

Epidemiologic Links Between Drug Use and HIV Epidemics: An International Perspective

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Abstract: Injecting use of heroin has been the highest risk substance use behavior for HIV since the beginning of the pandemic. These risks extend beyond individual levels to networks of drugs users and to wider social contexts that have been referred to collectively as the risk environment. Investigations of individual, network, and risk environment level associations with heroin availability, use, and subsequent spread among injecting drug users (IDUs) have been conducted in multiple settings, but much less is known about the world's center of illicit opium production and heroin exports—Afghanistan. Recent outbreaks of injecting drug use and of HIV infection attributed to IDUs in several African countries suggest that heroin use is expanding into new regions. This article explores the epidemiology of HIV among drug users in several risk environments, the epidemiology of heroin and its associations with HIV outbreaks among IDUs in Central Asia and the Commonwealth of Independent States, and the drug use and IDUs outbreaks now emerging in Africa. The dearth of targeted, evidence—and human rights—based responses to these epidemics is explored as a structural driver of HIV spread in these settings.

Key Words: HIV, injecting drug use, molecular epidemiology, narcotics trafficking

(*J Acquir Immune Defic Syndr* 2010;55:S10–S16)

INTRODUCTION

The global epidemiology of HIV in 2010 is marked by overall declines in rates of new infections in much of the world, but persistent spread among subpopulations, including drug users in multiple countries.¹ Although drug use has a number of individual-level associations with HIV infection, especially among stimulant users, crack cocaine smokers, and alcohol users in some settings, opiate users have always been at particularly high risk. Injecting use of heroin has been the highest risk substance use behavior for HIV and other blood-borne infections since the pandemic began. Relationships

among risks extend beyond individual levels to those of networks of drugs users and to wider social contexts, collectively referred to as the risk environment.² Research has been conducted on individual, network, and risk environment level associations with heroin availability, use, and subsequent spread among injecting drug users (IDUs).^{3–8} However, little is known about these factors in the center of opium production and heroin exports, Afghanistan, nor of its downstream effects in the region. Yet, there is no denial that regional IDU-driven epidemics have been rapidly increasing in Central Asia and the Commonwealth of Independent States (CIS).⁹ Recent outbreaks (ie, clusters of new infections, usually within social or drug using networks and often in population dense areas, such as cities or urban neighborhoods) of injecting drug use and HIV infection in several African countries suggest that heroin is expanding into new regions.^{10–12} This article addresses the epidemiology of HIV among drug users, particularly among heroin IDUs in Central Asia and the CIS, but also, and increasingly, among heroin IDU in Africa. The need for targeted evidence-based and human rights-based responses to these epidemics is explored as a structural driver of HIV spread in these settings.

Data from the Joint United Nations Program on HIV and AIDS suggest that the epidemic seems to have stabilized in many regions since its rapid expansion in the 1980s and 1990s.¹ Generalized epidemics remain uncommon outside Sub-Saharan Africa. HIV epidemics among IDUs in multiple settings, including in the United States, Australia, most of Western Europe, Hong Kong, and Brazil, also seem to be contained through combined implementation of HIV preventive interventions, drug treatment programs, and HIV antiretroviral therapy (ART) access.^{7,13–15} These interventions are summarized in widely used guidance from the World Health Organization and include needle and syringe exchange programs, drug treatment, including opioid substitution therapy, and access to ART for HIV-infected drug users (Table 1).

Nevertheless, subepidemics among both IDU and non-IDU are continuing marked by the unchecked spread in regions of the world that have limited resources for services to prevent HIV from diffusing into the population. In many countries, responses to drug users are punitive, including police crackdowns, harassment of drug users and outreach workers, detention, and long-term incarceration in harsh settings that compound health risks.² Limited resources for preventive and treatment services often makes drug addiction and HIV even harder to address. Methadone remains illegal in the Russian Federation, which has the most severe HIV

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TABLE 1. Comprehensive Approach for Drug Users

NSP
OST
VCT
ART
STI prevention
Condom use programs for IDUs and partners
Targeted information, education and communication
Hepatitis diagnosis, treatment (hepatitis A, B and C) and vaccination (hepatitis A and B)
TB prevention, diagnosis and treatment

WHO, UNAIDS, UNODC on IDU Driven Epidemics.
 NSP, needle and syringe programs; OST, opioid substitution therapy; STI, sexually transmitted infections; UNAIDS, Joint United Nations Program on HIV and AIDS; VCT, voluntary HIV counseling and testing; WHO, World Health Organization.

epidemic among drug users in the CIS.¹⁶ New and ongoing HIV outbreaks continue unabated among drug users in 2010 in many regions of the world, underscoring the need for sustained public health responses by governments, policy makers, public health officials, and by affected communities.

The Epidemiology of HIV Among IDU in 2010

In 2008, Mathers et al⁷ characterized the global epidemiology of IDU and HIV among IDU in 148 countries around the world.⁷ Overall, 15.9 million persons (range 11.0–21.2 million) were estimated to inject drugs. The largest numbers of IDU were living in China, the United States, and Russia, with HIV prevalence among IDU estimated to be 12%, 16%, and 37%, respectively. HIV prevalence among IDU was 20%–40% in 5 countries and more than 40% in 9. Worldwide, 3.0 million (range 0.8–6.6 million) IDU were estimated to be living with HIV infection in 2008, representing a substantial proportion of all persons living with HIV, and the majority of those were in Eastern Europe and Central Asia.⁷

In the CIS and Central Asia region, IDU accounted for an estimated 80% of the cumulative or prevalent HIV infections and for 62% of all new or incident infections in 2007.¹ Russia and Ukraine accounted for more than 90% of all HIV cases, and some two-thirds of these were among IDUs. And IDUs accounted for more than 60% of infections in Belarus, Georgia, Iran, Kazakhstan, Kyrgyzstan, Moldova, Tajikistan, and Uzbekistan (Fig. 1). The Western Chinese Province of Xinjiang (formerly East Turkestan), which is geographically and culturally situated in Central Asia, is currently experiencing a severe IDU-driven HIV epidemic; in 2008, it had the second highest HIV prevalence of any region in China.¹⁷

Although drug use is at the center of the CIS and Central Asian HIV epidemics, data are now emerging on new sexually transmitted infections from drug users to their sex partners, portending future waves of HIV diffusion throughout the region. A recent report by Niccolai et al¹⁸ investigated “bridging risks” from IDU to their sexual networks in St Petersburg, Russia. They found that HIV prevalence was an extraordinary 45% among the 631 drug users recruited to the study. Some 84% of the respondents reported being sexually active in the previous 6 months and not using condoms at last sex in 126

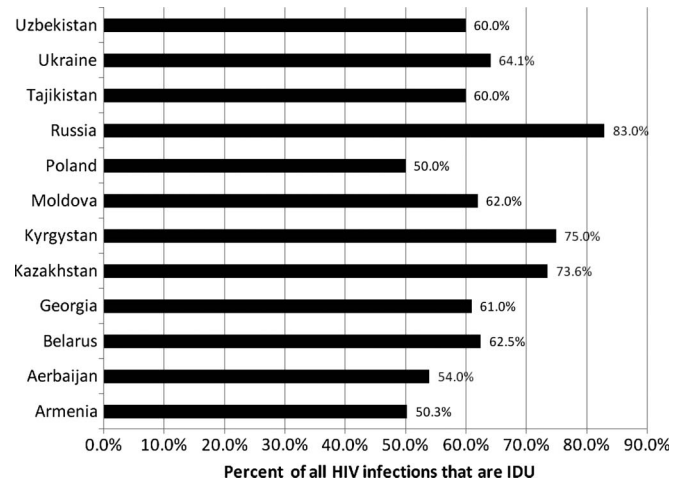


FIGURE 1. Proportion of cumulative HIV infections in IDU among all reported HIV infections in Eastern Europe and Central Asia, 2007.^{41,42}

