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HIV Infection among Persons who inject Drugs: Ending Old Epidemics and Addressing New Outbreaks

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Abstract

AIDS among persons who inject drugs, first identified in December 1981, has become a global epidemic. Injecting drug use has been reported in 148 countries and HIV infection has been seen among persons who inject drugs in 61 countries. Many locations have experienced outbreaks of HIV infection among persons who inject drugs, under specific conditions that promote very rapid spread of the virus. In response to these HIV outbreaks, specific interventions for persons who inject drugs include needle/syringe exchange programs, medicated assisted treatment (with methadone or buprenorphine) and antiretroviral therapy. Through a “combined prevention” approach, these interventions significantly reduced new HIV infections among persons who inject drugs in several locations including New York City, Vancouver and France. The efforts effectively ended the local HIV epidemic among persons who inject drugs in those locations. This review examines possible processes through which combined prevention programs may lead to ending HIV epidemics. However, notable outbreaks of HIV among persons who inject drugs have recently occurred in several countries, including in Athens, Greece, Tel-Aviv, Israel, Dublin Ireland, as well as in Scott County, Indiana USA. This review also considers different factors that may have led to these outbreaks. We conclude with addressing the remaining challenges for reducing HIV infection among persons who inject drugs.

Keywords

HIV; drug injection; combined prevention; persons who inject drugs

Introduction

When HIV was first observed among persons who inject drugs (PWID) in 1981[1] there were probably several hundred thousand injectors infected with HIV. In the most recent estimate, injecting drug use exists in 148 countries and HIV infection exists among persons who inject drugs (PWID) in 61 countries [2–6]. There are wide ranges in estimates of PWID and the number of PWID who are HIV infected globally; according to most recent reports, there are an estimated 8.9 to 22.4 million PWID globally, and approximately 0.9 to 4.8 million PWID are HIV positive [7]. However, in recent years, a reduction in newly diagnosed cases of HIV among PWID has been observed. In 2010, 110,000 new cases were reported; in 2013 only 98,000 were reported. [4]. The same factors that have led to the globalization of trade in licit goods (improved communications, improved transportation, reduced restrictions on the flow of capital)[8] have led to the worldwide diffusion of injecting drug use, with HIV infection frequently following drug distribution routes [9]. Thus, the overall situation of HIV among PWID has clearly become a global public health catastrophe over the last thirty years. In this review we will consider the prospects for eliminating HIV transmission among persons who inject drugs and also consider some recent outbreaks of HIV among PWID.

Potential for rapid spread of HIV among PWID

The transmission of HIV through the multi-person use (“sharing”) of drug injection equipment is a relatively efficient method of transmitting HIV. There have been many examples of very rapid spread of the virus in PWID populations. HIV incidence rates greater than 10/100 person-years (PY) have been reported in New York [10], Bangkok [11], Manipur India [12], Vancouver Canada [13] and areas in China [14, 15], Estonia [16] and Russia [17]. A number of factors have been associated with very rapid transmission of HIV among PWID (see Table 1).

It is not necessary for all of these factors to be present for rapid HIV transmission to occur, but typically multiple causes have been involved when rapid transmission has occurred [18, 19]. As discussed below, almost all of these conditions can be modified through appropriate public health interventions. Thus, we do have the knowledge needed to avert HIV epidemics among PWID.

Potential for preventing HIV epidemics among PWID

Several evidence-based interventions have been shown to reduce HIV transmission among PWID. Among these are needle/syringe programs (NSPs) [20, 21], medication-assisted treatment (MAT) for substance use disorders, particularly methadone maintenance treatment (MMT) [22] and antiretroviral treatment (ART) for HIV infection [23]. If effective prevention programs are implemented prior to outbreaks of HIV among PWID then it is possible to avert HIV epidemics. Australia [24] and the United Kingdom [25] are notable examples of countries that implemented large-scale effective HIV prevention programs early and never experienced national epidemics of HIV among PWID.

Successfully preventing epidemics of HIV among PWID is primarily a function of removing the conditions associated with rapid transmission (as noted in Table 1). Table 2 lists some of the evidence-based interventions that can reduce the conditions for rapid transmission.

