



Published in final edited form as:

AIDS. 2021 March 15; 35(4): 529–542. doi:10.1097/QAD.0000000000002757.

HIV in Iran: Onset, Responses and Future Directions

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Abstract

Iran, a country in the Middle East and North Africa (MENA) region, has been actively involved in the fight against HIV/AIDS over the past three decades. The unique features of the HIV epidemic in Iran are reflected by the modes of transmission and its recent changes to improve management and prevention programs. In this review, we recount the initial onset and subsequent spread of HIV infection in Iran, beginning with the first case diagnosed to the ongoing responses and most recent achievements in controlling this epidemic. Although in the MENA region Iran is one of the pioneers in implementing pertinent policies including harm reduction services to decrease HIV incidence, drug injection still continues to be the major risk of infection. In line with other nations, the programs in Iran aim at the UNAIDS 90–90–90 targets¹ and to eliminate mother-to-child HIV transmission. In this article, we discuss the strengths and shortcomings of the current HIV programs and offer suggestions to provide a better perspective to track and respond to the HIV epidemic. More generally, our account of the national religious and cultural circumstances as well as obstacles to the approaches chosen can provide insights for decision-makers in other countries and institutions with comparable settings and infrastructures.

Keywords

HIV; Iran; Review

¹UNAIDS 90–90–90 global targets to end the AIDS epidemic by 2020: by 2020, 90% of all people living with HIV will know their HIV status; 90% of all people with diagnosed HIV infection will receive sustained antiretroviral therapy; and 90% of all people receiving antiretroviral therapy will have viral suppression.

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Conflict of Interest

The authors confirm that they have no conflict of interest.

Introduction

HIV continues to be a major global health challenge with an estimated 37.9 million people living with HIV (PLWH) and roughly 1.7 million new infections in 2018 [1]. Despite the progress in curbing the HIV epidemic in many developed countries, the HIV pandemic is still affecting many people and taking lives mainly in developing and resource-limited countries. In the Middle East and North Africa (MENA) region where Iran and 19 other countries are located (Fig. 1), between 2010 and 2015 the number of new infections and AIDS-related deaths both increased, which differs from the global decreasing trend [2, 3], but appear to have stabilized since 2015 [4]. The data presented in this review are the most current available for the country. Because of political and economic restraints, some of the information has not been updated to the present time. However, in general the overall trend for this infection in Iran remains similar.

Iran is the home to 79.9 million people [5]. The majority (74.0%) live in urban areas, with 24.0% aged under 15 years old, 99.6% Muslim, and 87.6% of people aged 6 or older attending school [6]. According to Iran's Ministry of Information and Communications Technology, the mobile phone penetration rate is over 100% [7] and there are 67.6 million internet usage with 80.5% population penetration in Iran [8]. The gross domestic product (GDP) was reported as 439.51 billion US dollars in 2017 [9], which put Iran among upper-middle-income countries in the World Bank classification [10]. Life expectancy is 71.6 for men and 77.7 for women [11]; the lead cause of death is non-communicable diseases (NCD) with a projection of 12.7 million DALY (Disability-Adjusted Life Year) in 2025 [12]. About 84% of inpatient services are public and provided by 920 hospitals in Iran. After the implementation of the Health Transformation Plan, 97% of the Iranian population was covered by basic insurance and the cost covered by households for public services declined to less than 10% [13]. Throughout the country, 51 medical universities monitor the public health outcomes and health services, and report about 35 notifiable diseases and conditions (including HIV) [14] to the Centre for Disease Management and Control in the Ministry of Health.

HIV epidemic in Iran

Despite a global decline in the number of new HIV infection, in countries like Iran the incidence of HIV infection is increasing.

Total number of people living with HIV in Iran: Using UNAIDS spectrum and modeling [15], it is estimated in 2019 that 59,000 (95% CI 33,000 to 130,000) people are living in Iran with HIV, and each year about 4,100 (95% CI 1,200 to 12,000) new infections and 2,500 (95% CI 1,200 to 5,600) AIDS-related deaths occur in the country.

Total number of people diagnosed with HIV: According to the report from the Iranian national HIV registry system, 38,966 people were diagnosed with HIV infection by the end of 2018. The majority were male (83%), and aged between 16 to 40 years old (67.6%) (Table 1) [16]. The number of HIV-infected people who died due to any cause was 15,845 by the end of 2018.

The first patient with HIV infection in Iran was a boy diagnosed with hemophilia in 1986 [17]. Since then, Iran has witnessed a high level of HIV infection especially among people who inject drugs (PWID). The first case of HIV transmission through unsafe drug injection was identified in 1989. The annual number of reported HIV cases has been very low in the country since the first major outbreak of HIV infection in PWID in 1996–7 [18]. In 2019, a total of 4,100 (24.4% female) people were newly diagnosed with HIV (Fig. 2) [15] which represents 0.007% of the Iranian adult population aged 15 years and older. From 2010 to 2015, the overall number of diagnosed cases per year was less than 2000 and the male to female ratio were similar (range from 3.4 to 2.0) [16]. Since 2016, the number of annual reported cases increased from 2085 to 2150, but the proportion of female HIV cases decreased from 33% to 17% (Fig. 2).

The HIV epidemic in Iran is mainly concentrated among key populations with frequent unsafe injection and sex risk behaviors including PWID, men who have sex with men (MSM), as well as female sex workers (FSW) and their clients [19]. These populations are the key groups targeted by the Iran national HIV strategic plan. By 2018, the most common mode of transmission (61.9%) was using shared needles among PWID. Sexual contact and mother-to-child transmission (MTCT) accounted for 20.5% and 1.6% of all diagnosed patients, respectively (Table 1) [16].