(41%) of their partnerships. In the bridging analysis, unprotected sex between a drug user and sex partner not known to be a drug user or HIV infected occurred in 18% of all the sexual partnerships. Findings such as these are also being reported in several United States and Western European cities.^{19–21}

Heroin Epidemiology and HIV Spread

At the time of the Soviet invasion of Afghanistan in 1979, the Afghan opium crop was estimated at 200 metric tons of opium base per year, a potential yield of some 20 tons of heroin.^{22,23} Poppy cultivation and opium production increased markedly over the decade of Soviet occupation. By 1990, the last year of Soviet engagement, the crop yield had reached some 1600 metric tons; the Soviet forces had reportedly experienced significant problems with opiate use and dependence among its troops. Opium production increased again during the turbulent “Warlord” years of the 1990s, and through the early years of Taliban rule from 1996 through 2000, when the crop was estimated at 3300 tons. In 2001, the Taliban briefly banned opium poppy cultivation. That year the crop fell to some 200 tons, a dramatic reduction, though stockpiling seems to have mitigated the decline from affecting regional supplies. The last year of Taliban rule was 2001, when the United States led coalition forces invaded Afghanistan after the 9–11 attacks.

The first full year of the US-led forces occupation, 2002, saw a resurgence in poppy cultivation and a return to pre-2001 levels.²² In that year, Afghanistan became the world’s largest exporter of illicit opiates, surpassing even Burma/Myanmar. The Afghan crop continued to increase, to more than 4000 tons in 2004, more than 6000 tons in 2006, and more than 8000 tons in 2007, the year when the largest production of opiates was ever recorded, accounting for more than 90% of the estimated global production (Fig. 2).²² Heroin purity had increased over these years, and prices of the drug had fallen.²² The enormous supply of opiates has driven its availability across Central Asia and much of the Former Soviet Union. States and countries as diverse as Uzbekistan, Islamic Iran, Tajikistan, and European Russia have all experienced epidemics in heroin use, followed

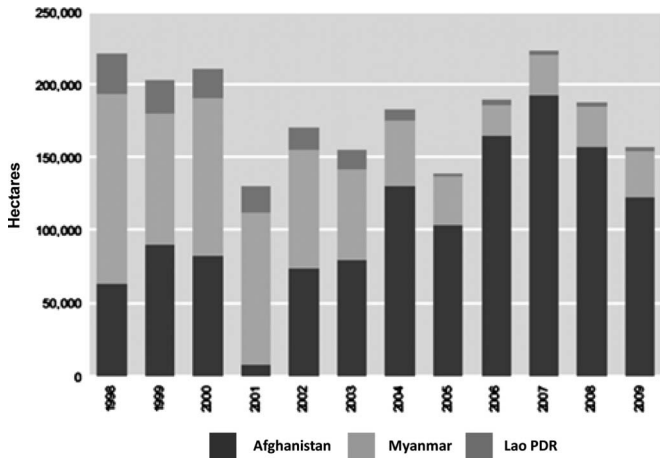


FIGURE 2. Opium poppy cultivation in Afghanistan, Burma/Myanmar, and Laos, 1999–2009. Adapted from the UNODC.⁴³

closely by epidemics in heroin injection and consequent increases in HIV. Iran and Russia now have among the highest rates of opioid dependence per capita of any state or country.⁷ Iran, with its lengthy border along Afghanistan’s southern and western production zone, led the world in opioid seizures in 2007; in that year, an estimated 0.7–1.6 million Iranians were heroin dependent, with some 2.8% of adults having used opiates in the past year.²⁴ The relative paucity of drug treatment programs in the region, and the ongoing political limitations on substitution therapy in many countries, most notably the Russian Federation, create a “perfect storm” for continuing increases in opioid dependence and drug injection, and the consequent spread of HIV.

