services, and HCV CoC. Blood samples were collected for HIV testing, accompanied by both pre-test and post-test counseling sessions. HIV testing utilized SD-Bioline rapid tests from South Korea, with reactive results confirmed by a follow-up Unigold HIV rapid test.

Variables

The main outcomes were the proportion of participants involved at each step of the HCV CoC. Self-reported data were collected to assess participants' status in various stages of the HCV CoC, with the following outcomes based on specific survey questions: a) ever tested for HCV: Participants were asked, Have you ever been tested for HCV?, with response options of yes or no.; b) tested positive for HCV antibody: Participants were queried about the result of the HCV test, with response options including positive, negative, uninterpretable, did not receive the test result, and do not know; c) diagnosed with HCV: Participants were asked if a healthcare provider had ever informed them of an HCV infection diagnosis, with response options of yes or no; d) initiation of HCV treatment: Participants were asked if they had ever taken medication to treat their HCV infection, with response options of yes or no; e) achieved sustained virologic response (SVR): Participants were asked if they knew the result of their post-treatment HCV test, with response options including positive for HCV, negative for HCV, uninterpretable, and did not know.

Factors associated with HCV CoC engagement included sociodemographic, structural, mental health, drug use, and treatment and service engagement variables. Sociodemographic variables included age (18–29, 30–44, or ≥ 45), gender (men or women), education (less than high school or high school or more), knowledge of HCV transmission through sharing needle/syringe (no or yes), HIV serostatus (negative or positive). Structural variables included having medical insurance (no or yes), lifetime experience of homelessness (no or yes), lifetime experience of arrest/incarceration (no or yes), and lifetime experience of stigma within healthcare settings (no or yes). Mental health variables included ever diagnosis with any mental health problems by a psychiatrist (no or yes), and lifetime self-harming behavior (no or yes). Drug use variables included length of injection (< 5, 5–10, > 10 years), frequency of injection in the last 6 months (no injection, weekly/monthly, or daily), and lifetime experience of non-fatal overdose (no or yes). Service engagement variables included receiving NSP in the last 12 months (no or yes), OAT in the last 6 months (no or yes), and the hepatitis B virus (HBV) vaccine in the lifetime (no or yes).

Statistical analysis

Descriptive statistics, including relative frequencies of categorical variables, were utilized to characterize the study participants and HCV CoC. To examine factors associated with the different stages of the HCV CoC, we were able to analyze one outcome measure (i.e., antibody testing), with the denominator being the total sample. Due to the limited sample size of individuals previously diagnosed or underwent treatment, the model lacked sufficient power to assess factors associated with other stages. Bivariable and multivariable logistic regression models were employed to investigate the factors associated with HCV antibody testing. The final model also included a random-effects variable to account for city-level heterogeneities in the data. Adjusted odds ratios (aOR) along with their corresponding 95% confidence intervals (CI) were estimated and reported. Covariates with a significance level of $P < 0.2$ in the bivariable analysis were included in the full multivariable regression model. These analyses were conducted using Stata v.17 (StataCorp, College Station, Texas, USA). Considering that unweighted regression models provide greater accuracy, wider coverage, and more reliable estimates than RDS-weighted models [2], we chose to employ an unweighted regression modeling approach, aligning with an expanding body of research [11, 24]. Furthermore, we calculated and presented RDS-adjusted estimates for HCV testing by covariates, incorporating network size and homophily within networks. These RDS-adjusted estimates were generated using RDS-Analyst version 1.8.

Ethical considerations

All study protocols were reviewed and approved by the ethics committee of Kerman University of Medical Sciences (Ethics Codes: IR.KMU.REC.1401.216). Participation in the study was anonymous, and verbal informed consent was obtained from all participants before their enrollment, encompassing both biological and behavioral data collection and declining to participate did not affect service or care provision.