Currently, the HIV epidemic in Iran is shifting from men to women (Fig. 2), and from drug injection to sexual contact transmission (Fig. 3). Still, drug injection is the major route of transmission. Among people diagnosed with HIV in 2017, the main modes of transmission were sexual contact (47% of cases), and then drug injection (32% of cases). The total number of women diagnosed with HIV also increased from 4.7% (of all cases) in 2001 to 33% in 2016 [20, 21]. Although drug injection is the leading route, sexual partners of PWID have been at high risk of transmission due to unsafe sexual contact with their injecting partners. For example, non-injecting sexual partners of PWID reported sexual contact with multiple male partners of whom half had never used a condom in the past six months [22].

HIV subtypes: A molecular study showed subtype CRF_35AD as the predominant HIV strain circulating in Iran (see Figure 1, Supplemental Digital Content 1, which illustrates the Frequency of different phylogenetic subtypes resulting from analysis of 252 HIV samples collected from HIV-infected individuals who were under ART for 9–15 months at 14 HIV testing centers across Iran in 2015 and 2016) [23]. This subtype is also the most common strain reported previously among PWID and is epidemiologically linked to HIV infection in those living in Afghanistan or immigrants from Afghanistan. Iran and Afghanistan share common languages, migrant and mobile populations, and a border through which passes the largest portion of the world's heroin. They also share HIV epidemiological features as shown by having the same CRF subtype in the two countries [24].

HIV prevalence in general population: The HIV prevalence is low among the general population, pregnant women and blood donors. In 2017, of 308,627 pregnant women who were tested for HIV, showed only 0.04% were positive. Moreover, in 2010–2013, only eight HIV infections were newly diagnosed in a survey of 6,876 pregnant women, which corresponds to only 0.01% HIV prevalence [2]. HIV screening of blood supplies started in

Iran in 1989, are routinely conducted on all blood supplies. Early studies showed only 0.004% of blood donors were HIV positive [25, 26].

HIV prevalence in high-risk and key populations: To monitor the HIV infection and associated sexual and injection risk behaviors, the Centers for Disease Control and Prevention (CDC) of Iran has conducted behavioral surveillance among people at higher risk for HIV infections including PWID, FSW, prisoners, and MSM and transgender people [19].

PWID: Using a network scale-up method, about 1.2 million people in Iran are addicted to illegal drugs, mainly methamphetamine, heroin and cannabis, of whom 22% (~200,000 people) are injecting drug users [27]. The HIV prevalence among PWID was estimated at 15.4% in 2010 [28], which slightly decreased to 13.8% in 2013 [29]. The incidence of HIV also dropped in this group from 17.1 to 5.4 per 1,000 person-year (Table 2) [30]. Drug injection and poverty are linked together in Iran as they are in other countries. In 2006, of the 1,200 beggars who lived in Tehran, 42% reported to be PWID [31]. The prevalence of HIV infection among street beggars and homeless people in Tehran were 1% and 1.7%, respectively (Table 2). In these populations, HIV infection was associated with older age, birthplace and drug injection. Notably, the majority of those who had HIV infection were not born in Tehran [15, 32].

Prisoners: Prisoners are considered another high-risk population for HIV infection in Iran. Outbreaks of HIV in prisons of Iran were first reported in mid-1990s [33]. The outbreak in the Kermanshah prison in 1995 triggered the national response to HIV [34–36].

Since 2003, harm reduction programs within prisons were scaled up by increasing the number of triangular clinics, adding free and voluntary HIV consulting and testing and methadone maintenance treatment (MMT), bleach and disposal razors, free condoms and needle/syringe, and by training prisoners and their family members. The triangular clinics provide services for sexually transmitted infections (STIs), drug treatment and also HIV testing and treatment in prisons and the community upon release [37–42]. Iran is the only county in the MENA region and is one of the few countries in the world that has such comprehensive integrated harm reduction programs (called “Prison based Active Health Services Provision or PAHSP”) since 2013 [43] for inmate populations [44, 45]. Having such services over several years has led to a reduction of HIV prevalence to 0.8% among incarcerated populations in 2016 (Table 2). This decreasing trend of HIV prevalence has also been observed in sentinel surveillance of prisoners since 2005 (3.24%) (see Figure 2, Supplemental Digital Content 1, which demonstrates the trend of HIV prevalence among prisoners in Iran between 1999 and 2018).

FSW: The other key population at risk for HIV in Iran is FSW. Using multiple methods for population size estimation including multipliers and network scale-up method and synthesis of results, it is estimated that approximately 228,700 FSW are living in cities in Iran [46]. FSW are an underserved population at high risk for HIV in Iran, the Middle East, and worldwide. In 2010, 1,005 FSW were evaluated from vulnerable women facilities and outreach sites in 14 cities of Iran. HIV prevalence was 4.5% [47] and only 27.5% of FSW had been tested for HIV in the previous year and received their results [48]. To increase HIV

status awareness, HIV rapid testing was introduced in 2012 at facilities for vulnerable women and clinics used by FSW. In 2015, HIV testing in the last year among FSW who used health facilities increased to 75.1%. However, among FSW recruited outside of facilities (i.e., by outreach), only 34.0% had been tested in the previous year [48]. The overall HIV prevalence among FSW decreased to 2.1% in 2015, but it was high at 9.8% in FSW with a history of drug injection [49]. The incidence of HIV also dropped in this group from 2.4 to 1.1 per 1,000 person-year (Table 2). There are no data on HIV prevalence and testing among the clients and other sexual partners of FSW in Iran.

The Iranian HIV program provides testing and other prevention and care services for FSW via non-governmental community-based organizations (CBO) called facilities for vulnerable women. These centers have FSW-friendly environment that are staffed with trained personnel. They have been used successfully by different programs to provide services and also by researchers as a place to access and recruit FSW for studies [46, 50].

