IV infection is a global public health concern, but the arrival and expansion of antiretroviral treatment (ART) decreased non-AIDS complications and mortality in people living with HIV (PLHIV) and have an equal life expectancy like people without HIV (Gardner et al., 2010; Mugavero et al., 2013). In addition to the advantages shown in individual PLHIV, ART significantly decreases HIV onward transmission. This lays the foundation for the Joint United Nations Programme on HIV/AIDS (UNAIDS) 90-90-90 goal, which included 90% of PLHIV diagnosed, 90% of persons diagnosed with HIV initiating ART, and 90% of people taking ART virally suppressed to ending the AIDS epidemic by 2020. The HIV care cascade includes all stages of HIV treatment, from infection through virological suppression (Marsh et al., 2019). Involving PLHIV in the HIV care cascade is critical to meet the UNAIDS 90-90-90 targets and understanding the limitations of service coverage, particularly among key subpopulations, and how to address them.

There are an estimated 59,314 (UI: 32,685–125,636) PLHIV in Iran, of whom 22,054 people were diagnosed (37% of PLHIV). At the end of 2019, 25% of PLHIV in Iran received antiretroviral therapy, of whom 6,338 (11% of PLHIV) people had viral load suppression (Farhoudi et al., 2021). Although in recent years 37% of the newly diagnosed HIV cases have been acquired through sexual contact (SeyedAlinaghi et al., 2021), with more than 208,000 people who inject drugs (PWID) in Iran, injection drug use continues to be the leading route of HIV transmission and one of the main drivers of the HIV epidemic in Iran (Ghalekhani et al., 2019). There is a paucity of evidence on each step of the continuum of care among PWID in most countries, and as a result, it is critical to address...
HIV among this key population not only because of the disease’s impact on their health but also because of the potential influence on the general population.

In this study, using data from a recent HIV behavioral surveillance survey, we assessed the HIV continuum of care (i.e., HIV diagnosis, ART initiation, retention on ART, and viral load suppression) among PWID in 2019–2020 who were recruited from 11 cities in Iran to monitor progress toward the UNAIDS 90-90-90 target.

**Methods**

**Setting and Data Collection**

All data were collected from the fourth national behavioral surveillance survey of Iranian PWID. The cross-sectional survey has been reported in detail previously (Khezri et al., 2021). In brief, by respondent-driven sampling (RDS) method, we recruited 2,663 PWID from 11 major cities in Iran between June 2019 and March 2020. Individuals were eligible for inclusion if they were ≥18 years old, self-reported injection drug use at least once during the past 12 months, lived in the city of study during past 6 months, could converse in Persian, provided verbal informed consent, and had a valid referral coupon consistent with the study methodology. The recruitment of participants started with a purposive selection of seeds. We provided three referral coupons (that were valid for 3 weeks) to each participant and trained them to recruit up to three peers to the study. This method was repeated with succeeding recruits until the targeted sample size was achieved. We also provided monetary incentives for the interview (10,000 Tomans ≈ 1 USD), HIV/HCV rapid test (5,000 Tomans ≈ 0.5 USD), and an extra incentive of 10,000 Tomans for every successful peer recruitment.

During the recruitment process at each study site, eligible participants at first step completed face-to-face interviews to report information, including demographics, drug use, sexual practices, history of HIV testing and treatment, and harm reduction services utilization, then on the next step they also completed HIV/HCV testing after giving consent for tests and receiving pretest counseling. HIV testing was conducted using two sequential HIV-antibody tests. The first test used was SD-Bioline, South Korea rapid test, and if it was reactive, a confirmatory test (i.e., Unigold HIV rapid test) was conducted. HCV testing was performed with HCV antibody (i.e., SD-Bioline, South Korea) rapid test.

**Study Variables**

The primary outcomes of this study were to calculate the percentage of PWID that were (a) diagnosed with HIV, (b) linked to services, (c) treated with ART, and (d) had a suppressed viral load (defined as viral load of less than 1000 HIV RNA copies per mL). We measured the outcomes by asking the following questions through the face-to-face interview among those diagnosed through HIV rapid testing during our study, “Do you know your HIV status?”; “Have you been linked to HIV care?”; “Have you ever been linked to ART?”; and “What were the results of your viral load test?”

**Statistical Analysis**

Descriptive statistics were reported for demographic and behavioral characteristics, including gender, age group, marital status, ethnicity, education, job status, monthly income, drug injection, and incarceration history. All analyses were conducted using Stata 14.1.