Importantly, risk elimination is not necessary to avert HIV epidemics among PWID. In areas in which HIV prevalence is low (< 5%) and stable among PWID, typically 10% to 20% of PWID report current sharing of needles and syringes [26]. Prevalence stays low because almost all of the sharing is among persons who are HIV seronegative and because the sharing is typically confined within small, stable groups, without mechanisms for rapid injecting risk partner change. It is noteworthy that HIV infection has not been eradicated among PWID in these areas. In addition to the continuing risk behavior, it is likely that HIV is being repeatedly re-introduced into the local PWID population through sexual transmission and through travel/migration by HIV seropositive PWID. Therefore, prevention of HIV epidemics among PWID should not be considered a once and done task, rather it should be considered as requiring continuous effort.

The Potential for Ending High Seroprevalence HIV epidemics

When HIV prevalence is high in a PWID population more opportunities are available for HIV seronegative persons to share needles and syringes with HIV seropositive persons. Thus, even modest levels of risk behavior are likely to generate continuing HIV transmission at incidence rates of 4 to 6/100 person years (PY) [27]. Over the last decade, however, we have seen evidence that “combined prevention and care” (NSP, MAT, and ART all implemented at high levels of coverage) can dramatically reduce HIV transmission to very low rates (< 5/1000 person-years at risk) and thus “end HIV epidemics” among PWID.

Case histories describing the chronology of the HIV epidemic among PWID for several well-researched HIV epidemics show the effectiveness of combined prevention and care and provide insights into the dynamics of how to end such epidemics (see Table 3 for summaries of these outbreaks by location)..

New York City

Late 1970s to early 1980s—HIV was introduced into the PWID population in the mid to late 1970s [10]. At that time there clearly was no awareness of AIDS, both heroin and cocaine were being injected, many injections occurred in shooting galleries and there were severe restrictions on access to sterile injection equipment (prescriptions were required for the purchase of sterile needles and syringes, possession of narcotics paraphernalia was a crime). HIV spread rapidly, with an estimated incidence of 13/100 PY (based on testing of historically collected serum samples) [28].

Mid-1980s to early 1990s—News of the new disease spread rapidly among PWID who assumed that transmission was blood-borne, like hepatitis B. Efforts were made within the PWID community to reduce syringe sharing, including an increased demand for sterile injection equipment [29]. HIV prevalence stabilized at approximately 50% with estimated incidence of 4/100 PY.

Mid 1990s to early 2000s—Activists opened small-scale NSP. In 1992, with the concurrence of the New York City government, the New York State Department of Health began official licensing and funding of NSPs. The annual number of syringes exchanged increased from 250,000 to 3,000,000. HIV incidence declined from 4/100 PY to 1/100 PY and HIV prevalence declined from 50% to 15%.

Early 2000s to 2011—Gradual implementation of ART for all persons with CD4+ cell counts <350 cell/ml. AIDS- related deaths declined among PWID. HIV prevalence increased from 18.3% to 21.5% and then declined to 8.6%. HIV incidence remained at approximately 1/100 PY.

2012 to present—Expansion of ART to all persons regardless of CD4+ cell count, leading to approximately 75% of HIV seropositive PWID receiving ART [30]. HIV prevalence among PWID is approximately 10% and HIV incidence is estimated at 0.1/100 PY [31].

Vancouver, Canada

1980s—Like many port cities, by the late 1980s Vancouver had a large influx of high potency heroin and cocaine, as well a population of approximately 13,000–15,000 PWID [32]. One third of these individuals lived in the Downtown Eastside (DTES) neighborhood. The DTES is home to a large open drug and sex work scene, as well as a dense network of single room occupancy hotels, which allowed for high-risk network formation and indoor injecting environments where drugs and paraphernalia were shared [32]. HIV was first detected in PWID during the early 1980s, with new infections increasing slowly throughout the late 1980s [33]. Although the world's first methadone program was implemented in Vancouver in 1959, the program remained small in scale [34]. The city's first NSP opened in 1988 and was supplemented by pharmacy sales of sterile syringes, resulting in 127,806 syringes exchanged in the first year of operation [35]. Surveillance of HIV in PWID in Vancouver remained limited at this time.

