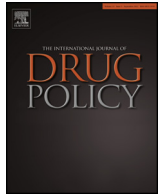




Contents lists available at ScienceDirect

## International Journal of Drug Policy

journal homepage: [www.elsevier.com/locate/drugpo](http://www.elsevier.com/locate/drugpo)



### Editors' choice

# A cross-national analysis of the effects of methadone maintenance and needle and syringe program implementation on incidence rates of HIV in Europe from 1995 to 2011

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### ARTICLE INFO

#### Article history:

Received 26 August 2015

Received in revised form 2 February 2016

Accepted 6 February 2016

#### Keywords:

HIV prevention

Harm reduction

Needle and syringe programs

Methadone maintenance therapy

People who inject drugs

Health policy

### ABSTRACT

Although many studies have found an association between harm reduction interventions and reductions in incidence rates of Human Immunodeficiency Virus (HIV) infection, scant research explores the effects of harm reduction cross-nationally. This study used a year- and country-level fixed effects model to estimate the potential effects of needle-and-syringe programs (NSPs) and methadone maintenance therapy (MMT) on incidence rates of HIV in the general population and among people who inject drugs (PWID), in a sample of 28 European nations. After adjusting for Gross Domestic Product (GDP) and total expenditures on healthcare, we identified significant associations between years of MMT and NSP implementation and lower incidence rates of HIV among PWID and the general population. In addition to years of implementation of NSP and MMT, the greater proportion of GDP spent on healthcare was associated with a decrease in logged incidence rates of HIV. The findings of this study suggest that MMT and NSP may reduce incidence rates of HIV among PWID cross-nationally. The current study opens a new avenue of exploration, which allows for a focus on countrywide policies and economic drivers of the epidemic. Moreover, it highlights the immense importance of the adoption of harm reduction programs as empirically-based health policy as well as the direct benefits that are accrued from public spending on healthcare on incidence rates of HIV within the general population and among subpopulations of PWID.

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### Background

The high prevalence of HIV among people who inject drugs (PWID) contributes substantially to global mortality rates (Degenhardt & Hall, 2012). Worldwide, 30% of HIV infections outside of sub-Saharan Africa are caused by injection drug use (International Harm Reduction Association [IHRA], 2012). It is estimated that between 11 and 21.2 million people inject drugs of which between .8 and 6.6 million are infected with HIV (Mathers et al., 2008). Numerous scientific studies—including reports by The World Health Organization (WHO), the United Nations Office on Drugs and Crime (UNODC), and the Joint United Nations Programme on HIV/AIDS (UNAIDS)—conclude that opioid agonist

therapy (OAT) and needle and syringe programs (NSP) are empirically-validated interventions to curb the spread of HIV/AIDS among PWID (Bluthenthal et al., 2004; Frischer & Elliott, 1993; Gibson, Flynn, & Perales, 2001; Huang et al., 2014; Judd et al., 2004; Khoshnood, Blankenship, Pollack, Roan, & Altice, 2000; Kral, Anderson, Flynn, & Bluthenthal, 2004; Miller et al., 2002; Millson et al., 2007; Obadia, Feroni, Perrin, Vlahov, & Moatti, 1999; Pollack, Khoshnood, Blankenship, & Altice, 2002; Rhodes et al., 2004; Riley, 2000; Strathdee et al., 2010; Van Den Berg, Smit, Van Brussel, Coutinho, & Prins, 2007).

The provision of accessible HIV prevention interventions for PWID is a multisectoral, rights-based approach to reducing environmental and individual risk factors for HIV infection (Blankenship, Reinhard, Sherman, & El-Bassel, 2015; Beletsky et al., 2015; Cook, Bridge, & Stimson, 2010; De Cock, El-Sadr, & Ghebreyesus, 2011; Degenhardt et al., 2010; Des Jarlais, 1995; Östlin, Eckermann, Mishra, Nkowane, & Wallstam, 2006; MacMaster, 2004; Rhodes, 2002; Rhodes et al., 2003; Rhodes et al., 2004; Strathdee et al., 2010,

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2015). There is a large body of global literature calling for collaboration across sectors in the delivery of HIV prevention interventions (Degenhardt et al., 2010; Campbell & Williams, 1999; Östlin et al., 2006). This literature stresses the importance of including government actors, criminal justice agencies, public health organizations, social service offices, and international development agencies to in a socially inclusive agenda that is rooted in sound human-rights principles of equal access and medical treatment with dignity for PWID (Beletsky, Grau, White, Bowman, & Heimer, 2011; Beletsky et al., 2015).

Harm reduction interventions have the potential to change environmental risk factors by providing places to obtain clean syringes rather than obtaining syringes in locations known to increase risk of HIV infection namely public locations or shooting galleries (Drucker, Lurie, Wodak, & Alcabes, 1998). Further, a safe and designated physical space to discard potentially infectious syringes is a promising alternative to discarding syringes in open spaces (Friedman et al., 2007). Regarding individual-level factors, both NSP and OAT remove the mode of disease transmission by virtue of two different mechanisms of behavior change. Provision of an adequate dose of an opioid substitute for heroin consumption reduces injection behaviors thereby reducing the likelihood of sharing syringes (Mathers et al., 2010; Vlahov et al., 1997) The mechanism producing individual-level change for NSPs involves removing as many potentially infectious syringes from public access and syringe sharing, which reduces potential opportunities for transmission of HIV and other communicable diseases (World Health Organization, 2015).

Extant literature using patient-level data consistently identifies a reduction in the incidence of HIV as a result of access to treatment and retention in care (Rhoades, Creson, Elk, Schmitz, & Grabowski, 1998; Sorensen & Copeland, 2000; Springer, Chen, & Altice, 2010; Thiede, Hagan, & Murrill, 2000; Wells, Calsyn, Clark, Jackson, & Saxon, 1996). A meta-analysis by MacArthur et al. (2012) summarized findings from 12 studies and pooled 9 studies with 23,608 person years of follow-up and found a 54% reduction in HIV infection among PWID. A later systematic review of reviews by MacArthur et al. (2014) found 13 reviews of interventions to treat HIV infection among PWID. Findings from the reviews suggest moderate support for NSPs and strong support for OST programs in reducing incidence rates of HIV among PWID.

In addition to individual-level behavior change and reducing environmental risk factors, the structural and macro level importance of adopting social policies in favor of the implementation of harm reduction programs are increasingly discussed in international literature (Beletsky et al., 2015; