Drug injecting, rapid HIV spread, and the 'risk environment': implications for assessment and response

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Introduction

An increased focus on the environment has been a characteristic of public health discourses in the past two decades [1]. The principles underpinning the 'new' public health movement, as adopted by the World Health Organization since the mid-1980s, envisage risk reduction as an inter-sectoral and multi-level activity encouraging individual, community, policy and environmental change [2–4]. As recently outlined by the World Health Organization, the future of public health relies on developing multi-sector partnerships capable of creating the environments conducive to health [5]. This increased focus on the environmental dimensions of health has led to calls for shifts within public health epidemiology [6–9]. This is especially the case in understanding the distribution and determinants of behavioural disease, and HIV infection is no exception. HIV infection does not progress within populations in uniform or random ways, but is subject to the relativity of risk and to variations in population behaviour in different social, cultural, economic, legal, policy and political environments [10–14].

Recent multi-method research provides an emerging basis for assessing the 'risk environment'. Evidence suggests that injecting drug users' (IDUs') risk perceptions and behaviours are influenced by the social and material contexts in which risk occurs. Key micro and macro factors mediating risk behaviour include: the physical and social settings of drug injecting [15,16]; IDUs' friendships, social relationships and networks [17]; peer group and cultural 'norms' [12,18]; as well as the wider social, economic and policy environment [14,19,20]. Syringe sharing, for example, is not merely a product of individuals' risk calculus and immediate setting [15], but is also contextually determined by paraphernalia laws, drug policing and law enforcement [21–24], injecting equipment availability [21–23,25], gender, ethnic and health inequalities [26,27], the political and social economy [13,20, 28,29], and, perhaps most importantly, public health policy [5,11,19,21–23,30].

An understanding of the environments in which risk behaviours and relationships occur may thus be an essential ingredient of assessment approaches, which produce effective public health, and HIV prevention, responses. The 'risk environment' remains an under-researched yet critical factor in the development of HIV prevention. The challenges of the 'new' public health movement for understanding health as the interaction between populations and their social and material environments have yet to be fully realized. HIV prevention remains a predominantly 'individualistic' exercise, and often misses the environmental influences on HIV spread and the potential for social and environmental change [10,12,14,31]. This may especially be the case in the development of interventions targeting IDUs, for here, there is often considerable political resistance to introducing public health measures, and changes at the structural level, *even if* they are known to be internationally effective in limiting or preventing HIV epidemics [20,21,30].

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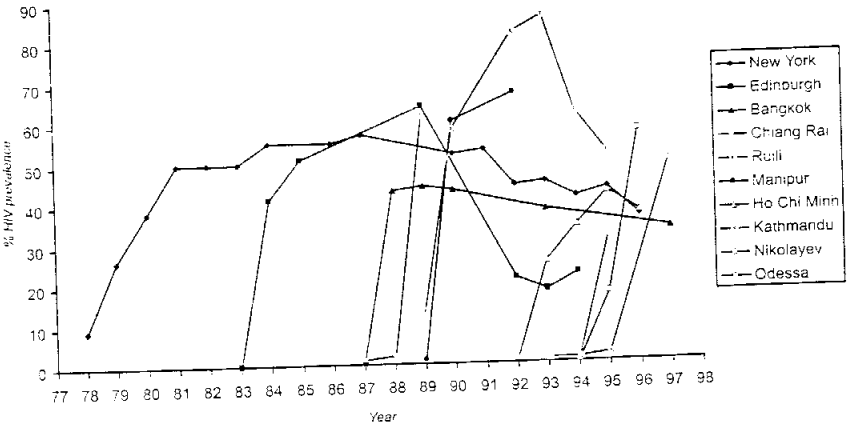

Fig. 1. Rapid increases in HIV prevalence among IDUs, 1978–1998.

By way of two case examples, we examine evidence for environmental influences on rapid HIV spread among IDUs, and its implications for assessment and response in two regions where drug injecting is a pivotal feature of HIV transmission. Our examples draw on south and south-east Asia (SEA) and the Newly Independent States in eastern Europe (NIS). We also review international evidence that highlights 'rapidity in response' and 'public health approaches' as necessary features of effective HIV prevention among IDUs.

Two decades of HIV epidemics among IDUs

Injecting drug use been reported from 129 countries and territories, of which 103 also report HIV associated with IDU [32]. This is a steady increase on the 83 countries reporting HIV among IDUs in 1996 [33], and the 53 doing so in 1993 [34]. Injecting drug use is the predominant mode of transmission in parts of southern Europe, the United States, North Africa, the Middle East, Asia and the NIS [32–40], and is increasingly significant in South America [30].