MSM: In comparison with other key populations, data on MSM and transgender people in MENA are very limited [3, 51]. The sociocultural regulations and norms make MSM in this region have limited access to HIV prevention services and thus so increase their vulnerability to HIV infection is increased [52]. Having sex with the same-gender is taboo and illegal in Islamic countries such as Iran. In two PWID surveys conducted in Iran, 5 and 16% of male participants reported sex with another man in the past [53, 54]. Using network scale-up method, it is estimated that the population size of MSM in Iran to be more than 360,000 people. In a systematic review of 10 studies that included PWID in Iran, the prevalence of lifetime male sex with male was 5 to 49.4% [55]. (Table 2).

Transgender: Data on transgender people are very limited too in the Iran and the MENA region. About 1 in 141,000 of the adult population (15 to 44 years old) in Iran has gender identity disorder [56]. The importance of HIV infection in this key population is not fully known by their community and they need to be more informed through education. The HIV prevalence among transgenders was 1.9% in a small study conducted in 2014 (Table 2) [57].

Sexual partners of PWID and drug users: The two other groups which are also considered as high-risk for HIV infection in Iran are partners of PWID and non-injecting drug users. Women make up 16% of all HIV patients in Iran; 76% of them acquired HIV infection from their male partners/husbands who were primarily PWID [22, 28]. The majority of new infections (6,222 out of 9,136) in 2010 were estimated to belong to PWID and their sexual partner subpopulations. Certainly, female partners of PWID are one of the top priorities for under-served high risk populations in Iran [58]. About 1,100 new HIV infections occur annually among sexual partners of PWID, putting them as the second of HIV affected population in Iran [59]. Regarding HIV in non-injecting drug users, a systematic review which included 10 studies of non-injecting drug users with a total sample size of 2,275 people, reported the HIV prevalence of 2.6% (5.6% in Tehran vs. 0.4% in other cities) (Table 2) [60].

National HIV response

The government responses to the HIV epidemic in Iran are planned and implemented in several phases. The first national strategic plan for HIV/AIDS (for 2002 to 2006) included programs for public awareness, harm reduction for PWID and also prevention of mother to child transmission (PMTCT) programs. The second (2007–2010) and third (2011–15) national strategic plans included more specific training programs for young people. The fourth strategic plan (2016–2020) now focuses on reaching the UNAIDS 90–90–90 goals by scaling up HIV testing and care services throughout the country and more tailored programs for the key populations [61, 62].

HIV surveillance: Iran also has developed and improved the monitoring and surveillance system for HIV since 2002. The HIV/AIDS case-based surveillance is one major part of the National HIV/AIDS surveillance system established in 2009 [63]. Reportable cases are those diagnosed with HIV by a positive ELISA test and confirmation by Western blot. Those with advanced HIV infection (stage 3 or AIDS), AIDS (WHO clinical stage 4) or AIDS-related deaths are confirmed by medical records and death certifications. Newly diagnosed cases are being reported to the national surveillance by one leading center in each province which offers voluntary HIV counseling and testing (VCT). These centers are being supervised by a local medical university at each capital city of the provinces. They work with a central lab (affiliated with the local medical university) and all other HIV testing centers, hospitals, clinics and medical providers in the city that refer to them people with positive (or reactive) test results for confirmatory tests and reporting. Data for every new diagnosed patient are submitted to an electronic portal which is managed by the National HIV program [64].

The other major parts of the HIV/AIDS surveillance program in Iran are mapping, population size estimation and bio-behavioral surveys of key populations. Since 2009, the majority of these multi-city surveys designed and implemented by HIV/STI Surveillance Research Center, a WHO Collaborating Center for HIV Surveillance was based in Kerman, Iran. This collaboration between CDC and an academic institution has been very successful and has led to improved practical knowledge on the local epidemic and its drivers has provided more data-driven policy and intervention programs [65].

Sexual health and education: The Iran national response also includes education as one of the main strategies to increase public awareness about HIV, thereby reducing the risks and stigma. However, due to social norms and sometime political climate, the Iranian government's initiatives on sex education are limited to mandatory premarital sex education and counseling programs for all couples intended to marry, it is not given to high risk youth and other high-risk populations with the desire for extramarital sex [66]. The sexual health program for couples has training materials on sexual and reproductive health and topics ranging from contraception to reproductive system anatomy and partner communication [67]. Moreover, all university students in Iran are being trained about family planning at universities [68]. These two programs do not address the needs of individuals who are having pre-or extra-marital sex or same-sex, and do not include materials on how to prevent from HIV infection or other STIs. These programs mainly focus on family planning. Efforts to incorporate formal sex education into schools has not been successful due to the common

belief that providing accurate information to adolescents about sex and reproduction might promote premarital sexual relations [69]. Studies have revealed substantial gaps in adolescents' knowledge towards HIV/AIDS prevention and treatment [70]. As an example, a study of high school students in Tehran reported erroneous beliefs about the routes of HIV transmission: mosquito bites (33%), sneezing and coughing (23%), public swimming pools (21%) and public toilets (20%) were inaccurately selected as ways that HIV can be transmitted. The majority of students believed that "moral principle" would shelter them from HIV infection, which might be explained by the strength of religious values rooted in Iranian society [71]. In a 2014 study of the general population, 29% of adult men who visited barbershops in Tehran reported sexual contact with more than one person in the past year, of whom only 52.8% used a condom, and less than 30% were ever tested for HIV [72].