1990s—By 1992 the number of new HIV infections among local PWID began to increase steadily [33]. By the mid-1990s various factors converged to exacerbate the spread of HIV, including increases in unstable housing, the deinstitutionalization of the mentally ill, as well as marked changes in drug supply and use patterns [32]. Notably, powder cocaine became widely available, with many PWID injecting cocaine 10–20 times per day [36]. Although the NSP had expanded and was distributing over 2 million syringes by 1996–1997, an HIV incidence of 18.6/100 PY was detected among local PWID [35]. This prompted the regional health authority to declare a public health emergency in the DTES, and local drug users began to organize and initiate peer-led programs [32]. In 1996, a rapid expansion of MMT began following the shifting of the program from federal to provincial authorities [34].

Early- mid 2000s—A series of studies soon revealed a range of deficiencies in the local NSP, including restrictive one-for-one needle exchange rules and limited hours of operation [35]. The NSP was then decentralized and shifted to a distribution model that emphasized secondary exchange [37]. This approach resulted in large declines in syringe sharing and HIV incidence [37]. Local drug users became increasingly organized, and became more

formally involved in the delivery of a range of programs including NSP and succeeded in reaching high risk PWID [35]. MMT continued to expand dramatically during this period, with the number of MMT patients more than tripling between 1996 and 2006 [33]. Further development of harm reduction interventions occurred, including the opening of two supervised injecting sites, with one found to have a strong positive effect on syringe sharing [38]. ART began to expand dramatically and was provided to all individuals with CD4+ cell count of < 350, and, by 2003, new HIV infections among PWID began to decline and HIV incidence was 0.69/100 PY [33].

2005–2015—The number of PWID on ART continued to expand dramatically following 2005 [39]. Between 2006 and 2014 the median HIV viral load among local PWID declined 3.6 log₁₀ copies/mL to 1.5 c/mL, and the proportion of individuals with undetectable plasma viral load increased from 28.6% to 63.0% ($p < 0.001$) [39]. Although the proportion of ART-exposed individuals increased significantly, rates of HIV drug resistance declined (Adjusted Hazard Ratio = 0.78 per year, $p = 0.011$) [39]. Cohort data from this period also suggested a strong association between declining community HIV viral load and HIV incidence [40]. The number of people on MMT in the province also increased 10% between 2007 and 2009, from 8,985 to 11,033 [33]. Data from 1996–2013 indicate that MMT enrollment was independently associated with a lower hazard of HIV infection (ARH: 0.64, 95% CI: 0.41 – 0.98) [41]. Since 2008, HIV incidence has remained below 0.38/100 PY [42].

France

Early 1980s to early 1990s—Access to sterile syringes and methadone maintenance programs among PWID remained very restricted in France until the early mid-1990s; care for opioid dependence was more often provided by psychiatrists who were prone to use non-pharmacologic approaches.

Up through 1996, France has experienced a very high prevalence epidemic of HIV infection among PWID with an estimated HIV prevalence (based on self-report) of approximately 40% in 1988 [43]. A serological survey in 1990 in Paris estimated that 30% of PWID were HIV-positive [44, 45]. In that period, knowledge of HIV status mitigated risk behaviors: a European study including France showed that compared to PWID who had never been tested, those who knew that they were HIV-positive were more likely not to give their used equipment to others (RR: 1.3; 95% CI: 1.2 – 1.5) [46].

According to national health surveillance institute (InVS) estimates, between 1990 and 1996, among PWID, the peak in the number of diagnosed HIV cases (corrected to take into account delays in reporting HIV diagnosis and underreporting) occurred between 1993 and 1994 with 1900 and 1800 newly diagnosed cases, respectively (Fig 4) [47].