HIV has spread rapidly among IDUs in many countries (Fig. 1). Rapid spread continues to occur at least 15 years after it was first documented in New York [41] and 10 years after it occurred in south-east Asia [35–37]. After years of low and stable HIV prevalence, recent reports show increases to 25% HIV prevalence among IDUs in Vanouver, Canada [42]. Two regions witnessing rapid HIV spread among IDUs, almost a decade apart, are SEA (since 1986) and the NIS (since 1995).

South and south-east Asia (1986–1998)

Studies in SEA show HIV prevalence among IDUs rising to 40% within 1–2 years of the presence of HIV first being identified [33–37]. This was the case in Bangkok (1987–1988) and Chiang Rai (1988–1989) in Thailand, Yunnan Province in south-west China (1989), Mytkyina, Mandalay and Yangon in Myanmar (1989), and Manipur in north-east India (1989–1990) [35,37,43–45]. HIV spread among IDUs has also occurred more recently in Malaysia [37,46] and Vietnam [47].

HIV prevalence among IDUs has reached alarming levels in many of these countries, and between 1992 and 1993 was reported to be 95% in Mytkyina, 86% in Mandalay, 74% in Yangon, 86% in Ruili (Yunnan), 66% in Longchuan (Yunnan) and 67% in Manipur, and in 1995 was 42% in Ho Chi Minh City [35–37,43–49]. High prevalence persists in many of the regions where rapid spread has occurred. Estimates in 1997 suggested prevalence rates between 50 and 76% in Ruili, 44 and 55% in Longchuan, 37% in Ho Chi Minh City, and 33% in Bangkok [37,47,50–53]. At least 50% of HIV cases are estimated to be associated with IDU in China, and at least 70% in Malaysia, Myanmar and Vietnam [37,46,47].

Furthermore, the threat of rapidly emerging epidemics in SEA remains. In Kathmandu, Nepal, where continued low prevalence (under 2%) over some years was associated with the early introduction of HIV prevention [54], reports in 1998 suggested an increase to 50% prevalence among a sample of 165 IDUs [55]. This increase has coincided with an interplay of 'environmental' risk factors, to a large extent exogenous to the impact of existing HIV prevention. These include the diffusion of new patterns of drug use, and in particular, shifts from opiate smoking to drug injecting influenced by the increased availability and affordability of injectable heroin, as well as shifts towards buprenorphine injecting (and possibly greater levels of sharing as a consequence), and increased migration and population mixing [55]. As we will note,

Table 1. HIV infection among injecting drug users (IDUs) in the Newly Independent States in eastern Europe, 1993–1998.

	1993		1994		1995		1996		1997		1998	
	Total	(IDU)	Total	(IDU)	Total	(IDU)	Total	(IDU)	Total	(IDU)	Total	(IDU)
Belarus	10	(2)	5	(1)	8	(0)	1021	(934)	653	(568)	554	(434)
Moldova	3	(0)	4	(0)	7	(1)	55	(38)	404	(358)	408	(341)
Russian Federation	108	(0)	158	(2)	196	(5)	1535	(1018)	4337	(2220)	3913	(1637)
Ukraine	51	(0)	44	(0)	1499	(1049)	12228	(5729)	15443	(7950)	12896	(5574)

Source: Official Ministry of Health estimates and [39,40,56–66].

these environmental 'pre-conditions' for epidemics may exist in a number of south Asian and SEA countries.

Newly Independent States, eastern Europe (1995–1998)

Since 1995, a decade after HIV transmission had peaked in western Europe, new epidemics have occurred among IDUs in a number of NIS, including Ukraine, Russia, Belarus, Moldova, and in Kazakhstan, Central Asia [38–40] (Table 1). In Ukraine, new HIV cases have soared from an average of 47 per year between 1992 and 1994 to almost 1500 in 1995, 12 228 in 1996, and 15 443 in 1997, with recent estimates indicating 80% of new infections associated with IDU [56]. Rapid spread has been most acute in the southern Ukrainian cities of Odessa and Nykolayev. In Odessa, HIV prevalence among IDUs rose from 1.4% in January 1995 to 13% in August 1995 and to 31% by January 1996, and in Nykolayev, from 0.3% in 1994 to 17% in early 1995 to 57% by January 1996 [57,58]. New outbreaks continue to occur. In Poltava, where only three HIV-positive IDUs were registered in 1996, 30% HIV prevalence was reported in 1998 (L. Khodakevich, personal communication, 1999). Evidence suggests continued HIV diffusion among IDUs in rural areas (for example, Odessa region, Poltava, and Cherkassy), Donetsk in the east, and Dnepropetrovsk, Zaporozhie and Kiev in the centre [59].

In Russia, prior to 1994, no HIV cases among IDUs had been reported. Since then, two new cases among IDUs were reported in 1994, five in 1995, 1018 in 1996, and 2220 in 1997 [60,61]. Official estimates in 1996 suggested that 66% of new cases were associated with IDU, and in 1997, this was 51%, yet other studies estimate this between 74 and 90% [62,63]. The regions associated with rapid spread are: Kaliningrad, since January 1996; Krasnodar, since February; Nizhny Novgorod, since March; Tumen, since April; Rostov, since June; Tver, since January 1997; and Tula, since April 1997 [60,64,65]. HIV cases among IDUs have been reported from 56 of the 59 regions in Russia, with local reports suggesting outbreaks in 1998 in Belgorod and Verkhnii Soldar (Sverdlovsk).

One year after rapid spread was reported from Ukraine, similar reports emerged from Belarus. In Svetlogorsk, in the south, an 18% HIV prevalence was estimated among IDUs in May 1996, yet by July 1996 it was estimated at 50% [58]. Laboratory analyses of residue blood in IDUs' syringes estimated that 67% of IDUs in Belarus were HIV-positive in 1997 [66]. At the end of 1997, 87% of new HIV cases were among IDUs, as were 78% at the end of 1998 [66]. In Moldova, reported cases have risen from an average of under three per year between 1992 and 1994 to seven in 1995 and to 55 in 1996, of which 38 (69%) were among IDUs [58]. By the end of 1998, 84% of cumulative cases were among IDUs. In June 1996, there were 69 reported HIV cases in Kazakhstan, Central Asia. Since this time, HIV testing has increased, and by June 1998, 677 HIV cases were detected, of which 83% were among IDUs (S. Kumar, unpublished work).

Mapping the risk environment

The foregoing description of two regional epidemics raises the question of what facilitates the rapid spread of HIV infection. An over reliance on 'risk factor' epidemiology, which focuses on individual determinants of risk (such as knowledge, attitudes and behaviour), may be inadequate in assessing the 'risk environment'. Rather, we would emphasize the importance of delineating the environmental factors influencing HIV outbreaks, and considering the extent to which the environmental 'pre-conditions' of epidemics can be identified, and HIV epidemics predicted and thus prevented. Current knowledge of how social and material factors may promote rapid HIV spread remains limited. In drawing on evidence of HIV diffusion in SEA and the NIS, we suggest the following macro environmental factors as potentially important.

Diffusion of drug injecting

A prior condition for the spread of HIV by drug injection is the existence of a population of IDUs [34].

Both SEA and NIS have experienced a rapid and recent spread of IDU. In Ruili, Longchuan and Luzi (Yunnan), for example, the number of registered addicts (known to be a major under-estimate) rose dramatically during the mid- to late 1980s, overlapping with the emergence of HIV outbreaks, with 57% of IDUs reporting initiation after 1988 [67]. The uptake of injecting in China has been rapid: prior to 1987, surveys indicated that less than 2% of drug users regularly injected, yet by 1992, surveys showed 33% to regularly inject, and by 1995, between 47 and 79% (in Weshan and Guangzhou) [53]. Similar reports have been made elsewhere in the region [37]. In the NIS also, there has been rapid growth in IDU populations since 1990, including in Belarus, Moldova, Russia, and Ukraine [40]. In Russia, some estimates suggest 700 000 IDUs; an estimate 20 times higher than those made in 1990 [32], while others suggest as many as two million [68], with registered drug users in treatment increasing from 91 000 in 1994 to 350 000 in 1997 [59]. Increasing numbers of IDUs in the NIS have coincided with decreasing trends in age at first injection, and concomitant increases in health problems associated with drug injecting soon after initiation among younger injectors [32,40].

Where injectable drugs are produced, injecting is likely to occur [34–37]. In many south and SEA countries, transitions from opium or heroin smoking to injecting have been facilitated by the decreased availability of non-injectable-grade opiates, and the increased availability and affordability of injectable ones. This has been influenced by law enforcement and interdiction initiatives restricting drug production and supply [35,37,69–72], and by the transference of technologies in drug production and administration [44]. In India, for example, shifts from heroin smoking towards the injection of pharmaceutical buprenorphine have occurred in the context of reduced heroin supply associated with law enforcement, as well as concomitant increases in the availability of injectable buprenorphine associated with its prescription as a withdrawal treatment to heroin smokers [44].

Anti-opiate laws may contribute to increasing the price and decreasing the purity of opium and heroin, shifting trade and transit into new areas, thus creating opportunities for new consumption patterns, and encouraging shifts towards the production of injectable grade heroin, which is both relatively inexpensive to produce and purchase as well as easier to transit and deliver [35,37,69]. In SEA, shifts to local heroin refining were initially prompted by the success of enforcement against refiners in the Mediterranean as well as by the demand for heroin from US servicemen in Vietnam [35]. Anti-communist insurgents supported by the United States, as well as tribal groups, became participant in opiate production and transit. New drug production and associated trafficking routes (also associated with arms, and later gem and sex worker trafficking) had major implications for the development of heroin production in Myanmar, Thailand and southern China, and the later adoption of heroin smoking and injection among local populations [35,37,69–72]. Increases in heroin use in Yunnan have been associated with enforcement activities in Myanmar, which shifted transportation routes out of Shan State into Yunnan and onwards into Hong Kong [34]. Recent increases in amphetamine use and injecting in Thailand, as well as in other SEA countries, have been associated not only with the 'globalization' of drug markets, but also with restrictions in heroin supply that have encouraged shifts towards local amphetamine production [53,70].

The uptake of new patterns of drug use appear influenced by an interplay of macro social, economic and political changes. In the NIS, it seems to be no coincidence that rapid diffusions in drug use and injecting have occurred since 1990, paralleled by major social dislocation and change. Shifts to private economic production have occurred in the context of dramatic declines in gross domestic product and have led to increased unemployment, increased income differential and poverty, and the rapid expansion of informal and criminal economies [73–75]. Drug production and distribution markets in Russia and Ukraine have proliferated since 1991, particularly in the domestically produced injectable opiates derived from poppy straw [39,60]. Further suggestion of the links between social condition and ill-health are indicated by the parallel increases in alcohol consumption and morbidity [75], cholera, tuberculosis, and diphtheria [76,77], massive increases in the prevalence of syphilis [78], decreases in life expectancy [75], and deterioration in health and welfare services [79].

Trade, transport and migration

Shifts in trade, transport and communication networks facilitate the diffusion of IDU and associated HIV [34–37]. In Manipur, the distribution of IDU and HIV is associated with the main trading road through the country [44]. The geographical proximity of China, Myanmar, Thailand and Vietnam, with considerable economic linkage and growth strengthened by the 'relaxation' of economic policies, has led to cross-border and urban migration, particularly among traditionally 'mobile' populations [37,47,67]. Increased migration often precedes new diffusions in IDU, and associated HIV, particularly given the involvement, at least initially, of migrant, transient and ethnic minority populations in drug trade, production and use [37,53]. This was found to be the case in Myanmar among migrant mining labourers, among Thai fishing labourers and truck drivers, and among ethnic hill tribes

in Thailand and the Shan and Kachin States of Myanmar [35,37,80]. Alongside opportunities for trade and income generation (including via sex work), mining areas in Myanmar constitute 'epidemic focal points' combining high levels of risk behaviour, population mobility and mixing [80].

Shifts in trade, communication links and migration facilitate the transfer of knowledge about techniques of drug administration [34,44], encourage population mixing, and contribute to the disintegration as well as formation of social networks [13]. The spread of injecting is thus also structured by social relations, with some social groups more likely to encounter opportunities to use and inject drugs than others. Diffusions in IDU tend to emerge first among populations who, by virtue of income, social position or mobility, have opportunity to experiment with injecting [34]. Population mixing has implications for the rapidity of IDU and HIV spread, while network disintegration can hamper prevention response [13]. As studies in Hong Kong, Thailand and Vietnam have indicated regarding prison and refugee camps, such environments may not only act as 'epidemic focal points' given the high levels of risk behaviour and population mixing occurring within them, but also as points of 'epidemic geographic dispersal' once prisoners are released and refugees repatriated [81].

Economic developments in southern Yunnan have encouraged migration from neighbouring countries and from elsewhere in China [67]. Alongside the expansion of trade routes, drug trafficking, while much diminished since the 1950s, re-emerged during the 1980s, with local ethnic populations becoming participant [37]. The border counties of Ruili and Longchuan (adjacent to Myanmar and Laos) have shown high levels of HIV prevalence among IDUs for a decade [48,49,67]. The Province is also close to northern Thailand and Chiang Rai (which is south of the Shan State border in Myanmar) where rapid spread has also occurred [43]. Evidence suggests increasing HIV spread eastwards throughout the Province and beyond into China [37,67].

Similarly, in Ho Chi Minh City, which witnessed rapid commercial development and urban migration in the mid-1980s, a pre-existing opium trade was bolstered by the introduction of 'open door' economic policies (*Doi Moi*), which strengthened trade links with neighbouring countries of the Golden Triangle (where approximately 20% of the world's opium supply used to process heroin is produced) [47]. In Ho Chi Minh City, which shares trade with Thailand, 86% of HIV cases are among IDUs [37,47]. In northern Vietnam also, which shares a border with China and Laos, large populations of IDUs are reported, as are pockets of rapid HIV spread, with the majority of cases reported since 1996 [47]; in Lang Son, for example, 97% of new HIV cases in 1996 were among IDUs [47].

In the NIS, there are unsubstantiated claims that the Black Sea Coast (a popular holiday destination in the NIS) has formed a geographical nexus of HIV diffusion between Ukraine and Russia [40]. Krasnodar, for example, has both good transportation links with Black Sea harbours and witnessed the first major HIV outbreak in Russia [40]. Other reports suggest geographical diffusion from Ukraine to Russia. In Tumen, a mid-size town in western Siberia, all IDUs testing HIV-positive were temporary workers from Ukraine [40]. Molecular studies indicate similar viral subtypes among Kaliningrad and Ukrainian IDUs, and among southern-Russian IDUs having travelled in Ukraine [82,83]. The recent emergence of HIV among IDUs in countries in the region with currently low HIV prevalence, such as Armenia and Georgia, has also been associated with population migration and travel to and from Russia and Ukraine [40,84]. In addition, while most drugs injected in the NIS are domestically produced (see later), the states reporting rapid HIV spread are also in close proximity to drug supply routes, particularly those originating in Afghanistan, moving through the Central Asian Republics to Ukraine and Russia, and onwards to Western Europe [64]. Afghanistan may become a key 'crossroads' for drug distribution into both the NIS and SEA.

Methods of drug production

HIV diffusion may be influenced by methods of drug production and consumption. Methods of drug production in the NIS may have a direct link with HIV transmission. The most commonly injected opiates in the NIS are domestically produced derivatives of poppy straw, including Russian and Ukrainian 'chornyi' ('black') or 'khimiya' ('chemistry'), and 'hanka' in Russia and Kazakhstan. Liquid 'amphetamine-like' drugs, 'Vint' ('screw') or 'belie' ('white'), are also domestically produced from ephedra (which grows wild) or ephedrine (extracted from cough syrup) [39]. HIV may enter the production process via containers and mixers used to collect, decant and mix the solution ingredients (which may include industrial solvent, acetic anhydride, vinegar, soda, water), or via injecting equipment used to test the solution directly from mixing containers [39,40,60].

Reports in Belarus, Kazakhstan, Ukraine and Russia also suggest that the domestic production of liquid opiate may have involved, or still occasionally involves, the use of human blood as a clarifying or purification agent [39,85]. Chemical analyses indicate that the liquid derived from poppy straw may contain a high proportion of chemical toxins relative to opium al-

kaloid [85]. In the event of illegally produced acetic anhydride being prohibitively expensive (at approximately $1 for every 1 ml), human blood may be used as an alternative neutralizing agent. One Russian study suggests that to purify one glass of poppy straw, several drops (or between 4 and 5 ml) of fresh blood are required, and that the chances of infection 'after a single injection of this drug tends to be maximal' [85].

Social norms and drug cultures

The social acceptance or 'normalization' of drug injecting may contribute to the rapid adoption of injecting as a preferred route of administration [34]. The diffusion of IDU in SEA has coincided with transformations in trade and transport, and in the NIS since the shift to 'free-market' economies, but the cultural acceptability of opiate use may pre-date recent transitions in IDU and HIV spread. While drug injecting is relatively recent in China, Laos, India, Myanmar and Vietnam, it has occurred in Hong Kong since the 1950s and in Thailand since the 1960s, and the private use of opium in the Golden Triangle region has long been culturally accepted [34,37,69]. Similarly, opiate use is not a new phenomenon in the NIS, and the cultivation of opium poppy is traditional in parts of Russia, Ukraine and Central Asia. Recent studies in Russia and Ukraine suggest that drug injecting is unlikely to be viewed as an 'unusual' behaviour requiring 'specialist' knowledge, and as with the prescription of injectable rather than sublingual buprenorphine in India, there appears a high level of acceptance for administering medicines by injection [86] (T. Rhodes, C. Fitch, unpublished work).

Methods of drug distribution

In the NIS, rapid HIV spread is also associated with the methods by which drugs are distributed to consumers. Two modes of drug distribution include the distribution of drug solutions in ready-filled syringes (drug users purchase the ready-filled syringe), and via 'front-loading' directly from a dealer's donor syringe (dealers may carry 10 ml syringes and/or a separate container of solution from which to re-fill their donor syringe) [39,40]. These modes of distribution appear to be influenced by a number of factors, including: geography (where drug production sites are separate from drug distribution sites); ease of transport; the need for rapid transactions between consumers and dealers; and ease of measurement in the amount of distributed solution (T. Rhodes, C. Fitch, unpublished work). The shared use of mixing containers may also occur at drug production sites [32].

In SEA also, methods of drug distribution may increase HIV risk. In Ho Chi Minh City, for example, much drug injecting takes place within off-street shooting galleries ('lo chich') with professional injectors ('chu') administering the injections, frequently drawing the solution from a common pot [32,47]. Fears of arrest associated with possessing injecting equipment encourage drugs to be used within the relative security of shooting galleries, yet methods of distribution may mitigate against individuals' attempts to reduce HIV risk.

Legal and policy environment

A lack of organizational infrastructures and resources for developing rapid responses, and policy environments which mitigate against the development of public health interventions, can exacerbate emerging HIV epidemics [5,19–22,30]. Of critical importance is the general lack of needle and syringe availability in many SEA countries, as well as in parts of the NIS. This has given rise to high rates of needle and syringe sharing, including the shared use of homemade injecting equipment [44,47,49,80]. In addition, the lack of access to sterile water and bleach has mitigated against IDUs' attempts to reduce risk of infections by cleaning their injecting equipment [70].

While there is increased policy recognition of the public health priorities associated with IDU, in many countries, supply reduction and law enforcement initiatives (often involving harsh penalties) hold dominance [21,53,87,88]. Despite increases in law enforcement activities in the past two decades, the global expansion of drug trade and diffusion of IDU continues [25,34]. Drug control policies may contribute to the increased transience of IDU populations, thus limiting opportunities for public health intervention [24,53,80]. Informal or formal policies of 'paraphernalia' control inevitably increase syringe sharing, thus accelerating potential HIV transmission [21–25]. Structural impediments to HIV prevention in Myanmar, for example, include the illegality of drug use per se and the obligation to inform the authorities about drug users (which inhibits outreach), government restrictions on the operation of NGOs, and the prohibition of reading materials to prisoners [80]. In China, supply reduction interventions also dominate, and prevention largely consists of voluntary or enforced detoxification at 're-education' or drug rehabilitation centres [53]. Law-enforced drug treatment, usually involving detoxification, is also common in Myanmar, and exists in Malaysia. Evaluations indicate that the relapse rate from drug treatment involving coercion is high, usually between 70 and 90% [53,87,89]. There are no documented examples of methadone treatment programmes or needle and syringe distribution or exchange (NSDE) in China, Malaysia or Myanmar [45,46,53].

While it is not the case in the period of rapid HIV spread, evidence suggests the development of integrated public health responses in Hanoi and Ho Chi Minh City in Vietnam and in parts of Thailand

(including Mae Chan in the north), including government-sanctioned NSDE, pilot or established methadone programmes, peer education and outreach [32,70,87]. Availability and distribution of injecting equipment nonetheless remains severely limited in the countries as a whole, particularly given fears of arrest [47,53]. Other well-documented examples of integrated public health responses include those in Kathmandu, which incorporates NSDE, methadone treatment and community outreach [54,87,90], the peer outreach programmes incorporating NSDE in Manipur, Madras and Calcutta [91–93], and the user-organizing, outreach, NSDE and buprenorphine treatment interventions in Delhi [5]. Evaluations associate the Kathmandu and Madras interventions with reduced risk behaviour among participating IDUs [54,91]. There are also increased efforts to target HIV prevention among IDUs and migrant populations in the Golden Triangle borderlands [94].

HIV spread in the NIS has encouraged increased policy support for HIV prevention. In Russia, the Duma recently accepted the need for action, the National Ministries of Health, Education, Internal Affairs and Defence are working with UN agencies on national HIV-prevention assessments, and the Ministry of Health has encouraged its regional AIDS Centres to focus on HIV prevention among IDUs [64]. In March 1998, the 1991 Ukrainian law on 'Prevention of AIDS and Social Protection of Populations' was amended to enable the implementation of 'harm reduction' approaches, including NSDE. With the technical support of UN agencies, the Ukrainian National Committee for the Prevention of AIDS and Drug Abuse has worked towards the development of public health policies and strategies, targeting IDUs since 1996 [57,58].

There is also evidence of HIV-prevention interventions in the NIS. NSDE programmes have been established in Belarus, Moldova, Kazakhstan, Russia and Ukraine [32,64]. In St Petersburg, NSDE has operated from a mobile outreach bus, operated by the NGO Renaissance, since 1997 [64]. Yet moves to introduce changes in the Russian Law on 'Narcotic Drugs' (1998) potentially restrict the impact of syringe distribution and exchange. In Moldova, a prison-based NSDE project has been established, and in three Ukrainian prisons, there are pilot interventions to distribute condoms, bleach and information on the cleaning of injecting equipment [32]. These are the first interventions to provide bleach or access to sterile injecting equipment in prisons in the NIS. There is also evidence of outreach. In Russia, the Moscow Outreach Programme, in which former drug users provide leaflets and condoms, also provides onwards referral to HIV testing and drug treatment services [64]. In addition to providing mobile NSDE, the Yaroslavl Project in Russia aims to facilitate peer support towards risk reduction among IDU networks [95]. Preliminary evaluation associates the intervention with statistically significant reductions in syringe sharing [95]. Opioid agonist pharmacotherapies, including oral methadone, are provided in a number of central and eastern European countries but there are no such programmes in the NIS where rapid HIV spread has been reported [32].

Effective responses

The rapid spread of HIV among IDUs in SEA and the NIS has occurred in contexts characterized by rapid social and economic change. This process appears to have encouraged environments conducive to HIV transmission, particularly among marginalized populations. The 'risk environment' consists of an interplay of 'exogenous' factors that operate outside of, yet impinge on, the capacity of individuals to reduce HIV risk. We have identified factors associated with migration, drug trade, production, distribution and legal policy environment as salient. In such contexts, high levels of individual risk behaviour, such as syringe sharing and unprotected sex, can sustain further spread. The risk environment thus mediates the potential efficacy of individual- and community-level HIV prevention responses. This leads to three related conclusions.

Paradigm drift and shift

First, there remains the need for 'paradigm shifts' in methods of assessment and response. HIV prevention research remains unduly tied to 'risk factor' approaches in epidemiology and 'individualistic' approaches in intervention development. With contemporary epidemiology 'ill-equipped to address epidemic control' [7], it is increasingly recognized that effective HIV prevention rests on its capacity to 'bridge' rather than further entrench methodological and disciplinary divides in methods of assessment and response [96–98]. Epidemiology has, once again, begun to re-embrace social scientific notions of the 'social environment' [6]. There is increasing evidence of 'paradigm drift' towards public health models of assessment which emphasize environmental and policy context in addition to understanding individual and community behaviour change [5–8]. Yet, in HIV prevention, as elsewhere, there very much remains a 'divide' between *advocating* the need to understand the 'risk environment', and the *application* of method, which tends to reproduce the dominance of individualistic paradigms of disease explanation and response [10–14,31].

This underscores the potential for HIV prevention research to be 'paradigm shifting'. Characterized by greater innovation than many other fields, we see the

continued potential for HIV prevention research to envisage its methods as a set of complementary tools to assessment, the use of which may be evaluated on the basis of their practical, as well as scientific, outcomes [32,96,97]. If assessment is to lead to effective responses, it requires approaches that realize a convergence between social science investigations of the 'meaning' and 'context' of risk behaviour with epidemiological investigations of 'host' and 'environment' [98]. In this respect, there is an increasing receptivity to use of qualitative methods in helping to inform, complement and interpret epidemiological measures of 'environment', as well as greater interest in multimethod and 'rapid situation assessment' approaches [96–99]. Such approaches have the potential to establish assessment as an integral component of community development, policy advocacy and multisectoral intervention development, where a focus on the risk environment is a central rather than peripheral unit of analysis and change.