Results

Among 2,308 PWID, most participants were aged between 30 and 45 years (54.9%) and were men (95.8%). About two-thirds (67.1%) had less than a high school education, and 47.3% were divorced or widowed. Overall, 21.1% reported having knowledge of HCV transmission through sharing needles/syringes. Most PWID reported lifetime experiences of homelessness (63.4%), incarceration (70.7%), and stigma within healthcare settings (62.7%). Over half injected for more than 10 years (55.5%), 47.9% injected daily in the last six months, and 28.5% experienced a non-fatal overdose in their lifetime. Moreover, 73.2% used NSP in the last 12 months, 25.4% received OAT in the last 6 months, and 22.4% received the HBV vaccine in their lifetime (Table 1).

Of the total sample, there were 532 PWID (23.1%; 95% CI 21.3, 24.8) who ever received an HCV antibody test, 321 (13.9%; 95% CI 12.5, 15.4) received the HCV antibody test in the last year, 78 (3.4%; 95% CI 2.7, 4.2) had tested positive for HCV antibodies, and 57 (2.5%; 95% CI 1.9, 3.2) had received an HCV diagnosis. Of those diagnosed, 31 (54.4%; 95% CI 40.7, 67.6) reported initiating treatment for HCV infection, and 18 (31.6%; 95% CI 19.9, 45.2) achieved SVR (Fig. 1).

HCV antibody testing was significantly higher among PWID who were older (24.9% vs. 9.6%, $P<0.001$), currently married compared to divorced/widowed (33.3% vs. 18.0%, $P<0.001$), had knowledge of HCV transmission through sharing needles/syringes (45.9% vs. 17.0%, $P<0.001$), and were living with HIV (63.0% vs. 22.6%, $P<0.001$). Regarding structural variables, HCV antibody testing was significantly higher among PWID who reported having medical insurance (29.4% vs. 21.4%, $P<0.001$), and never experienced homelessness (29.7% vs. 19.2%, $P<0.001$). A significantly higher level of HCV antibody testing was also reported among PWID who were diagnosed with any mental health problems (38.8% vs. 21.7%, $P<0.001$), injected for more than ten years (29.0% vs. 11.1% for < 5 years, $P<0.001$), injected weekly or monthly in the last six months (28.3% vs. 17.3% for no injection, $P<0.001$), and reported a lifetime experience of non-fatal overdose (32.1% vs. 19.5%, $P<0.001$). Moreover, HCV antibody testing was higher among PWID who received NSP in the last 12 months (29.6% vs. 5.8%, $P<0.001$), OAT in the last 6 months (33.9% vs. 19.4%, $P<0.001$), and the HBV vaccine in their lifetime (39.1% vs. 19.8%, $P<0.001$) (Table 1).

Multivariable logistic regression model showed that those who knew about HCV transmission through sharing needle/syringe (aOR 8.09; 95% CI 5.25, 12.48), were living with HIV (aOR 4.15; 95% CI 1.58, 10.92), had never experienced homelessness (aOR 1.89; 95% CI 1.31, 2.72), had experienced arrest/incarceration (aOR 1.83; 95% CI 1.26, 2.64), had been ever diagnosed with any mental health problems (aOR 2.88; 95% CI 1.79, 4.61), had ever experienced non-fatal overdose (aOR 1.51; 95% CI 1.08, 2.10), and had received NSP in the last 12 months (aOR 6.20; 95% CI 3.86, 9.93), had received OAT in the last 6 months (aOR 2.10; 95% CI 1.39, 3.18), and had received HBV vaccine in their lifetime (aOR 2.31; 95% CI 1.59, 3.35) were significantly more likely to report receiving an antibody test (Table 2).

Subgroup analysis indicates that PWID who injected in the past 6 months, compared to those who injected between 6 and 12 months, were significantly more likely to have ever been tested for HCV antibody (24.6% vs. 17.3%, $P=0.001$) and to have been tested for HCV antibody in the past year (15.9% vs. 6.1%, $P<0.001$). However, there were no significant differences in the proportions of individuals who were antibody-positive, RNA-positive, initiated treatment, or achieved SVR (Supplementary Table 1).