The Molecular Epidemiology of HIV in Central Asia

The central role Burmese heroin exports had played in HIV spread in South and Southeast Asia was first reported in 2000.⁵ Molecular epidemiology, including identifying links between HIV subtypes and heroin trafficking routes in the region, helped to elucidate these relationships. Afghanistan has a similar role as Burma in Central Asia today—that is, its opium production has fueled epidemics of opioid dependence in neighboring states and countries. However, the molecular epidemiology of HIV-1 relative to heroin trafficking in the region remains as yet unclear (Fig. 3).

Carr et al first reported on the emergence of the CRF02_AG virus, a stable circulating recombinant of West African origin, in Uzbekistan in 2005.^{4,25–28} CRF-2_A/G is the predominant variant of HIV-1 found in Nigeria, Cote d’Ivoire, and several other West African epidemics. An essentially identical picture was identified among a cohort of IDU in neighboring Tajikistan,⁴ with roughly equal prevalence of subtype A and the CRF02_AG recombinant. Uzbekistan and Tajikistan share a long and complex border and both border Afghanistan. The Central Asian states of Kazakhstan and Kyrgyzstan, which lie to the north of Central Asia and do not border Afghanistan, are similar to Russia, with predominance of the A clade. Clade A, now rare in Africa, predominates in Russia, Ukraine, Belarus, Siberian Russian, and Azerbaijan, a remarkably wide geographic dispersion attributed largely to IDU.²⁵

Afghanistan has been found to have a distinctly different cluster, with roughly half of infections accounted for by clade A, and the rest by 2 A/D recombinants, including CRF35_A/D.²⁶ These variants are also found in East Africa, specifically in Uganda. Iran, Afghanistan’s neighbor to the

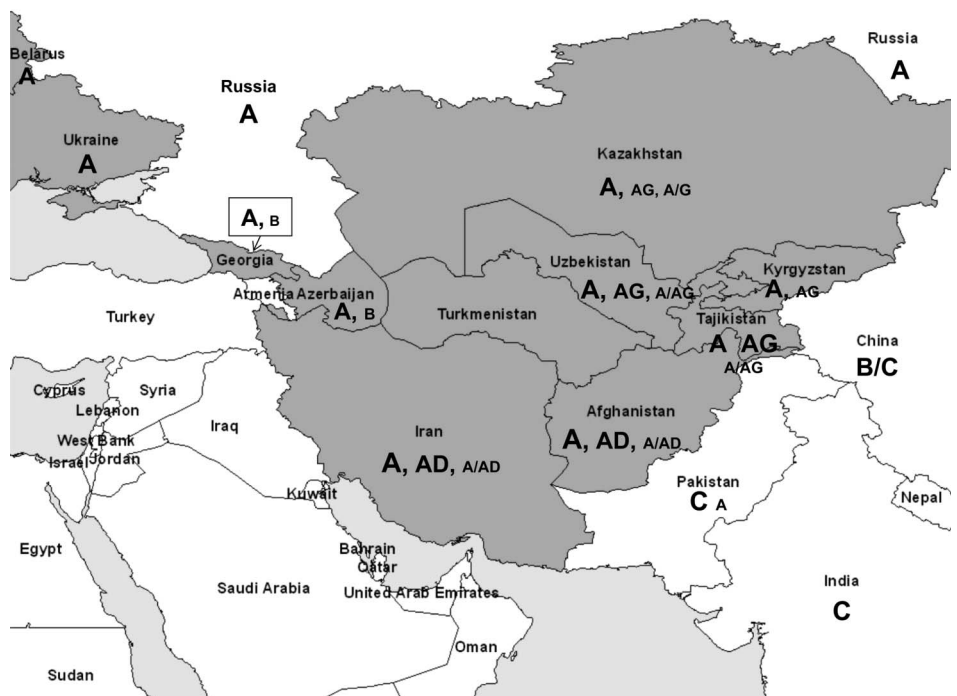


FIGURE 3. HIV-1 subtypes in Central Asia and the Caucasus. Prevalent subtypes of HIV-1 in Central Asia are listed for each country where data are available. Font size for these subtypes denotes relative proportion of prevalent subtypes specific to each country. Adapted from Beyrer et al,⁴ Sanders et al,²⁷ Carr et al,²⁸ and Rai et al.²⁹

west, shares this unique molecular picture and having A, A/D recombinants, and the CRF35_A/D variant.²⁷