While only 3 experimental methadone centers were opened in Paris [48], the double epidemic of HIV and drug use mobilized non-governmental organizations and primary care physicians who were in the front line to engage these patients in care. Special primary care - hospital networks allowed referring many of these patients to hospitals to receive first generation AZT treatment and care for AIDS-related comorbidities. And, many primary care

physicians who were providing care for PWID started to prescribe palliative low-dosage buprenorphine (Temgesic) to these populations to alleviate withdrawals symptoms and possibly relieve AIDS-related pain.

This alarming epidemic and the pressure from primary care physicians, harm reductionists and civil society pushed health care authorities to adopt a pragmatic approach to control HIV among PWID. Thus, expanded access to harm reduction interventions started to be implemented in France in 1993. The health policy resulted in a rapid scale-up of sterile injection equipment (1994), followed by the simultaneous expansion of methadone use (to be initiated in specialized centers - 1994) and an innovative strategy of buprenorphine treatment for opioid dependence in primary care settings and the availability of ART for PWID living with HIV in 1996. All programs were completely subsidized by the French government [49].

Late 1990s to early 2000s—Primary care physicians began to initiate buprenorphine treatment or prescribe methadone once a patient was stabilized (approximately two weeks after methadone induction in a specialized center). The physicians were not required to receive special training, there was no limit to the number of patients a physician may treat, and no requirements for urine drug testing or counseling.

Overall, this approach enabled a substantial increase in the number of patients receiving buprenorphine through primary care providers, far exceeding treatment access to methadone programs in specialist centers. Before 2000, a total of 65,000 individuals received buprenorphine treatment, whereas only 4000 received methadone treatment [49]. In 2005, an estimated 90,000 patients received buprenorphine treatment in France, compared with 10,000 who received methadone treatment [50]. Notably, the number of heroin overdose deaths sharply declined by 80% in less than 10 years [49].

Access to NSP was mainly available through community sites named “CAARUD” funded by the government, which provided syringes, harm reduction tools, education to PWID on reducing injecting and HIV and HCV risk behaviors, and referral to other services for PWID (screening, vaccination, social, infectious disease and psychiatric services).

A study conducted in 1998 among PWID attending NSP in France found that self-reported HIV prevalence among those who were tested (accounting for 90.5% of the study group) was 19.2% [51]. Moreover, 19% of the participants reported sharing syringes in the previous month. The study also showed that heroin and cocaine use were significantly associated with higher risk of syringe sharing, while buprenorphine injectors had safer injection practices.

A repeated survey about self-reported practices among PWID [52] showed that syringe sharing decreased over time (from 48% in 1988–1989 to 33% in 1990–1991 and 13% in 1996).

Mid 2000s to 2011—The high opioid maintenance treatment coverage among PWID (70%) [49] together with expanded access to community NSP and ART (i.e. controlled community HIV viremia) resulted in a striking reversal of HIV epidemics among PWID – from 1900 newly HIV cases in 1993 to 600 cases in 1997 and less than 100 cases from 2009

onward (corresponding to less than 1% of the whole population of newly HIV diagnosed cases in 2012) [53].

HIV prevalence estimate among PWUD in 2011 was 10% (95% CI: 7% – 12%)[54] - which is rather stable compared to the 2004 estimate (10.8%, 95% CI: 6.8% – 16.6%) [55], but much lower than the underestimated HIV prevalence of 40% based on self-reporting before the implementation of harm reduction interventions.

Using 81,000 as the denominator estimated using a capture-recapture approach [56], Le Vu et al. [47] suggested that there were 70 (95% CI: 0 –190) recent HIV infections among newly diagnosed cases in 2008 among PWID and an estimated HIV incidence of 91/100,000 PY (95% CI: 0 – 237).

2012 to present—When the harm reduction package started to be implemented in France, the French health authorities were aware that they were controlling parenteral transmission of HIV but they did not realize they were also controlling sexual transmission of HIV among PWID by using ART as prevention (TasP). The expanded access to buprenorphine and methadone in this population was a means of ensuring high adherence [57] and long-term virological response to HIV treatment [58] making the population of PWID less likely to transmit HIV.