Discussion

Our findings showed that only one in four of PWID in Iran were tested for HCV antibody in their lifetime, and one in seven PWID underwent testing for HCV antibodies in the last year. Out of the total sample, 3% tested positive for HCV antibodies and 2% of the total sample received a diagnosis of HCV infection. Among those diagnosed with HCV, over half reported initiating treatment for HCV infection, and about one-third achieved SVR. HCV antibody testing was significantly associated with having knowledge of HCV transmission through needle/syringe sharing, living with HIV, never experiencing homelessness, ever experiencing arrest/incarceration, having a history of mental health diagnoses, having experienced non-fatal overdose, and utilizing NSP, OAT, and the HBV vaccine.

While the overall engagement in the HCV CoC stages among PWID in Iran was low, our research indicates an increase in engagement between 2020 and 2023. Previously, we estimated that 12% of PWID had ever been tested for HCV, 4% tested positive for HCV antibodies, and 3.7% had received an HCV diagnosis. Among those diagnosed, 15% initiated treatment, and 3% achieved

Table 1 Ever hepatitis C virus antibody testing by demographic, structural, mental health, drug use, and service engagement variables among people who inject drugs in Iran, 2023

Variables	Total sample N (%)	Ever HCV antibody testing n (%)	RDS adjusted % (95% CI)	Crude odds ratio (95% CI)	*P* value
Total, N	2308	532 (23.1)	23.0 (19.4, 30.2)		–
Demographics					
Age group					
18–29	136 (5.9)	13 (9.6)	9.0 (6.6, 12.9)	Ref	
30–44	1,267 (54.9)	315 (24.9)	23.0 (18.6, 30.0)	3.13 (1.74, 5.62)	< 0.001
≥ 45	905 (39.2)	204 (22.5)	24.1 (20.0, 26.3)	2.75 (1.52, 4.97)	0.001
Gender					
Men	2,212 (95.8)	506 (22.9)	22.5 (18.1, 25.3)	Ref	
Women	96 (4.2)	26 (27.1)	28.6 (20.0, 32.0)	1.25 (0.78, 1.98)	0.339
Education					
Less than high school	1,544 (67.1)	347 (22.5)	23.0 (19.0, 28.9)	Ref	
High school or more	756 (32.9)	182 (24.1)	25.6 (20.0, 29.6)	1.09 (0.89, 1.34)	0.392
Marital status					
Divorced/widowed	1,091 (47.3)	196 (18.0)	20.0 (17.6, 25.4)	Ref	
Currently married	532 (23.1)	177 (33.3)	30.0 (28.9, 36.6)	2.27 (1.79, 2.88)	< 0.001
Single	683 (29.6)	158 (23.1)	22.6 (20.3, 28.6)	1.37 (1.08, 1.73)	0.008
Knowledge of HCV transmission through sharing needle/syringe					
No	1,822 (78.9)	309 (17.0)	15.6 (14.5, 18.5)	Ref	
Yes	486 (21.1)	223 (45.9)	43.5 (40.6, 48.7)	4.15 (3.34, 5.15)	< 0.001
HIV serostatus					
Negative	2,281 (98.8)	515 (22.6)	20.4 (19.6, 28.1)	Ref	
Positive	27 (1.2)	17 (63.0)	65.2 (63.5, 68.8)	5.82 (2.65, 12.80)	< 0.001
Structural variables					
Having medical insurance					
No	1,847 (80.9)	396 (21.4)	20.5 (19.5, 22.2)	Ref	
Yes	436 (19.1)	128 (29.4)	29.3 (24.4, 30.5)	1.52 (1.20, 1.92)	< 0.001
Lifetime experience of homelessness					
No	842 (36.6)	250 (29.7)	30.4 (28.8, 36.6)	1.78 (1.46, 2.16)	< 0.001
Yes	1,460 (63.4)	280 (19.2)	19.1 (18.6, 25.5)	Ref	
Lifetime experience of arrest/incarceration					
No	675 (29.3)	140 (20.7)	22.2 (17.1, 26.6)	Ref	
Yes	1,630 (70.7)	392 (24.1)	23.6 (19.5, 29.0)	1.21 (0.97, 1.50)	0.087
Lifetime experience of stigma within healthcare settings					
No	845 (37.3)	200 (23.7)	22.6 (18.5, 25.0)	Ref	
Yes	1,422 (62.7)	331 (23.3)	22.0 (18.0, 25.6)	0.97 (0.80, 1.19)	0.831
Mental health					
Diagnosed with any mental health problems, ever					
No	2,065 (90.9)	448 (21.7)	21.0 (20.0, 26.0)	Ref	
Yes	206 (9.1)	80 (38.8)	37.6 (32.2, 39.6)	2.29 (1.69, 3.09)	< 0.001
Self-harm, ever					
No	1,230 (53.6)	284 (23.1)	25.6 (23.3, 28.9)	Ref	
Yes	1,065 (46.4)	246 (23.1)	25.9 (22.9, 29.4)	1.00 (0.82, 1.21)	0.996
Drug use					
Length of injecting, years					
< 5	413 (17.9)	46 (11.1)	10.5 (9.5, 12.6)	Ref	
5–10	615 (26.6)	115 (18.7)	17.4 (15.6, 19.6)	1.83 (1.27, 2.65)	0.001
> 10	1,280 (55.5)	371 (29.0)	30.0 (27.1, 35.6)	3.25 (2.34, 4.52)	< 0.001