There are striking features in the molecular epidemiology of HIV-1 in this region. First, despite extensive trade and population exchange, there seems to be little if any penetration by the C clade viruses that predominate in Pakistan and India into Central Asia, although there is recent evidence of transmission of A clade viruses among IDU in Pakistan.²⁹ Second, again despite trade and travel routes, there seems to be no admixture of the B/C recombinants, which are the principal viruses found in Northwest China. Instead, A clade variants that predominate across the Former Soviet Union are found throughout the Afghan export zone. Within this zone, however, 3 distinct clusters can be identified: a Tajik-Uzbek axis with A and A/G recombinants; a Kazakh-Kyrgyz axis with A alone; and an Afghan-Iranian axis with A and A/D variants. Explanations for this emerging molecular epidemiology are as yet unclear but are likely associated with both cultural changes and new narcotic trafficking routes.

How narcotics trafficking may influence HIV molecular segregation is suggested by a study in Tajikistan, a frontline state for Afghan opiate exports. In 2004 and 2005, qualitative interviews with drug users, clinical providers working with heroin users, and with narcotics control officials in Dushanbe identified several key features in the Afghan-Tajik trade. First, most of the northern Afghan areas bordering Tajikistan are also ethnic Tajik homelands, with strong links of culture, kinship, trade, and language (Tajik is in the Persian family of languages, closely related to Farsi, and spoken in Tajikistan and Afghanistan. Tajikistan was created by the Soviets based partially on linguistic grounds; other major languages of Central Asia, such as Kazakh, Uzbek, and Kyrgyz, are of Turkish origin and not understandable as Tajik). These extensive ties suggest that Tajik and Afghan drug users would interact in similar ways as ethnic groups straddling the China-Burma and India-Burma borders have been shown to do—and that we would, therefore, find a shared HIV-1 molecular epidemiology. But this is not the case. In the Burma heroin zone, “overland” heroin trafficking was a key component of HIV spread among drug users,⁵ and trucking and truckers play a key role in overland trade and connecting networks of drug users. Petty drug users have a key role as well. They are known to cross borders to buy drugs, to use with the sellers, and to carry a few kilos across various routes.⁵ But the Afghan to Tajik trafficking zone is strikingly different: the border is a range of mountains that is impassable most of the year due to snow and ice. Trafficking across this border is largely by helicopter (Narcotics Control Program official, Afghan to Tajik trafficking zone, personal communication to Beyrer C, 2004). Air links disrupt person-to-person connections between drug users and their networks and may explain the apparent segregation of HIV-1 subtypes at this border.

That Iran and Afghanistan have linked epidemics and seem to form a distinct cluster in the region may be related to a different history of population admixture. Iran housed up to 2 million Afghan refugees during the long period of wars and Taliban rule. Life in Iranian camps was known to have led to substance abuse among some refugees and to heroin injection among a substantial number.²⁴ HIV spread increased in

Afghanistan with the return of this refugee population in the post-Taliban period. The tight clustering of variants between Afghanistan and Iran likely results from a shared origin among injectors in Iran and, at least as 1 report suggests, among Iranian and Afghani drug users in Iranian prisons.³⁰

The Tajik-Uzbek cluster is more difficult to understand. Relations between the States have been problematic, with Uzbekistan going as far as to place antipersonnel land mines along their common borders to prevent crossing by Tajik migrant laborers into Uzbekistan.²⁶ Tajik migrants seeking work still cross the border, however, and migration out of Tajikistan is high, with unemployment estimated at more than 40% among Tajikistan adults.³¹