Though HCV prevalence in France was extremely high before the introduction of the combined prevention model (>70%), it remains still over 40% in the last estimate [54] and can be linked with the rising use of stimulants. To maintain these results for HIV and reduce the spread of HCV the following has been instituted: increasing access to HCV screening and treatment for PWID, introduction of innovative and effective interventions in the new health law such as safe consumption rooms [59–61] and tailored educational peer intervention for PWID (named “AERLI”) [62]. These directions are important signals that French health authorities have utilized their experience with large-scale combined prevention to shape drug policy.

Overview

We see several important commonalities in these case histories of successful implementation of combined prevention and care for HIV among PWID. First there is the possibility of rapid reductions in HIV incidence after large-scale implementation of combined prevention in PWID populations. As noted above, HIV incidence among PWID in Vancouver declined from 18.6/100 PY in 1996–1997 to 0.38/100 PY in 2008. Figure 1 shows the association of the implementation of syringe exchange in New York with the decline in HIV incidence among PWID in the city from 3.55/100PY in 1990–1992 to 0.77/100PY in 1999–2002 as syringe exchange programs were scaled up.[63]. Figure 2 shows the decline in newly identified cases of HIV among PWID in France after implementation of combined prevention in the mid- to late-1990s. The number of newly identified cases fell by almost 80%. As a working hypothesis, we would attribute these rapid, large effects to removing the conditions for rapid HIV transmission (Tables 1 and 2) in the local PWID population.

The possibility of a rapid large effect of combined prevention implies that areas with ongoing high HIV prevalence should implement these approaches at a public health scale as quickly as possible. Rapid implementation does have a large upfront cost, but if it leads to a large reduction in incidence, then the sooner implementation occurs, the sooner it is likely to become cost-saving as well as averting new HIV infections.

These three case histories also show a sustained reduction in HIV incidence for many years after the initial large reduction, to where HIV incidence is $< 01/100$ PY in each of the locations. We would hypothesize that this long-term reduction in HIV incidence is the result of gradual reductions in the numbers of HIV positive PWID likely to transmit HIV. This decrease reflects HIV positive PWID likely to transmit the virus by these changes: HIV seropositive PWID may leave the active injecting population through entering treatment and ceasing to inject or through disability or death. They may continue to inject but reduce transmission behavior (passing on used needles and syringes to others and/or reduce unsafe sexual behavior), or they may enter ART and reduce their infectiousness. Figure 3 shows the percentage of the PWID population in New York City likely to transmit HIV through sharing needles and syringes--those who are both HIV seropositive and report distributive sharing. Figure 4 shows the comparable data from Vancouver. These figures actually underestimate the reduction in the potential for transmission, as a high percentage of HIV seropositive PWID in both cities are now likely to be on ART with subsequent viral suppression.

As the percentage of the PWID population who are likely to transmit HIV to their peers becomes vanishingly small in a local PWID population, potential re-introduction of HIV into the population becomes of greater importance. Such re-introduction may occur from sexual transmission from HIV seropositive persons who do not inject drugs or from travel by HIV seropositive PWID to the local area. Thus, prevention programs must be continued. The possibility of changes in the patterns of drug use also requires that prevention programs be sustained (discussed below).

Other areas with great reductions in HIV transmission among PWID

In addition to the three case histories discussed above there is also strong evidence for great reductions in HIV transmission among PWID in Amsterdam [64], Baltimore [65] and Taiwan [66]. All of these areas also experienced high HIV prevalence epidemics among PWID, with prevalence reaching 20% or greater and the current incidence is $< 1/100$ PY. The Amsterdam epidemic is somewhat unusual in that not only was there a reduction in HIV transmission among PWID, but the numbers of persons injecting drugs declined, from 66% to 36% in the Amsterdam cohort study [67].

Recent Outbreaks of HIV in PWID Populations

While there has been great success in reducing HIV transmission in some PWID populations, there have also been a number of outbreaks of rapid transmission of HIV in PWID populations (see Table 4 for summaries of these outbreaks by location).