Table 1 (continued)

Variables	Total sample N (%)	Ever HCV antibody testing n (%)	RDS adjusted % (95% CI)	Crude odds ratio (95% CI)	*P* value
Frequency of injection, last 6 months					
No injection	440 (19.5)	76 (17.3)	17.6 (15.2, 16.9)	Ref	
Weekly/Monthly	734 (32.6)	208 (28.3)	27.6 (25.3, 30.1)	1.89 (1.41, 2.54)	< 0.001
Daily	1,078 (47.9)	237 (22.0)	20.6 (28.9, 25.6)	1.35 (1.01, 1.79)	0.040
Lifetime experience of non-fatal overdose					
No	1,646 (71.5)	321 (19.5)	20.5 (17.3, 27.0)	Ref	
Yes	655 (28.5)	210 (32.1)	30.6 (26.8, 35.6)	1.94 (1.58, 2.38)	< 0.001
Service engagement					
Needle exchange, last 12 months					
No	607 (26.8)	35 (5.8)	4.9 (3.0, 9.1)	Ref	
Yes	1,660 (73.2)	492 (29.6)	25.4 (19.3, 29.0)	6.88 (4.81, 9.83)	< 0.001
Opioid agonist treatment, last 6 months					
No	1,715 (74.6)	332 (19.4)	17.9 (14.0, 19.1)	Ref	
Yes	584 (25.4)	198 (33.9)	34.5 (30.1, 39.9)	2.13 (1.73, 2.63)	< 0.001
Receiving HBV vaccine, ever					
No	1,617 (77.6)	321 (19.8)	20.9 (17.4, 25.6)	Ref	
Yes	466 (22.4)	182 (39.1)	40.2 (38.8, 46.4)	2.58 (2.07, 3.23)	< 0.001