By contrast, it is easier to understand why clade A variants predominate in the northernmost Central Asian states of Central Asia, Kazakhstan, and Kyrgyzstan. Kazakhstan has strong trade and travel links with Russia, a large Russian ethnic minority population, and is largely Russian speaking. Additionally, trucking routes link these states to Russia and most of the heroin trade is reported to be trucking based (as is the case in Burma and China).²³

Although each of these clusters has unique features, all share at least some component of clade A in their epidemics. And all of the Central Asian states, with the exception of closed Turkmenistan, have significant labor migration to Russia. This likely has a role in the preponderance of clade A in this region, yet it remains unclear why clade A (which is now rare in Africa except as a component of A/D, A/C, A/G, and A/E recombinants) should circulate among IDU in this region as a stable, nonrecombinant form. A possible hypothesis is that the efficiency of parenteral HIV transmission among IDU may put less selection pressure on transmitted variants compared to sexual transmission, thus leading to less viral diversity.

The Emerging Epidemics of HIV Among African Drug Users

The Reference Group to the United Nations on HIV and injecting drug use has analyzed data from Africa demonstrating that HIV among African IDU is well established in several countries (Fig. 4). HIV rates of more than 30% have been reported among IDU in Kenya, in East Africa, and in neighboring Tanzania and its island province of Zanzibar.^{11,12} The spread of HIV in East Africa may be linked to a new heroin trafficking route, originating in Afghanistan but reaching East Africa by ship through the Red Sea which involves ports in Yemen.²²

High rates of HIV among IDUs have now been reported in countries outside East Africa, including Libya and South Africa.⁷ South Africa provides some of the only prospective data available on drug treatment, allowing for the limited assessment of trends (Fig. 5). In 1996, treatment for heroin dependence accounted for under 2% of admissions, but by 2008, heroin accounted for more than 10% of all admissions for dependence (Fig. 5),²² indicating that heroin use and injection may be increasing in this population.

Similar findings have been reported for African men who have sex with men (MSM) and IDU risks in Malawi, Namibia, Botswana, and townships in South Africa,¹⁰ with the