Scott County, Indiana

The first HIV case attributed to this outbreak was noted in Scott County, Indiana on 02/25/2015. The cases increased to 76 cases by 03/26/2015 and 163 cases on 05/29/2015 as part of the outbreak among PWID. There was a very high frequency of drug injecting (4–15 injections per day of oxymorphone an oral prescription opiate) with injecting commonly occurring in group settings (2 – 6 persons). Prior to this outbreak, the PWID had low levels of knowledge that HIV was a local threat (very few cases reported prior to outbreak, no community outreach to PWID, very little HIV or HCV testing). Syringe exchange was illegal in the state when the outbreak occurred, limiting access to sterile injection equipment. Medication-assisted treatment (methadone, buprenorphine) was also not locally available [68]. Syringe exchange was legalized as a “public health emergency” response after the outbreak occurred. Extensive contact tracing and HIV testing were also implemented and by the end of August approximately 65% of those infected were started on ART and 30% were virally suppressed.

Athens, Greece

From 2001–2010 Greece reported fewer than 20 cases per year of HIV among PWID; in 2011, the number of new infections increased to 256 cases and PWID made up 27% of HIV cases that year; in 2012 PWID were the most affected population making up 41% of new HIV infections that year; 80% of cases occurred among national Greek citizens [69]. The dramatic increase in drug injection in 2011–2012 was unexpected as well as the limited knowledge among PWID with respect to HIV infection. A gradual shift away from opiate injection to crack cocaine injection had occurred. Very limited HIV prevention services (community outreach, syringe exchange, HIV testing, medication-assisted treatment, ART) were available prior to the outbreak. The economic crisis and immigration of PWID to Athens led to increased homelessness among PWID and the formation of large injecting risk networks and increased needle sharing [70].

A large seek, test, treat and retain effort (project ARISTOTLE) was implemented in response to the outbreak. HIV prevalence stabilized and the incidence has declined to 1.71/100PY in 2013, a 78% decrease from the HIV incidence recorded at the peak of the outbreak in 2012 [71].

Dublin, Ireland

An outbreak of HIV in 2014–2015 among PWID in Dublin occurred with 38 confirmed cases, compared to the typical reporting of approximately 2 cases of HIV among PWID per year [72]. A high frequency of injection, particularly related to a new psychoactive substance “snow blow” was being used by PWID in Dublin, and methamphetamine. “Snow blow” (a-PVP, a second generation cathinone) has been associated with more chaotic behaviors, higher rates of disinhibition, more sharing of needles and syringes and higher rates of unprotected sex. A high frequency of PWID has taken place in Dublin. Additionally, over 75% of the HIV seropositive PWID are homeless. However, good resources exist for harm reduction equipment (needles/syringes, opiate substitution treatment) [73]. ART is offered to all seropositive PWID and harm reduction programs are available in Dublin.

Tel-Aviv, Israel

During 2011 and the first trimester of 2012, no HIV cases among PWID were reported. In May 2012, 5 new cases of HIV were reported among PWID in Tel-Aviv and by April 2013, 40 confirmed new cases of HIV were seen. A high frequency of injecting occurred, with all infected PWID switching recently to a cheaper, injectable substance ‘hagigat,’ a derivative of Cathinon (a chemical stimulant derived from khat, similar to amphetamines). All newly HIV infected PWID were using ‘hagigat.’ And, due to its short effect compared to heroin, users were reportedly injecting up to 30 times per day. Tel-Aviv had closed injecting networks (evidence by transmission of HIV in this outbreak being highly concentrated among needle exchange participants). Currently good coverage of harm reduction including NSP and opiate substitution are available in the city. Education among PWID has increased following the outbreak along with increased supplies of sterile injection equipment [74].

Overview

These outbreaks of HIV infection may best be understood in terms of the four factors associated with rapid transmission of the virus among PWID (Table 1) and the general principle that patterns of drug use change over time. The Scott County, Indiana outbreak best can be seen as a “perfect storm” in which all four of the factors, especially lack of prevention measures, occurred simultaneously, leading to extremely rapid transmission. The Athens outbreak also included all four factors, with economic factors leading to increased homelessness and larger injection networks, inadequate supplies of sterile injection equipment, inadequate outreach and HIV testing that could have warned of the local danger of HIV. Moreover, a severe shortage of medication assisted treatment for persons who were injecting at very high rates was present.