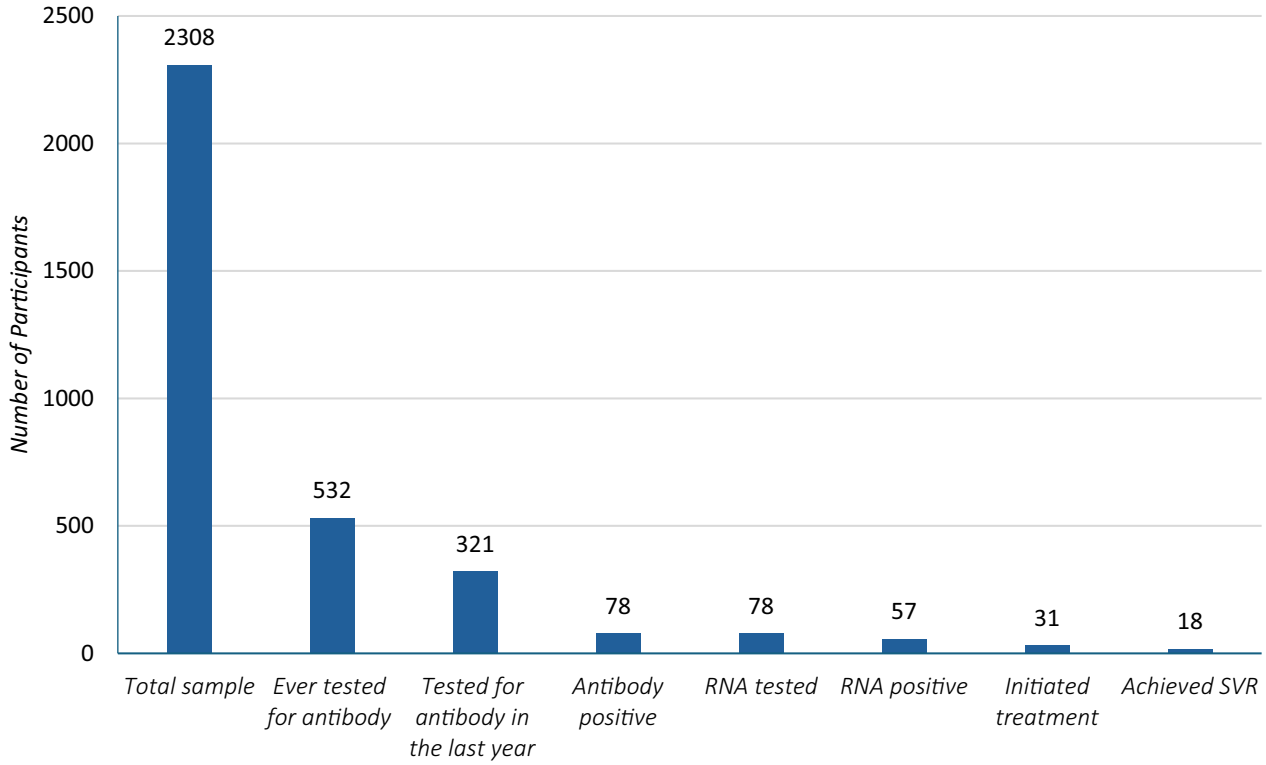

Fig. 1 Hepatitis C virus (HCV) cascade of care among people who inject drugs in Iran in 2023. Note: Self-reported information was used to examine HCV cascade of care stages. SVR stands for sustained virologic response. Denominators for all stages of the cascade of care can be the total sample. The timeframe for all stages (except for being tested for antibodies in the last year) is ever

Table 2 Factors associated with hepatitis C virus antibody testing among people who inject drugs in Iran, 2023

Variables	Adjusted odds ratio[a]	95% CI	*P* value
Age group			
18–29	Ref		
30–44	1.29	0.60, 2.75	0.506
≥45	1.30	0.57, 2.93	0.523
Marital status			
Divorced/widowed	Ref		
Currently married	1.21	0.80, 1.81	0.359
Single	1.27	0.90, 1.79	0.166
Knowledge of HCV transmission through sharing needle/syringe			
No	Ref		
Yes	8.09	5.25, 12.48	< 0.001
HIV serostatus			
Negative	Ref		
Positive	4.15	1.58, 10.92	0.004
Having medical insurance			
No	Ref		
Yes	1.39	0.94, 2.04	0.090
Lifetime experience of homelessness			
No	1.89	1.31, 2.72	0.001
Yes	Ref		
Lifetime experience of arrest/incarceration			
No	Ref		
Yes	1.83	1.26, 2.64	0.001
Diagnosed with any mental health problems, ever			
No	Ref		
Yes	2.88	1.79, 4.61	< 0.001
Length of injecting, years			
< 5	Ref		
5–10	1.21	0.72, 2.02	0.461
> 10	1.58	0.95, 2.61	0.074
Frequency of injection, last 6 months			
No injection	Ref		
Weekly/Monthly	1.41	0.84, 2.38	0.190
Daily	1.19	0.71, 1.98	0.501
Lifetime experience of non-fatal overdose			
No	Ref		
Yes	1.51	1.08, 2.10	0.015
Needle exchange, last 12 months			
No	Ref		
Yes	6.20	3.86, 9.93	< 0.001
Opioid agonist treatment, last 6 months			
No	Ref		
Yes	2.10	1.39, 3.18	< 0.001
Receiving HBV vaccine, ever			
No	Ref		
Yes	2.31	1.59, 3.35	< 0.001