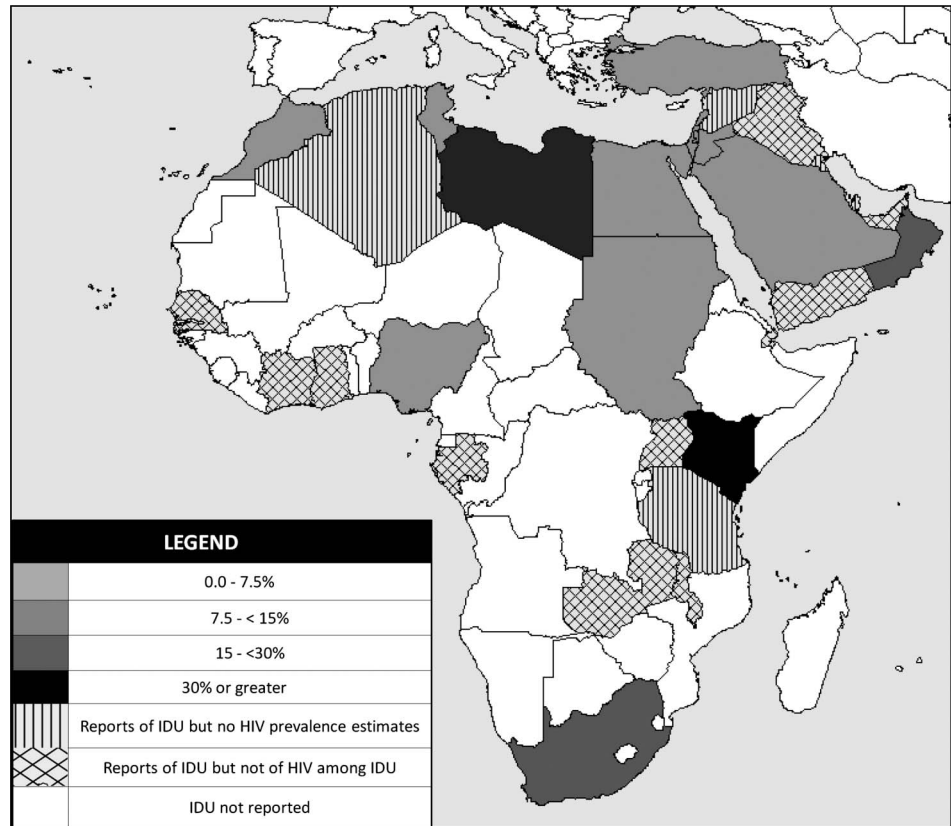


FIGURE 4. HIV infection rates among injecting drug users in African and middle eastern countries, 2008.⁷

lowest rate of HIV at 2.5% in townships outside of Cape Town, and the highest at more than 12% in Malawi (Fig. 6). Overall, HIV prevalence was 6.5% among MSM/IDU in this study.¹⁰ Dahoma et al³² have recently reported that 12.3% (95% confidence interval 8.7 to 16.3) of MSM from Zanzibar, Tanzania, were HIV infected. Risks for HIV infection included injecting drugs in the past 3 months, hepatitis C virus infection, and having been paid for sex in the past year.

These reports challenge historical assumptions about AIDS in Africa as primarily caused by heterosexual HIV transmission. Injection drug use and same-sex behaviors among men are clearly having a public health impact in several African countries, portending a new wave of HIV across the continent. Yet, as in many countries, the need for experienced public health personnel in Africa outpaces the supply, making an effective response to this next wave of HIV infections particularly difficult. Still, the evidence on HIV outbreaks among MSM and IDU in Africa cannot be ignored.

Responses and Policy Options

A paradox about IDU-driven epidemics of HIV is that, although they continue to expand and to emerge in new regions like East Africa, they have proven relatively easy to control. Research on HIV outbreaks among IDU has repeatedly shown that an early and comprehensive approach which includes drug treatment, needle and syringe exchange, HIV testing, and access to ART can significantly impact HIV incidence and lead to rapid declines in new infections.³³ Why then, is HIV continuing to spread in so many settings? One

reason is the limited availability of HIV prevention services for drug users, as described by Mathers et al.³³ They found that the availability of opiate substitution therapy, a key component of effective HIV prevention and drug treatment for drug users, was extremely low in Central Asia, at less than 1%, and essential services for drug users in sub-Saharan Africa were virtually nonexistent.³³

In the same review, Mathers et al³³ found markedly limited access to ART for HIV-infected IDU: only 1 in 25 HIV-infected drug users had access to ART in 2009, with an estimated range of 2–18 per 100 drug users worldwide. In Central Asia, access to ART ranged from less than 1% among IDU in Uzbekistan to a high of 5 per 100 IDU in Tajikistan,

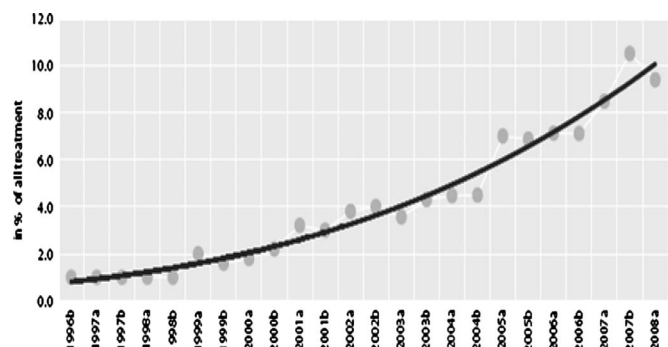


FIGURE 5. Percentage of all drug treatment admissions for heroin dependency in South Africa, 1996–2008.⁷