Harm reduction and prevention programs: The other main prevention interventions in Iran are harm reduction programs for PWID, most-at-risk women (including FSW) and men. These programs are mainly implemented by NGOs, funded and supervised by the Ministry of Health (MoH) and Welfare organizations. These activities include education, needle and syringe programs, condom and safe sex promotion programs, and drug treatment (e.g. MMT). In addition, HIV counseling and testing including rapid HIV testing and social support are available. There are 25 positive clubs and hotlines in 20 (out of 31) provinces that provide prevention and treatment services to PLWH [73]. In 2017, there were 8,578,845 needles/syringes distributed, or an average 43 needles/syringes for each PWID per year; needle exchange program (NEP) sites increased from 170 in 2008 to 718 by 2017 [15]. In a recently published systematic review, the prevalence of needle/syringe sharing ranged from 5.7 to 63.9% across studies. The lifetime needle/syringe sharing was also very variable with a range from 11 to 57.1% [55]. After five years of NEP in Tehran, the majority of PWID were aware of and used NEP. However, less than one in ten (10%) had accessed to the detoxification services and MMT [74].

The national ART guideline recently adopted the pre-exposure prophylaxis (PrEP) guidelines. PrEP is being prescribed to HIV sero-discordant couples and to MSM and FSW who have multiple partners or report unprotected sex [75].

Prevention of Mother to Child Transmission (PMTCT)

Per PMTCT guidelines in the HIV national strategic plan [76], all positive pregnant women should receive ART during their pregnancy, delivery and breastfeeding periods even if they have not taken ART before [61]. Cesarean section is recommended to pregnant women with a viral load over 1,000 copies/ml, and all newborns are tested for HIV. In this regard, all newborns from HIV-positive women are being tested in 48 hours after delivery by a DNA or RNA PCR test. If the mother is on ART, the test is repeated in two weeks to confirm the results. While the test results are being confirmed, all the newborns are given ART [77]. Despite the expansion of PMTCT to all cities in Iran including the suburbs, the absolute number of HIV positive newborns remains relatively stable. One reason could be the increasing number of HIV positive women giving birth. In 2006, 0.2% of pregnant women living with HIV received ART as PMTCT and MTCT accounted for 132 new HIV cases (MTCT rate 0.5%) in Iran [78]. In 2014, 16 medical universities started a new PMTCT

program to improve case findings which yielded the diagnosis of an additional 168 new HIV-positive pregnant women, higher than the cases reported for the previous years. In 2018, MTCT accounted for 5 new HIV cases (MTCT rate 3.3%) in Iran. As of 2017, HIV screening has been added as a routine prenatal care test among pregnant women in all antenatal clinics [77].

Overall HIV care services: HIV care services are being provided by many facilities in Iran (Table 3). The first VCT center was established in Iran in 2000 [79]. Gradually a VCT program was integrated into health centers all around the country and also in all blood banks and rehab centers supervised by the MoH (Fig. 4) [50, 80]. Through VCT centers, access to HIV care and treatment has also increased [13, 81]. All PLWH, are entitled to basic health insurance coverage. In addition, ART is provided free-of-charge for all subjects in the VCT centers [82].

HIV/AIDS program has been integrated into the health system with a structured plan and it is available at different levels for prevention, care and treatment. There are related facilities appropriate to each level under the supervision of MOH (Fig. 4) [83, 84].

HIV positive clubs: For HIV-infected individuals, positive clubs provide information on prevention as well as psychosocial support with the aim of empowering and developing the capacities of PLWH towards management and improvement of life skills as well as reducing stigma and discrimination in Iran (Table 3). About 8,000 PLWH and their families are receiving psycho-social and living supports through the positive clubs. Women living with and affected by HIV are the majority of the positive club members. Nearly half of these positive clubs are administered by women. Iranian positive clubs won Red Ribbon Awards for outstanding community leadership on AIDS in 2012, 2014 and 2016 [85].

HIV testing and diagnosis

More than 700 centers in Iran provided HIV testing and counseling in 2017. Compared to 2016, HIV testing increased about 2.8 times. In total, 887,951 people were tested for HIV in 2017, of whom 2,306 (0.3%) were HIV positive [15]. While the number of testing has been increased substantially, the low yield of HIV positive cases coming to the centers is a challenge to improve the biggest gap in the continuum of care which is HIV diagnosis.

ART uptake and retention

The VCT centers provide ART services to those diagnosed and confirmed to have HIV infection. Based on the updated ART guideline, trained general practitioners also can prescribe ART. In 2017, 230 general practitioners had been trained on the use of ART in 12 training courses [15]. Also, since July 2017, Iran started the “HIV test and treat” strategy. Now, Dolutegravir is recommended as one of the first line alternatives in the medical regimen in Iran [86]. The ART coverage increased from 1% (of estimated PLWH) in 2007 to 18% in 2017 (see Figure 3, Supplemental Digital Content 1, which shows Antiretroviral treatment coverage based on number of PLWH on ART to the estimated number of PLWH, 2007–2017). The retention on ART in 2016 was 88.7% in a 12-month period after the ART initiation [15].

Viral suppression

There are two recommended ART regimens for PLWH who are 13 years or older in Iran; preferred and alternative. The preferred regimen is a combination of two Non-nucleoside reverse transcriptase inhibitors (NRTIs) and one Non-Nucleoside Reverse Transcriptase Inhibitor (NNRTI) or two NRTIs and one Integrase Strand Transfer Inhibitor (INSTI). Using the alternative regimen needs convincing indications; otherwise, the preferred regimen is recommended (see Table 1, Supplemental Digital Content 1, which demonstrates Current antiretroviral regimens for people living with HIV aged 13 years or older in Iran). As shown in (see Figure 3, Supplemental Digital Content 1, which shows Antiretroviral treatment coverage based on number of PLWH on ART to the estimated number of PLWH, 2007–2017), per national guideline, patients who start HIV medication will be tested annually for viral load. Out of 11,041 people who were on ART, only 5357 (48.5%) had a viral load test in 2017, of whom 3,796 (70.9%) had a suppressed viral load. Certainly, the monitoring of viral load needs to be improved by using electronic medical records and having trained social workers who contact patients and assist them with scheduling and completing a medical or laboratory visit. They are encouraging to reengage in care if needed.