[a] Variables with a *P* value < 0.2 in the bivariable analysis were included in the multivariable logistic regression model

SVR [16]. However, the engagement in HCV CoC stages among PWID in Iran was considerably lower compared to PWID in other regions. For instance, in Australia, 87% of PWID reported a history of HCV antibody testing, with 76% of those receiving an RNA test initiating treatment, and 58% achieving SVR [12]. This increase in engagement in the HCV CoC is attributed to the universal access to direct-acting antiviral (DAA) treatments for all adults living with HCV without restrictions [8]. In England, a study reported that the percentage of PWID reporting lifetime HCV treatment increased from 13% in the pre-DAA era to 26% since the widespread availability of DAAs [13]. However, Iran lacks a government-funded program for HCV, with services restricted to referrals to tertiary healthcare centers [1]. Additionally, the COVID-19 pandemic, which overlapped with the study's 2023 data collection period, may have further influenced HCV service uptake by disrupting healthcare services and limiting access to testing and treatment programs. This underscores the necessity for targeted programs aimed at closing gaps in the HCV CoC among PWID in Iran. Our findings have practical implications for future testing strategies, highlighting areas where programs can improve the provision and uptake of HCV testing.

Lifetime uptake of antibody testing was associated with experiencing non-fatal overdose and injecting in the past 6 months. These findings can plausibly be explained by PWID's understanding of their heightened risk of HCV infection, which is consistent with findings among PWID in England, Wales, and Northern Ireland [31]. The association of non-fatal overdose and HCV antibody testing supports the idea that experiencing a non-fatal overdose could prompt behavioral changes among PWID, including adopting new strategies to minimize risks, and seeking HCV testing following an overdose may represent one aspect of this shift in behavior [10, 31]. Injecting more frequently also requires more needles and syringes, suggesting increased contact with services, and providing more opportunities for HCV testing [31]. However, the level of knowledge regarding HCV transmission in our sample was low. A recent systematic review summarizing interventions to address barriers to HCV services among PWID suggests that at the patient level, interventions such as patient education, reminders for testing/treatment, motivational interviewing, and peer support can improve HCV service uptake [7].

HCV antibody testing was also associated with living with HIV, having a history of mental health diagnoses, and engagement in drug treatment and related services, including NSP, OAT, and the HBV vaccine. This is consistent with previous evidence which suggests that engagement in other services, such as OAT is associated with increased awareness of HCV treatment and its

effectiveness, highlighting the importance of regular contact with health services to support treatment uptake and adherence [12, 28]. These findings underscore the importance of increasing coverage of OAT and harm reduction services as a central strategy in endeavors to eliminate HCV, as well as integrating HCV services with drug treatment, harm reduction, and HIV care to improve engagement in HCV CoC [3]. Research also suggests that individuals using drug treatment services report that co-location with HCV testing and treatment within these facilities enhances the accessibility of such HCV services [27]. Given the low knowledge of HCV transmission in our sample, the results support the existing evidence suggesting that integrating HCV education, testing, and treatment with services already utilized by PWID could contribute to reaching elimination targets [12, 25].

PWID who reported structural adversities, including experiencing homelessness, were significantly less likely to test for HCV antibody. This result aligns with research from other countries, indicating that self-reported homelessness or unstable housing is linked to suboptimal utilization of HCV services, despite the increased risk for HCV among this subgroup [4, 12, 14]. Structural barriers such as homelessness not only impede access to healthcare but also exacerbate health disparities by limiting engagement with preventive services, including HCV testing and treatment.