**Results**

A total of 2,663 PWID were recruited and tested for HIV infection in our study. Of those, 95 individuals (3.1%; 95% confidence intervals [CIs]: 1.8–4.3) were diagnosed with HIV and were included in our analysis. Among 95 PWID who were diagnosed with HIV (Table 1), the majority were male (97.8%), 35 years of age or older (81.0%), divorced (34.7%), had experience being homeless (70.5%), had a history of incarceration (84.2%), injected drugs for more than 5 years (82.1%), and injected mostly opioids (60%).

Based on the results of questionnaires, of those PWID (n = 95) diagnosed with HIV during the study (Figure 1), 64 (67%, 95% CI: 56–76) were already aware of their status, 54 (57%, 95% CI: 46–66) were linked to an HIV care service, 54 (57%, 95% CI: 46–66) initiated ART, 47 (49%, 95% CI: 39–59) retained on ART, and 14 (15%, 95% CI: 8–23) were virally suppressed.

**Discussion**

We evaluated the continuum of care among PWID in Iran to evaluate the national HIV program among key populations, like PWID, to help understand the status of health services for PWID, the gaps in the delivery of services, and suggest measures to fill these gaps. Our results indicated that about half of the PWID diagnosed with HIV had ever started ART and less than one in six were virally suppressed. Therefore, the study identified that getting ART and sustaining undetectable viral loads are the most important gaps and challenges in the cascade of care among PWID in Iran and that these areas need to be improved.
Reaching 90-90-90 targets among PWID globally requires addressing populations from diverse countries with a broad spectrum of political, economic, and HIV epidemic status environments. Comparing the first cascade indicator in Iran with other countries revealed that this proportion was relatively higher than in Central Asia or other European countries (Brown et al., 2018; Gupta & Granich, 2017; Sazonova et al., 2020; Vourli et al., 2020). However, the 57% ART coverage among PWID with HIV was lower than the average in other low- to middle-income countries globally and within Eastern Europe and Central Asia (Risher et al., 2015; Sazonova et al., 2020). Some studies in other countries globally revealed that about three quarters of all PWID with HIV were virally suppressed and this is higher than the level of viral load suppression among PWID in Iran (Sazonova et al., 2020).

The lower engagement in HIV care among PWID in Iran could be influenced by the lack of accurate estimation of the number of PWID and the consequent inadequate services for this key population. In addition, a high level of stigma and discrimination within the general and PWID population is one of the key barriers. Although HIV rapid tests are now accessible at most health facilities like drop-in centers and voluntary

Table 1. Demographic and Behavior Characteristics of People Who Inject Drugs Diagnosed With HIV (N = 95) in the HIV Bio-Behavioral Survey, Iran, 2019–2020.

| Characteristics                  | n  | %   |
|----------------------------------|----|-----|
| Gender                           |    |     |
| Male                             | 93 | 97.9|
| Female                           |  2 | 2.1 |
| Age (years)                      |    |     |
| 25–34                            | 17 | 17.9|
| ≥35                              | 78 | 82.1|
| Current marital status           |    |     |
| Married                          | 14 | 14.7|
| Divorced                         | 35 | 36.8|
| Unmarried                        | 30 | 31.5|
| Married but live alone           |  7 |  7.3|
| Not permanent                    |  4 |  4.4|
| Widowed                          |  5 |  5.3|
| Ethnicity                        |    |     |
| Fars                             | 29 | 30.5|
| Azari                            |  9 |  9.7|
| Kord                             | 35 | 36.8|
| Lor                              | 14 | 14.7|
| Balouch                          |  1 |  1.0|
| Arab                             |  7 |  7.3|
| Ever homeless                    |    |     |
| Yes                              | 67 | 70.5|
| Education                        |    |     |
| Elementary or less               | 26 | 27.3|
| Middle school                    | 36 | 37.9|
| Diploma or university            | 31 | 32.6|
| Job status                       |    |     |
| Permanent job                    |  1 |  1.0|
| Temporary job                    | 11 | 11.6|
| Monthly income                   |    |     |
| Less than 40 $                   | 59 | 62.1|
| More than 40 $                   | 31 | 32.6|