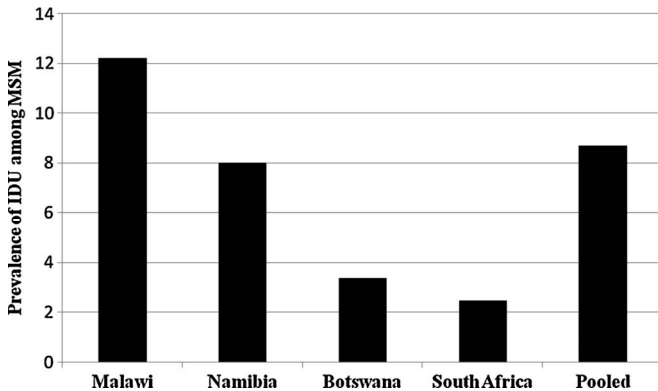


FIGURE 6. Prevalence of self-reported history of ever having injected drugs among men who have MSM in 4 southern African states, 2008.¹⁰

even as they are experiencing the rapid expansion of HIV among their IDU citizens. Montaner et al in Vancouver have shown the impact that access to ART can have on community viral load and hence on new HIV infections at the population level, underscoring that these are not only issues about access to care for drug users, but are much more, namely issues about HIV epidemic control.³⁴

Incarceration of drug users continues in many countries of the world, despite evidence that risks for HIV acquisition and transmission increase among IDU although incarcerated, for example, in Thailand, Iran, and Afghanistan.^{3,5,26,35} Punitive responses to drug users have been shown to increase HIV risk behaviors, such as syringe sharing during intensified police activity, avoiding drug treatment or syringe exchange programs out of fear of police surveillance, or decreasing access and use of services if registration as a drug user is required, as has been found in Ukraine, China, and Vietnam.^{26,35–39}

Criminalization and what has been called “mass incarceration” for drug-related offenses have had insidious effects on public health. In the United States, incarceration policies have led to the highest rate of imprisonment for any population worldwide: 702 of 100,000 population in 2007, with marked disparities in incarceration rates among racial and ethnic minorities.⁴⁰ Data from 26 Eastern European and Central Asia states and countries reveal the impact of mass incarceration on rates of tuberculosis (TB) in that region, with each percentage point increase in incarceration corresponding to a significant increase in the incidence of TB at the population level. Net increases in incarceration in this region have been estimated to account for roughly three-fifths of the average total increase in TB incidence from 1991 to 2002.⁴⁰

The epidemiologic data presented here suggest that HIV among drug using populations will continue to fuel the spread of the infection. The enormous opium crop yields in Afghanistan will feed dependency and addiction among users in Central Asia, the CIS, Africa, and the rest of the world for years to come. These conditions cry out for new policies and public health approaches to prevent and treat drug abuse and HIV/AIDS. Punitive responses to these diseases have been proven ineffective, although public health approaches have been proven to work. When populations in need can access

services for prevention, drug abuse and HIV treatment, and care, they can recover from their addictions and control their viral loads. Evidence-based practices and policies for reducing and preventing the diffusion of HIV among drug users, their sexual partners, and their children are available now. It is time to use them.

ACKNOWLEDGMENTS

The authors would like to thank Bradley Mathers of the U.N. Reference Group on HIV and Injecting Drug Use for the use of Figure 4. We would like to thank Daniel Wolfe of the International Harm Reduction Development Program of the Open Society Institute for the use of Figure 1. The data on opium production is courtesy of the United Nations Office on Drugs and Crime, which publishes the annual *World Drug Report*. Finally we would like to acknowledge our colleagues in Malawi, Namibia, and Botswana, including Gift Trapence F Motimedi, Eric Umar, Scolastika Ipinge, and Friedel Dausab, for the use of the African MSM data used for Figure 6.

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