Practical and policy interventions to overcome these barriers are essential. Research indicates that enhanced accessibility to HCV services could substantially boost their utilization, highlighting the need for innovative strategies to engage individuals experiencing homelessness in HCV testing and treatment [14]. Research also highlights the effectiveness of targeted outreach services, flexible treatment options, and integration of HCV care with other services frequently accessed by PWID experiencing homelessness for providing HCV care to this marginalized subgroup of PWID [5, 12, 23]. These strategies could include mobile clinics, peer-led interventions, and co-located services that provide housing, treatment, and medical care. Additionally, addressing the barrier of health insurance is critical, as our bivariable analysis showed that lack of medical insurance is associated with lower uptake of HCV antibody testing. To address these structural barriers, increasing community-based HCV programs located alongside existing social service programs that serve PWID could help mitigate these barriers [19]. Studies in Iran have demonstrated the success of such programs when implemented in substance use treatment clinics, drop-in centers, and homeless reception centers for PWID, which significantly improve HCV service engagement in these marginalized populations [1, 20]. These examples underscore the importance of integrating HCV care into broader social support systems to effectively address structural barriers and improve health outcomes among PWID.

Limitations

This study has several limitations that should be acknowledged. First, the survey's cross-sectional design restricts our ability to establish causal and temporal relationships between HCV testing and the variables of interest. Second, we did not perform HCV testing due to funding and logistical constraints and collected HCV-related data through self-reported responses in the questionnaire. Incorporating rapid HCV testing in future studies is warranted. Third, the limited sample size of individuals previously diagnosed or undergoing treatment lacked the statistical power to identify factors influencing engagement in care at other stages of the HCV CoC. This may have led to missing of critical barriers or facilitators at these stages and could introduce selection bias if individuals who progress further in the cascade differ systematically from those who do not. Fourth, our inclusion criteria of injection drug use in the past 12 months ensure a comprehensive representation of PWID, capturing individuals at varying stages of injection drug use and risk, and align with previous surveillance studies in the country. However, this broader definition may include individuals who have ceased recent injection activity and are likely at reduced risk of HCV exposure. Fifth, restricting recruitment to only 14 cities reduce the generalizability of the findings to other regions of the country, particularly smaller towns, and rural areas. Lastly, as the study relied on self-reported data, the findings may be influenced by recall bias and social desirability bias.

Conclusion

Overall engagement in HCV CoC among PWID in Iran is low, particularly concerning testing, which serves as the initial step in the HCV CoC. Although HCV treatment has seen an increase over time, achieving HCV elimination among PWID in Iran necessitates an improvement in HCV testing uptake, as well as additional funding and infrastructure. Findings suggest that those engaged in harm reduction and treatment services, or in settings where other services are routinely provided, can be successfully reached if HCV services are integrated into existing programs. However, structural barriers to testing persist, and efforts are necessary to enhance engagement in testing for individuals who are less likely to utilize services, or their situations pose difficulties in HCV testing and treatment uptake, such as those who are experiencing homelessness and lack of medical insurance.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12954-025-01162-7.

Additional file 1.

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Author contributions
Design and conduct the survey: MKH, SM, FT, AAH, MK, HSH. Data collection: MKH, SM, FT, MSB, NN, HM, HM, AAH, MK, HSH. Conceptualization and methodology: MKH, SM, FT, HSH, OZ, MSB, NN, HM, HM, AAH, CM, DCD, MK, HSH. Data analysis: MKH and FT. Writing—original draft: MKH. All authors contributed to the revision of the manuscript and approved the final version of the manuscript.

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Availability of data and materials
Data will be available upon request submitted to the corresponding author (hsharifi@kmu.ac.ir).

Declarations

Consent for publication
Not applicable.

Ethics approval
All study protocols were reviewed and approved by the ethics committee of Kerman University of Medical Sciences (Ethics Codes: IR.KMU.REC.1401.216). Participation in the study was anonymous, and verbal informed consent was obtained from all participants before their enrollment, encompassing both biological and behavioral data collection and declining to participate did not affect service or care provision.

Competing interests
The authors have confirmed they have no potential conflicts of interest to declare.

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