HIV continuum of care and treatment in 2018

In 2018, it was estimated that 61,000 (95%CI 34,000 to 120,000) people are living with HIV, of whom only 36% were aware of their status, 20% were on ART, and only 17% were virally suppressed. The biggest gap in the HIV continuum of care has been diagnosis (see Figure 4, Supplemental Digital Content 1, which demonstrates HIV continuum of care and treatment in Iran, 2018).

Challenges and way forward

The major gaps in knowledge, the needs and the future directions to improve HIV programs are summarized in Table 4.

Gaps in HIV Diagnosis

The diagnosis of HIV in overall and in key populations is clearly below the first 90 target [19]. To improve this parameter, the following are recommended (Table 4): Normalize HIV testing, reduce stigma for HIV and HIV diagnosis, introduce more key-populations friendly HIV testing strategies like community-based testing, non-clinical HIV testing, network-based HIV testing, HIV self-testing and peer-led HIV testing and counseling not only can improve HIV testing but also make HIV testing more effective to find undiagnosed people as these strategies showed to have a higher yield [15]. Partner and couple testing and notification services are mentioned in the national HIV testing guideline [15] but practical modules and specific training for lay providers to successfully implement these services are lacking. These trainings modules need to be developed and their effects should be monitored carefully to optimize the diagnosis services.

Low linkage and treatment uptake among key populations

Overall, the access to treatment improved from 76% in 2013 to 90% in 2015 [15]. Still the linkage to treatment is very low among PWID and member of key populations. A cascade

analysis of all HIV cases diagnosed in Kerman city from 1997 indicated those infected by unsafe injection routes had the lowest ART coverage indicators [64]. Reasons for such missed opportunities to treat people diagnosed with HIV need to be investigated carefully and strategies like peer navigation to improve the linkage need to be adapted. To reach to 90–90–90 targets in Iran, improvements in linkage of key population to treatment and care survives are critical.

Gaps in retention and viral suppression

Less than 5% of PLWH in Iran on ART are virally suppressed [15]. Although this figure might underestimate the truth due to silent transferring out of people from a center, lack of viral tests, or lack of reporting, it is far below the third UNAIDS 90 target. Studies show peer navigators [15, 82], who use their lived experience with HIV to support their peers/clients in understanding that they can also live long and healthy with HIV, can improve engagement, retention on ART and so, improve the viral suppression. Data from HIV case-based surveillance should monitor the HIV retention and viral suppression among all people diagnosed with HIV who started medication [19, 87].

Sustaining gains of harm reduction programs and moving forward

Currently, more than 2500 centers have the agonist maintenance treatment for PWID in almost all large cities, providing treatment to more than 300,000 patients [88]. There is an increasing need for harm reduction programs including methadone. The supply reduction poses a big threat to the coverage of these successful programs. Disruptions in the supply of methadone, and lack of trained health care providers are two major threats to the effectiveness and coverage of harm reduction program in Iran, particularly among incarcerated population [41]; these need to be addressed immediately.

Gaps in HIV research

Addressing barriers for HIV prevention and treatment services require innovative culturally appropriate well-studied interventions. As mentioned above, Iran has successfully conducted epidemiological and behavioral studies on key populations at risk for HIV. However, their use of data has typically remained at the level of statistical reporting and program evaluation. In order to engage in hypothesis-driven research that capitalizes on their positions, Iranian researchers need specific methodological and implementation sciences training. Developing a hypothesis-driven research proposal using an implementation science framework is critical, although this requires both financial and human resources. A potential local funder for this is the National Institute for Medical Research Development (NIMAD). It acts as the Iranian NIH that funds grant proposals to advance the medial research and training by supporting top-notch grant applications and training programs. Building HIV research capacities in Iran is achievable through collaboration with academic and non-profit (such as SAPHIR: Scientific Association for Public Health in Iran) institutes in the United States and other countries, a model that has been very successful and productive.

Conclusions

Recent developments in HIV research and surveillance and several program evaluations have led to a better understanding of the HIV epidemic in Iran and in key affected populations. Although certain studies cited were done some years ago, the data reported give a good insight into the challenges remaining and the programs adopted to combat this epidemic in Iran. From this review, one can appreciate the new national strategic plan that has identified HIV diagnostics and linkage, particularly among key populations, as the biggest gap in the HIV continuum of care. Adapting effective strategies and interventions to improve these gaps are critical for the Iranian HIV program to achieve the UNAIDS 90–90–90 target.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgements

We thank all staff in Centers for Disease Control and Prevention (CDC) of Iran for their help. This paper was supported by the National Institutes of Health (R25 MH064712).

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Fig. 1.

Iran has three leading institutes for HIV research, training, and surveillance. [IRCHA was established in 2005 and is a leading center for HIV clinical management and research. HIVHUB was established in 2009 as a World Health Organization Collaborating Center for HIV Surveillance. SHARC was established in 2009 and mostly focuses on HIV prevention sciences and behavioral interventions].

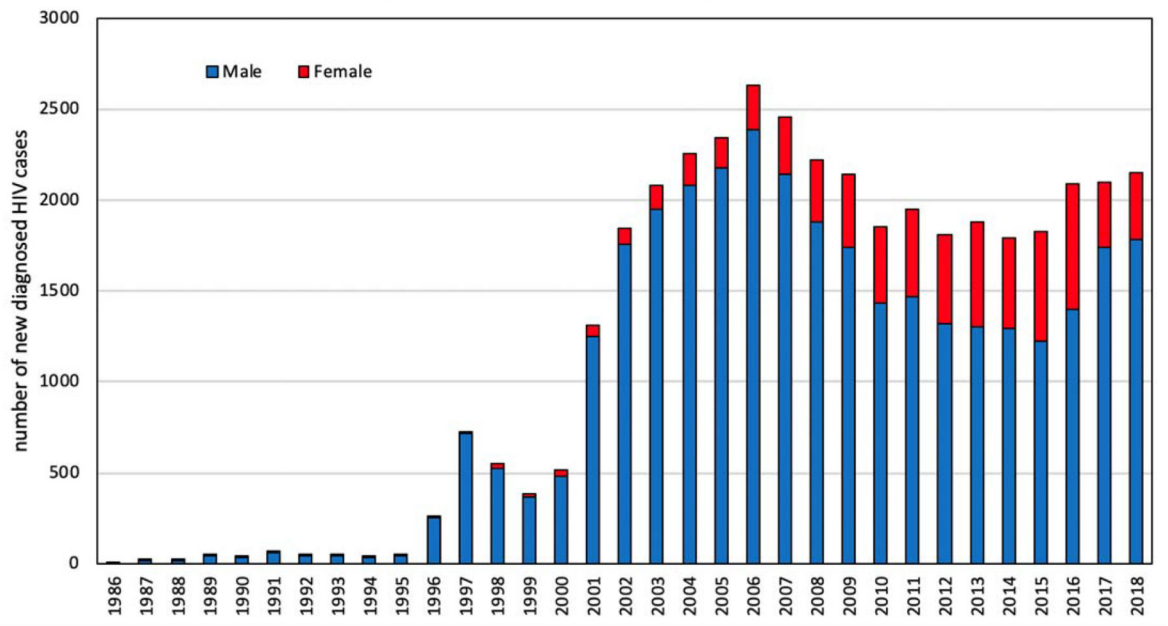


Fig. 2. Annual number of new diagnosed HIV cases in Iran from 1986 to 2018.

Center for Communicable Diseases Control, Ministry of Health and Medical Education.

Latest statistics on HIV infection in Islamic Republic of Iran, April to June 2017. 2018 [16].

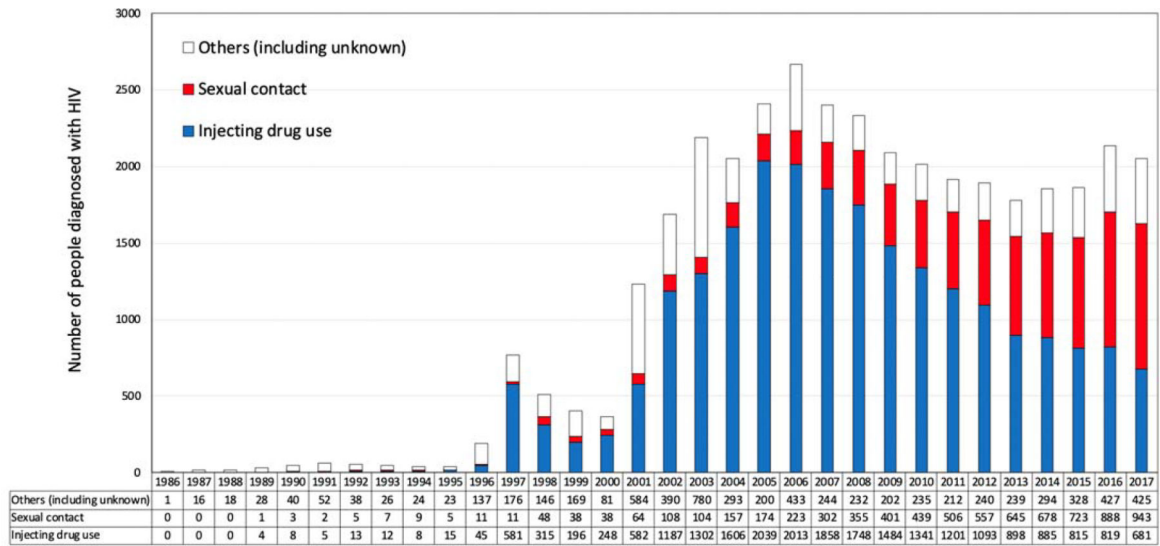


Fig. 3. Changes in the transmission routes in Iran from 1986 to 2017.
 Center for Communicable Diseases Control, Ministry of Health and Medical Education.
 Latest statistics on HIV infection in Islamic Republic of Iran, April to June 2017. 2018 [16].

