International Journal of Drug Policy 25 (2014) 1163–1173

Contents lists available at ScienceDirect

International Journal of Drug Policy

journal homepage: www.elsevier.com/locate/drugpo

Research paper

Controlling HIV among people who inject drugs in Eastern Europe and Central Asia: Insights from modelling

Peter Vickerman[a,b,*], Lucy Platt[b], Emma Jolley[b], Tim Rhodes[b], Michel D. Kazatchkine[c], Alisher Latypov[d]

[a] School of Social and Community Medicine, University of Bristol, UK
[b] London School of Hygiene and Tropical Medicine, UK
[c] UN Secretary General Envoy on HIV/AIDS in Eastern Europe and Central Asia, Geneva, Switzerland
[d] Management Sciences for Health, Leadership, Management and Governance Project, 19 Moskovsky Prospect, 6th Floor, Room 605, Kiev, Ukraine

ARTICLE INFO

Article history:
Received 20 June 2014
Received in revised form
24 September 2014
Accepted 26 September 2014

Keywords:
HIV
Eastern Europe
Central Asia
Modeling
PWID
NSP
OST
ARV
Combination interventions

ABSTRACT

Background: Although there is evidence of the effectiveness of needle and syringe programme (NSP), opioid substitution therapy (OST) and antiretroviral therapy (ART) in reducing HIV prevalence, most Central and Eastern European sub-regions still have low or no coverage of most or all of these interventions.
Methods: We conducted a modelling analysis to consider the potential impact on HIV incidence and prevalence of OST, NSP and ART in three illustrative epidemic scenarios: Russia (St. Petersburg); Estonia (Tallinn) and Tajikistan (Dushanbe). For each intervention, we consider the coverage needed of each intervention separately or in combination to: (1) achieve a 30% or 50% relative reduction in HIV incidence or prevalence over 10 years; and (2) reduce HIV incidence to below 1% or HIV prevalence below 10% after 20 years. A sensitivity analysis for St. Petersburg considered the implications of greater on no risk heterogeneity, none or more sexual HIV transmission, like-with-like mixing, different injecting cessation rates and assuming a lower HIV acute phase cofactor.
Results: For St. Petersburg, when OST, NSP and ART are combined, only 14% coverage of each intervention is required to achieve a 30% reduction in HIV incidence over 10 years. Similar findings are obtained for Tallinn and Dushanbe. In order to achieve the same reductions in HIV prevalence over 10 years, over double the coverage level is required relative to what was needed to achieve the same reduction in HIV incidence in that setting. To either reduce HIV incidence to less than 1% or HIV prevalence to less than 10% over 20 years, with all interventions combined, projections suggest that very high coverage levels of 74–85% are generally required for the higher prevalence settings of Tallinn and St. Petersburg, whereas lower coverage levels (23–34%) are needed in Dushanbe. Coverage requirements are robust to increased sexual HIV transmission, risk heterogeneity and like-with-like mixing, as well as to assuming a lower HIV acute phase cofactor or different injecting cessation rate.
Conclusion: The projections suggest that high but achievable coverage levels of NSP can result in large decreases (30%) in HIV incidence in settings with high HIV prevalence among PWID. Required coverage levels are much lower when interventions are combined or in lower prevalence settings. However, even when all three interventions are combined, the targets of reducing HIV incidence to less than 1% or prevalence to less than 10% in 20 years may be hard to achieve except in lower prevalence settings.

Introduction

Despite decreases in the rate of spread of HIV globally in the last decade, Eastern Europe and Central Asia have witnessed a dramatic increase in the incidence of HIV infection. Overall, the estimated number of adults and children living with HIV in this region in 2012 was 1.3 million [1,000,000–1,700,000] (UNAIDS, 2013). The epidemic is concentrated among populations at higher risk of HIV exposure, including people who inject drugs (PWID) and their sexual partners, men who have sex with men, sex workers, prisoners and migrants (Platt et al., 2013). In Eastern Europe and Central Asia, the shared use of drug injecting equipment has been the major driver of infections. Between 2006 and 2010, one in three

* Corresponding author at: School of Social and Community Medicine, University of Bristol, UK.
E-mail address: peter.vickerman@bristol.ac.uk (P. Vickerman).

http://dx.doi.org/10.1016/j.drugpo.2014.09.013
0955-3959/

of new HIV cases reported in Eastern Europe were associated with injecting drug use (Platt et al., 2013). The countries with the highest levels of reported diagnosed cases among PWID in Europe were Ukraine (153 per million people), Russia (98 per million people), and Kazakhstan (78 per million people) (Platt et al., 2013). Estimates from prevalence studies suggest that more than one in two PWID are HIV positive in parts of Estonia, Russia and Ukraine (Jolley et al., 2012; UNAIDS, 2013). Despite the recent increases in heterosexual transmission, the epidemic among PWID continues to expand, undefeated, and inadequately addressed in the region.

There is a large body of evidence demonstrating the effectiveness of combination interventions including needle and syringe programmes (NSP), opioid substitution therapy (OST) and antiretroviral therapy (ART) in reducing HIV incidence and prevalence among PWID (Abdul-Quader et al., 2013; Aspinall et al., 2014; MacArthur et al., 2012; Palmateer et al., 2010; van Den Berg, Smit, Van Brussel, Coutinho, & Prins, 2007; Wood et al., 2009). Indeed, a number of analyses from Central and Eastern Europe also suggest that these interventions could be cost-effective for decreasing HIV transmission (Alistar, Owens, & Brandeau, 2011; Kumaranayake et al., 2004; Long et al., 2006; Vickerman et al., 2006). Despite this, most Eastern European and Central Asian sub-regions of Eurasia still have low or no coverage of most or all of these interventions. OST is unavailable in Russia, Turkmenistan and Uzbekistan, and programmes in Estonia, Tajikistan and Ukraine are believed to reach only around 10%, 1% and 2% of PWID, respectively (Kurbatova, 2012; Latypov et al., 2012). The overall 35% coverage of ART in Eastern Europe and central Asia remains well below the global level of 60%. Furthermore, ART coverage is disproportionately low among PWID in Europe when compared with the general population (Donoghoe & Stengaard, 2010), and is particularly low in these high prevalence settings where the proportion of HIV positive PWID receiving ART is estimated to be much less than 10% (Mathers et al., 2010).

In such high HIV prevalence yet low intervention coverage settings, modelling can be useful for understanding what is required in terms of scaling up interventions to reduce HIV transmission to impact on the epidemic. Such model projections can be useful tools for influencing policy as has occurred for the debate on HIV and HCV treatment as prevention (Granich, Gilks, Dye, De Cock, & Williams, 2009; Grebely, Matthews, Lloyd, & Dore, 2013). To this end, we conducted a modelling analysis which considers the potential impact on HIV incidence and prevalence of OST, NSP and ART in three illustrative epidemic scenarios: Russia; Estonia and Tajikistan. The three interventions are key within the comprehensive package of interventions recommended by WHO, UNAIDS and UNODC for HIV prevention, treatment and care among PWID (WHO, 2012). Two of the epidemic scenarios are based on the high HIV prevalence (>40%) settings of St. Petersburg (Russia) and Tallinn (Estonia), whereas the third is based on a lower HIV prevalence (<20%) setting of Dushanbe (Tajikistan). All three settings currently have very low coverage of OST and ART among PWID at less than 10%. NSP coverage is high in Tallinn (approximately 70 syringes per PWID per year, Uuskula et al., 2011), moderate in Dushanbe (10–20 syringes per PWID per year (Personal communication, Ulugbek Aminov)) and low in St. Petersburg (Personal communication, Robert Heimer).

Methods

Overview of methods

We conducted a modelling analysis to consider the potential impact on HIV incidence and prevalence of OST, NSP and ART in three illustrative epidemic scenarios: Russia (St. Petersburg); Estonia (Tallinn) and Tajikistan (Dushanbe). The dynamic model of sexual and injection related HIV transmission among PWID is described in detail below. At baseline, the model is calibrated to detailed HIV prevalence and incidence data from each setting, adjusting for the possible decrease in HIV incidence resulting from heightened coverage of NSP in Tallinn (Uuskula et al., 2011) or moderate coverage of NSP in Dushanbe. The model also adjusts for possible longer duration of injecting in Tallinn and St. Petersburg than Dushanbe (Beyrer et al., 2009; Niccolai et al., 2010; Platt et al., 2006). In accordance with NSP data from Tallinn (Uuskula et al., 2011), the effect of NSP in Tallinn was assumed to scale up from 2003 to 2009 with the final efficacy estimated from fitting the model to observed prevalence and incidence trends in Tallinn, while assuming the efficacy in intermediate years is proportionate to the relative number of syringes distributed in that year compared to 2009. The same assumptions for the effect of NSP on HIV transmission were assumed for Dushanbe but with syringe distribution scaling up more slowly from nothing in 1999 to about 7 syringes per injecting drug user (IDU) per year in 2006, and then rapidly up to about 32 syringes per IDU per year by 2010 and 2011. The model was fit to HIV prevalence and incidence data for each setting by adjusting the HIV seeding prevalence in 1996 (to shift when the epidemic starts), the injecting related infection rate per month in the latent phase of HIV, and duration of injecting (both used to change the rate at which the epidemic progresses and the prevalence it stabilizes at). The sexual infection rate was also adjusted to give a prevalence of HIV among PWID in each setting that is due to sexual HIV transmission. The effect of NSP expansion in Tallinn was used to fit the model to the observed downturn in HIV incidence (and possibly prevalence) in Tallinn. The adjusted parameter values used for the model fits are presented in Table 1, while all other parameters were kept constant and are shown in Table 2. More details on the fitting methods are given below. A comparison of the model (Baseline projections) with prevalence and incidence data from each setting is shown in Fig. 1. It is important to note that the model runs should be seen as illustrative for the type of epidemic occurring in these different settings, i.e. the Tallinn epidemic represents a high prevalence epidemic with high coverage of NSP whereas the St. Petersburg and Dushanbe epidemics represent high and moderate HIV prevalence epidemics, respectively, with no or moderate NSP coverage.

Impact of scaling up OST, NSP and ART

These baseline model fits were then used to project the impact of scaling up OST, NSP and ART, while taking into account the following assumptions. Current receipt of OST was assumed to reduce an individual's injection related probability of becoming infected by 50% based on a recent meta-analysis of cohort studies that estimates the reduction in HIV incidence among people currently on OST (MacArthur et al., 2012). Because PWID predominantly inject opiates in these settings (Abdala et al., 2008; Beyrer et al., 2009; Wilson, Sharma, Zilmer, Kalikova, & Uuskula, 2007), all PWID were assumed to be eligible for OST. Similarly, high coverage NSP (assumed to correspond to 70 syringes distributed per PWID per year as achieved in Tallinn in 2008/2009) was assumed to reduce an individual's injection related risk of becoming infected by 40%, based on the possible effect of widespread NSP on HIV incidence in Tallinn (Uuskula et al., 2011) as calibrated through fitting the model to observed trends in HIV incidence in that setting. This effect is assumed to occur at the highest NSP coverage achieved in Tallinn in 2008/2009 (approximately 70 syringes distributed per IDU per year), whereas for lower coverage levels a linear relationship is assumed between syringe distribution per person per year and the relative decrease in transmission risk. This is likely to be a simplification of the real relationship between level of syringe distribution and resulting decrease in HIV incidence, but compares well with a recent meta-analysis of cohort studies that estimated exposure to NSP was associated with a 36–58% reduction in HIV