Public health approaches

In addition to social environmental approaches, a second factor influencing effective public health responses is rapidity. Early intervention is critical in preventing HIV epidemics among IDUs [11,100]. Once HIV prevalence among IDUs reaches 10%, it can surpass 40–50% within 1–4 years [33]. HIV epidemics among IDUs have occurred quicker than the time taken to develop appropriate HIV prevention and policy responses [35]. Often there has been a lag of some years before new epidemics have even become apparent [41]. Once established, high prevalence may be sustained for some years [35,41,50,52], although examples exist of epidemics being 'reversed' [30,101].

Cities or countries with most success in averting HIV epidemics have witnessed intervention developments which emphasize rapid re-orientation towards 'user-friendly and 'low-threshold' services, community-based and community-level approaches, and public policies supportive of such interventions [5,11,30, 100]. Practical interventions effective in forming such a response include: outreach [91–93,102]; peer and social network interventions [95,103]; community development interventions [12,87], legal access to sterile injecting equipment [23,30,54,104,105]; and low-threshold agonist pharmacotherapy, including methadone [25,90,106]. Evidence substantiates the early introduction of such interventions as an effective means of facilitating individual and community behaviour change. In both 'developed' and 'developing' countries, HIV prevention among IDUs has shown that the oft-quoted principles of 'new' public health approaches can be successful if actually applied [5], and in some countries provide rare examples of 'new' public health *praxis* [11,30].

In contrast, there has been less success in facilitating changes in the macro economic and policy environments influencing HIV risk. The relative success of individual- and community-level risk reduction among IDUs is to some extent shaped by the 'risk environments' in which they are developed [14]. It is of continuing concern that the social, economic, legal and policy environment may *limit* the potential impact of risk-reduction interventions, and hinder, as well as prevent, their introduction in many countries [13,19–22,87]. Rapidity in response, while a necessity, constitutes a considerable challenge if environmental factors mitigate against introducing HIV-prevention interventions. Key macro factors found to limit the success of HIV prevention among IDUs, in both 'developed' and 'developing' countries, include: rapid social and economic change; lack of economic resources; lack of public health tradition and associated infrastructures; lack of NGO and community organization infrastructures; geography and physical location; prevailing policies that emphasize law enforcement and drug control above public health priorities; and a local, cultural or political resistance to 'harm reduction' [5,13,21,30,71]. The concentration of resources towards law enforcement and drug control in particular may *exacerbate* HIV spread among IDUs [21,37,70]. This continues to occur in many countries despite evidence that public health responses are less resource-intensive and more cost-effective, both in terms of maximizing human as well as economic capital [25,63,107].

Predicting and preventing epidemics

Understanding the risk environment may lead to opportunities for predicting, and thus preventing, rapid HIV spread. As reports in Kathmandu, Russia and Ukraine indicate, the potential for new IDU-associated HIV epidemics remain. Assessment of the environmental conditions which facilitate such epidemics points to the need to establish infrastructures for the prevention of injecting drug use and HIV infection before rapid spread occurs. The environmental conditions for HIV outbreaks appear to exist in a number of south Asian and SEA countries. In Laos, for example, which is bordered by Myanmar, Thailand and Vietnam, there are indications of increased cross-border trade and migration, increased drug trafficking in heroin, the increased potential for shifts from opium smoking to injecting should heroin become more widely available, and a pre-existing familiarity with injecting as a mode of administration in therapeutic settings [53].

The potential for an 'ignitable HIV epidemic' has also been noted in Dhaka, Bangladesh [108], as well as in Calcutta [109], where recent transitions from heroin smoking to injecting have coincided with high rates of needle and syringe sharing. Similarly, there are in-

dications of potential IDU and HIV diffusion in countries with trade or transport links with Russia and Ukraine, including Armenia, Azerbajan, Georgia, Latvia and Lithuania, and in the Balkan countries traversed by drug-trafficking routes [40]. Reconstruction of HIV diffusion highlights that HIV spread among IDUs in SEA consisted of intersecting 'sub-regional' epidemics [36]. This has implications for predicting spread elsewhere as well as for planning policy responses, which transcend local communities and national boundaries.

Conclusion

In the decade since rapid spread occurred in SEA, a wealth of HIV-prevention expertise has been gained. Emerging epidemics are less a reflection of current public health methodology than of the multiple processes that create the environments conducive to rapid diffusions in drug injecting and HIV. Effective HIV prevention requires assessment of the micro and macro risk environment, and interventions targeting social and environmental change. Of critical importance is establishing public policies supportive of 'public health' and conducive to individual and community risk reduction. Changes at the community level can facilitate changes in individuals' behaviour, but they are no substitute for changes in the risk environment.

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