The Dublin and Tel-Aviv outbreaks occurred after the drugs being injected were changed to new drugs that had a shorter duration of effect. These new drugs were then injected much more frequently leading to the outbreaks. Dublin and Tel-Aviv illustrate the potential for quick changes in local patterns of drug use that can create the conditions for rapid transmission of HIV among PWID.

Summary and Future Directions

We now have over thirty years of research on HIV among persons who inject drugs. We have learned much in this time. We know the conditions under which rapid transmission of HIV occurs and we know how to apply multiple evidence-based interventions to remove those conditions from PWID populations. We thus are aware of how to avert epidemics of HIV among PWID. We also know how to dramatically reduce HIV transmission in areas that have experienced high seroprevalence epidemics. Large-scale implementation of NSP and OST can lead to great reductions in HIV incidence within a few years. Decreasing distributive sharing and the provision of ART for a high percentage of HIV seropositive PWID can then help to reduce HIV transmission to very low rates, ending the local HIV epidemic among PWID. While much has been learned in the last thirty years, there are still some important challenges (Table 5). Instituting combined prevention in limited resource settings, developing systems to monitor changes in patterns of drug use, developing more

effective interventions to reduce HCV transmission, improving treatment stimulant use disorders and reducing initiation into injecting drug use are all major challenges. These need to be addressed within a context of reducing the stigmatization of persons who use drugs. Having effective interventions is of little use if stigmatization prevents appropriate implementation of the interventions.

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Figure 1.
Annual number of syringes exchanged and HIV incidence among people who inject drugs (PWID), New York City, 1990–2002

Figure 2.
Number of HIV cases per year of diagnosis among PWID - France, 1990–2009
Source: National Health Surveillance Institute (InVS), 2011

Figure 3. Percent of all PWID at risk for transmitting HIV (HIV positive and distributive sharing), New York City 1990–2014

Figure 4.
Proportion of HIV+ with distributive sharing among all PWID, Vancouver 1996–2014

Table 1

Factors associated with rapid transmission of HIV in PWID populations

Absence of knowledge among PWID that HIV is a local threat
Limitations on PWID access to sterile injecting equipment
High frequencies of drug injecting behavior
Large injection risk networks, with mechanisms for rapid change risk partner change. Such mechanisms include injecting in group settings, in “shooting galleries” and the use of “dealer’s works”

PWID: Persons who inject drugs

Table 2

Interventions to reduce the factors associated with rapid transmission of HIV in PWID populations

Absence of knowledge among PWID that HIV is a local threat. Interventions: Community outreach education to PWID community, convenient HIV and HCV counseling and testing
Limitations on PWID access to sterile injecting equipment. Interventions: Syringe exchange programs, legal pharmacy sales of injection equipment, removing law enforcement activities that interfere with users obtaining, carrying and storing sterile injection equipment
High frequencies of drug injecting. Interventions: Treatment for substance use disorders, particularly medication-assisted treatment
Large injection risk networks, with mechanisms for rapid change risk partner change. Interventions: Changes in the social norms in the PWID community so that sharing needles and syringes is no longer seen as helping other users, but as a threat to the health of the group as a whole. Having HIV seropositive users know their status and inject last when needles and syringes are shared. Having sufficient supplies of sterile injection equipment so that PWID can provide each other with sterile equipment. Community education and access to sterile injection equipment are necessary components of the changes in social norms, but the changes develop within the PWID population rather than being created by outside groups