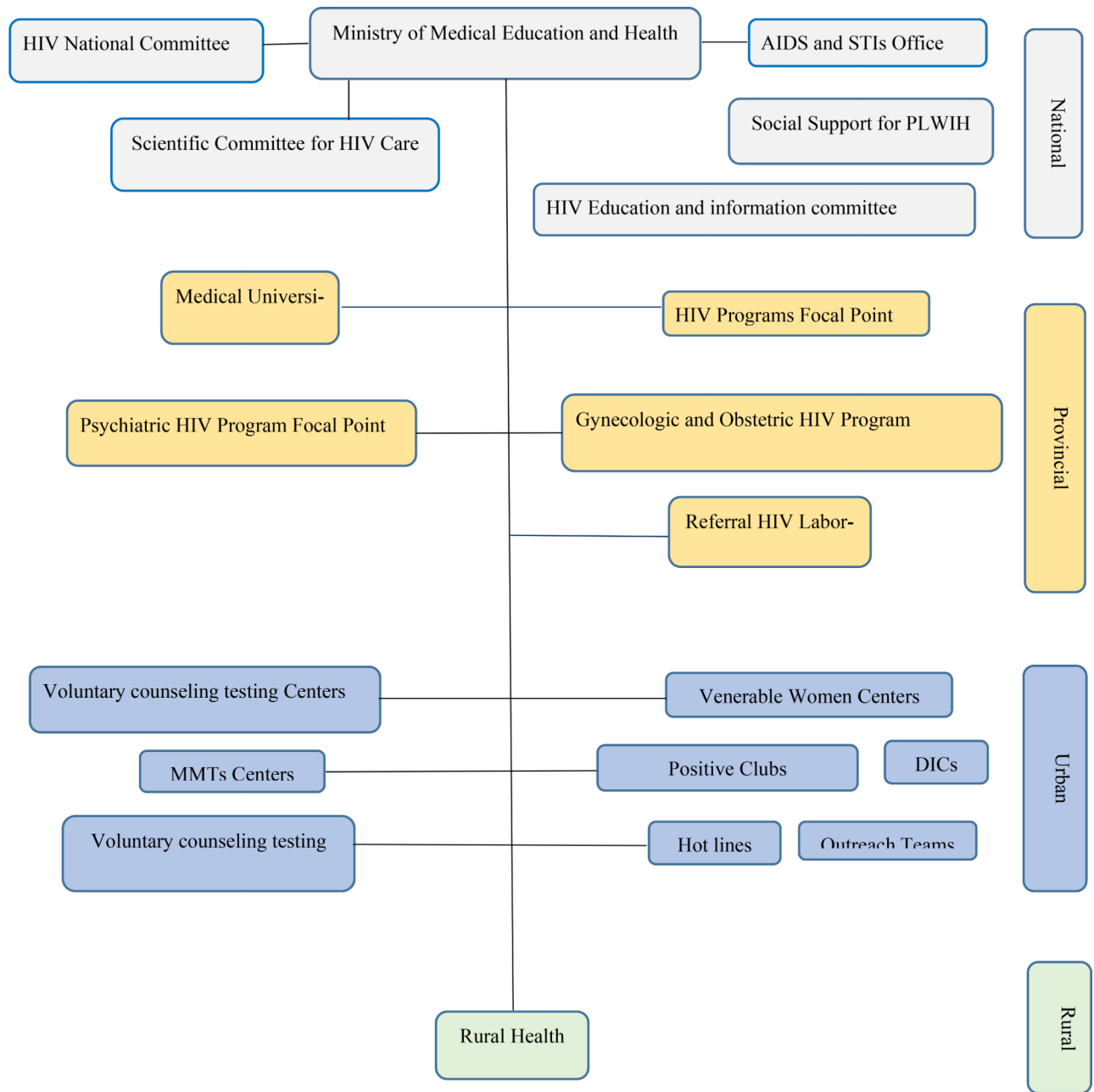


Fig. 4. Facilities and levels of treatment and care for HIV/AIDS in health system of Iran.

1. HIV/AIDS Surveillance System in the Islamic Republic of Iran: History, Structures and Processes. 2019 [83].
2. The Report of the Project Recommended Model for Integration of HIV/AIDS in Primary Health Network. 2011. (The Research Project was done according to agreement between Centers for Disease Control and Prevention (CDC) of Iran, Iranian Research Center for HIV/AIDS (IRCHA) and Joint United Nations Programme on HIV/AIDS (UNAIDS) in Islamic Republic of Iran.) [84].

Table 1.

Characteristics of people diagnosed with HIV in Iran from 1967 to 2018.

	Female		Male		Total	
	n	(%)	n	(%)	n	(%)
Age at HIV diagnosis (year)						
5	225	(3.4)	291	(0.9)	516	(1.3)
6–15	132	(2.0)	161	(0.5)	293	(0.8)
16–30	2352	(35.5)	9832	(30.4)	12184	(31.3)
31–40	2326	(35.1)	11805	(36.5)	14131	(36.3)
41–50	941	(14.2)	4625	(14.3)	5566	(14.3)
51–65	371	(5.6)	1359	(4.2)	1730	(4.4)
>65	39	(0.6)	97	(0.3)	136	(0.3)
Unknown	238	(3.6)	4172	(12.9)	4410	(11.3)
Total	6624	(100)	32342	(100)	38966	(100)
Transmission category						
Injecting drug use	510	(7.7)	23610	(73.0)	24120	(61.9)
Sexual contact *	4843	(73.1)	3169	(9.8)	8012	(20.5)
Mother-to-child	291	(4.4)	323	(1.0)	614	(1.6)
Blood and blood products	6	(0.1)	65	(0.2)	71	(0.2)
Unknown	974	(14.7)	5175	(16.0)	6149	(15.8)
Total	6624	(100)	32342	(100)	38966	(100)

* Heterosexual and homosexual combined as Iran CDC does not separate them.

Center for Communicable Diseases Control, Ministry of Health and Medical Education. Latest statistics on HIV infection in Islamic Republic of Iran, April to June 2017. 2018 [16].

Table 2.

Prevalence and incidence of HIV infection among the key populations in Iran.