Table 1. (continued)

| Characteristics                  | n  | %   |
|----------------------------------|----|-----|
| Ever alcohol use                 |    |     |
| Yes                              | 12 | 12.6|
| Ever Incarceration               |    |     |
| Yes                              | 80 | 84.2|
| Injection duration               |    |     |
| ≤5 years                         |  9 |  9.4|
| >5 years                         | 78 | 82.1|
| Most injection drug type in last 3 months |     |     |
| Opioids                          | 57 | 60.0|
| Stimulants                       |  10| 10.5|
| Daily injection in last 3 months |    |     |
| Yes                              | 55 | 57.9|
| Had ever sex                     |    |     |
| Yes                              | 62 | 65.2|
| No                               | 18 | 18.9|
counseling and testing centers, use of such services by PWID remains low (Ghalekhani et al., 2019). In line with this, other studies demonstrate that among all participants, 23% were tested for HIV in the past 3 months and half of them were tested for HIV more than a year ago, so this finding highlighted the issue mentioned above (Khezri et al., 2022). Based on the present HIV testing and counseling strategy in Iran, for people to get services they need to visit facilities, which may be a barrier for some key populations, especially older PWID, men, and those who are not interested in using any other health or social services. To overcome these barriers and reach a more desirable point with respect to these issues, Iran needs to reform and improve old strategies and use some new and viable approaches, such as social networking services, expanding community-based non-clinical testing programs, and offering HIV self-testing and peer-led HIV services. The above strategies have been shown to improve HIV services in other contexts and should be explored to fill such a large diagnostic gap (Broadhead et al., 2002; Jahanbakhsh et al., 2015; Smyrnov et al., 2018; Williams et al., 2019).

ART uptake in PWID and retention in HIV care in Iran can also improve. Studies in eastern European countries reveal that structured integrated interventions that focus on linkage between HIV care and opioid agonist therapy maintenance services could play an important role in improving retention in HIV care (Low et al., 2016; Mazhnaya et al., 2018). In addition, integration of TB/HCV and HIV services can be effective strategies to substantially increase HIV detection and ART initiation (Hermans et al., 2012; Miller et al., 2018; Van Rie et al., 2014). Peer navigation, transportation support, family-centered approaches, and the use of lay health care providers all can lead to a substantial increase in HIV detection and ART initiation (Govindasamy et al., 2014; Mehraeen et al., 2018). All of these potentially successful approaches could be adapted for and tested in Iran.

Our study has some limitations. First, data collection through the study was conducted using face-to-face interviews, which may be subject to social desirability, and this causes an underestimation in our cascade estimates due to stigmatized, sensitive, or illegal drug injection. Second, the sample participants recruited in our study were not representative of the entire PWID population in Iran because participants were recruited from the main cities where PWID populations are concentrated.

**Conclusion**

Our results revealed that in Iran, the gap between the number of diagnosed PWID and the number of PWID on ART is relatively large, with only half of the PWID with HIV being retained on ART. The second major gap is that only about a quarter of PWID with HIV were virally suppressed. To overcome these challenges, Iran should reform its HIV services delivery strategy among key populations like PWID and take this into account and adopt some new feasible methods like HIV-differentiated services delivery that need to be modified and tested in Iran.

**Disclosures**

The authors declare that they have no conflict of interest. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.
Author Contributions
All authors on this paper meet the four criteria for authorship as identified by the International Committee of Medical Journal Editors; all authors have contributed to the drafting or been involved in revising it, reviewed the final version of this manuscript before submission, and agree to be accountable for all aspects of the work. Specifically, using the CRedit taxonomy, the specific contributions of each author is as follows: Study Design and Direction: H. Sharifi and A. Mirzazadeh; Data Collection: N. Ghalekhani, G. Mousavian, M. Khezri, S. Mehdandoost, and F. Tavakoli; Data Analysis: F. Tavakoli; Manuscript Preparation: N. Ghalekhani; Supervision of Work: N. Ghalekhani and A. Mirzazadeh; Discussion and Reply to Comments: All authors; Read and Approve the Final Manuscript: All authors.

Key Considerations
- Only half of the PWID diagnosed with HIV during the study had ever started ART, and less than one in six were virally suppressed. Therefore, initiating ART and sustaining undetectable viral loads are currently the most inadequately addressed segments of the HIV cascade of care in Iran.
- To overcome these existing gaps in the HIV cascade of care among Iranian PWID, new and creative methods to deliver services are needed.
- Iran needs to adapt and implement other methods shown to be impactful in other countries.
- Along with implementing other countries’ methods, Iran needs to initiate some strategies that are tailored to be feasible in its national environment.

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All participants verbally consented to participate in this study, and the ethical committee of Kerman University of Medical Sciences approved the study protocol (IRBMREC.1396.2422).

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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