Table 3

HIV/AIDS Epidemics Summary for France, Vancouver, New York City

Location	Peak in PWID Cases	Factors leading to HIV Epidemic	Prevention Programs Implemented	Stabilized HIV Incidence
France	1993	<div><div>1</div>Heavy restrictions on sterile injection equipment</div> <div><div>2</div>Severe restrictions on methadone treatment</div>	<div><div>1</div>1994: Rapid expansion of NSP</div> <div><div>2</div>1994: Expansion of methadone treatment</div> <div><div>3</div>1996 Expansion of ART coverage</div>	0.91/100 PY
Vancouver, BC, Canada	1995	<div><div>1</div>Large influx of high potency cocaine and heroin</div> <div><div>2</div>Large open drug scene in downtown Vancouver</div> <div><div>3</div>Dense population—formation of high risk networks</div>	<div><div>1</div>1988 NSP established</div> <div><div>2</div>1996: Rapid methadone treatment expansion</div> <div><div>3</div>2000s: Rapid expansion of ART</div>	0.38/100 PY
New York City, USA	1993	<div><div>1</div>Restrictions on clean injection equipment</div> <div><div>2</div>Large number of shooting galleries</div> <div><div>3</div>High prevalence of syringe sharing</div>	<div><div>1</div>1992 NSP licenses and funded</div> <div><div>2</div>2000s: Gradual implementation of ART</div> <div><div>3</div>2012-present: Expansion of ART</div>	0.1/100 PY

NSP: Needle/Syringe Exchange Program

PY: Person-Years

Table 4**Recent Outbreaks of HIV Infection among PWID**

Location	Approximate Date of Outbreak	Number of New Infections	Factors Leading to Outbreak	Prevention Programs Implemented	Has Outbreak stabilized?
Athens, Greece	2015	256	<ol style="list-style-type: none"> 1 Graduate shift to crack cocaine injection 2 Very limited prevention programs 3 Large immigration of PWID to Athens 4 Increased homelessness 5 Large injecting networks 6 Limited knowledge of HIV infection among PWID 7 Economic instability 	<ol style="list-style-type: none"> 1 Large seek test and treat effort implemented, including referrals to MAT, ART treatment 2 Increased limits on needles exchanged, increased condom distribution 	Stabilization August 2015
Dublin, Ireland	2014	38	<ol style="list-style-type: none"> 1 High frequency of injection 2 Introduction of new injectable drug “snow blow” 3 Increased sharing of needles and syringes 4 High level of homelessness among HIV positive PWID 	<ol style="list-style-type: none"> 1 High coverage of NSP, MAT available 2 ART for all HIV positive PWID 	No
Scott County Indiana, United States	2011	163	<ol style="list-style-type: none"> 1 High frequency of injecting 2 Lack of established NSP 3 Group injection common (4–6 people) 4 MAT treatment not locally available 	<ol style="list-style-type: none"> 1 Legalized NSP at state level 2 Expansion of ART for HIV positive PWID 	Stabilization 2013
Tel-Aviv, Israel	2013	40	<ol style="list-style-type: none"> 1 High frequency of injecting (30+ times per day) 2 Transition to chemical stimulants “hagigat” 3 Closed injecting networks (outbreak contained to needle exchange participants) 	<ol style="list-style-type: none"> 1 Increased education regarding HIV transmission 2 Increased coverage of NSP and MAT programs 	Stabilization 2014

MAT: Medically Assisted Treatment

NSP: Needle/Syringe Exchange Program

Table 5**Important Challenges Facing Control of HIV Infection among PWID**

• Develop strategies for highly cost-effective implementation of combined prevention and care in resource-limited settings, as well as strategies to bring these interventions to appropriate scale. The use of peers can greatly increase coverage of some interventions at very modest cost.
• Develop systems for monitoring changes in drug usage patterns and develop rapid response mechanisms for adapting to changes. Several of the recent outbreaks described above occurred as a result of changes in drug usage patterns. Monitoring and rapid response mechanisms should probably be integrated into delivery of current services.
• Develop more effective interventions to reduce transmission of hepatitis C virus among PWID. HCV infection remains a substantial public health problem even in many of the areas in which HIV transmission has been reduced to minimal levels.
• Develop better treatment for stimulant drug use disorders. Our current treatments for stimulant drug use disorders are not nearly as effective as our treatments for opiate use disorders.
• Develop new interventions and new implementation plans for reducing initiation into injecting drug use. Reducing initiation into injecting drug use would reduce not only HIV and HCV transmission but also overdose and many of the other health and social problems associated with injecting drug use.
• Perhaps most importantly, develop interventions to reduce the stigmatization of persons who use drugs. Having effective interventions to reduce HIV and HCV transmission does little good if stigmatization keeps those interventions from being implemented.