Populations	Year	Study Sample	Study sites	Surveillance method	HIV Prevalence % (95% CI)	HIV Incidence per 1000 PY (95% CI)*	Source	
PWID	2010	2480	10 cities	Facility-based bio-behavioral survey	15.4 (9.5–22.9)	17.1 (15.3–19.3)	[28, 30]	
	2014	2491	10 cities		13.8 (9.4–18.2)		5.4 (4.7–6.2)	[29, 30]
Non-injecting female partners of PWID	2011	184	3 cities	Facility-based bio-behavioral survey	2.8 (0.7–11.3)	-	[22, 28]	
Injecting female partners of PWID	2011	42	3 cities	Facility-based bio-behavioral survey	7.7 (1.9–26.3)	-	[22, 28]	
Non-injecting drug users	2013	2275	review	Systematic review	2.6 (2.0–3.4)	-	[28, 30]	
FSW	2010	872	12 cities	Facility-based bio-behavioral survey	4.5 (2.4–8.3)	2.4 (1.7–3.4)	[30, 47]	
	2015	1372	13 cities		2.1 (1.4–3.0)		1.1 (0.8–1.6)	[30]
	2016	1276	1 city	Respondent-Driven Sampling based bio-behavioral survey	4.1 (2.9–5.3)	-	[28, 89]	
Prisoners	2009	5530	27 prisons	Multistage cluster sampling bio-behavioral survey	2.1 (1.2–3.6)	1.3 (1.1–1.7)	[28, 30]	
	2013	5511	27 prisons		1.4 (0.6–2.2)		0.5 (0.4–0.6)	[28, 30]
	2014	6900	1 prison		1.2 (1.0–1.4)		-	[28, 90]
	2016	5800	33 prisons		0.8 (0.5–1.3)		-	[28, 30]
MSM	2014	280	1 city	Facility-based bio-behavioral survey	3.6 (1.7–6.5)	-	[2]	
	2018	80	1 city		2.5 (1.5–6.5)		-	[91]
Transgender people	2014	104	1 city	Facility-based bio-behavioral survey	1.9 (0.0–4.8)	-	[28, 30, 57]	
Street children	2005	386	1 city	Time location sampling bio-behavioral survey	0	-	[28]	
	2010	1000	1 city		4.5 (2.5–6.5)		-	[28, 30, 92]
Homeless	2008	10672	1 city	Time location sampling bio-behavioral survey	1.7 (1.4–1.9)	-	[28, 32]	
Beggars	2008	4230	1 city	Time location sampling bio-behavioral survey	1.0 (0.7–1.3)	-	[31]	
Prisoners' family	2018	1120	1 prison	Time location sampling bio-behavioral survey	0.4	-	[93]	

* HIV incidence per 1,000 person-years was calculated using the method of Osmond et al. [94].

Table 3.

Existing structures for HIV services delivery in Iran by the end of 2017.

Structure	Services	Target Population	Responsible Organizations	Active Number
Drop-in Centers	Harm reduction, education, safe sex promotion, MMT, social support, rapid HIV testing	PWID	Welfare organizations, MoH and NGOs	289
Shelters	Education, support	PWID, most-at-risk women	Welfare organizations	100
Outreach teams	Harm reduction (needle and syringe distribution), education, safe sex promotion	PWID, most-at-risk women	Welfare organizations, MoH and NGOs	250 people
Methadone treatment centers	MMT, rapid HIV testing	PWID	Welfare organizations, MoH and NGOs	7990
Most-at-risk women's counseling centers	Harm reduction (needle and syringe distribution), education, safe sex promotion, STIs care and treatment, rapid HIV testing	Most-at-risk women	MoH and NGOs	34
Counseling posts	Harm reduction (needle and syringe distribution), education, safe sex promotion, STIs care and treatment, HIV counseling and testing including rapid HIV testing	All at-risk populations and persons seeking services	MoH, prisons organization	279
Voluntary Counselling and Testing Centers (triangular clinics)	Harm reduction (needle and syringe distribution), education, safe sex promotion, STIs care and treatment, HIV counseling and testing including rapid HIV testing, HIV care and treatment including prevention and treatment of opportunistic infections, ART, PMTCT, PEP	PLWH and their spouses and families, cases of accidental exposure	MoH, prisons organization	116
Telephone hotlines	Education, information and counseling	General public	MoH, prisons organization	in 20 provinces
Positive Clubs	Social support	PLWH and people affected by HIV	UNAIDS, MoH and NGOs	25

Methadone Maintenance Treatment (MMT), Sexually Transmitted Infections (STIs), Prevention of Mother to Child Transmission (PMTCT), Post-Exposure Prophylaxis (PEP).

Center for Communicable Diseases Control, Ministry of Health and Medical Education. Latest statistics on HIV infection in Islamic Republic of Iran, April to June 2017. 2018 [16].

Table 4.

Major gaps, needs and ways forward to improve HIV programs in Iran.

Gaps in HIV programs	Needs and ways forward
HIV diagnosis	<ul style="list-style-type: none"> • Normalize regular and routine HIV testing • Reduce stigma for HIV and HIV diagnosis • Introduce more key-populations friendly HIV testing strategies like <ul style="list-style-type: none"> ○ community-based testing ○ non-clinical HIV testing ○ network-based HIV testing ○ HIV self-testing ○ peer-led HIV testing
Low linkage and treatment uptake among key populations	<ul style="list-style-type: none"> • Assess and address individual and structural barriers for linkages • Address unmet needs for mental health and social needs • Assign social (peer) workers to contact and help members of key populations to enter into care
Retention and viral suppression	<ul style="list-style-type: none"> • Assess and address individual and structural barriers for adherence and retention • Address unmet needs for mental health and social needs • Assign social (peer) workers to contact and reengage patients who lost to care • Improve electronic medical records and clinical data management to track lost to care patients
Sustaining gains of harm reduction programs	<ul style="list-style-type: none"> • Maintain harm reduction programs including supply management for methadone • Train health care providers to address the increasing need of expanding services • Address special needs for incarcerated population
HIV research	<ul style="list-style-type: none"> • Hypothesis-driven implementation sciences to address gaps in the HIV program and the barriers to access • Train junior researchers to study innovative impactful culturally appropriate interventions • Map and approach local and international funders to support HIV research and training programs in Iran build upon existing collaborations.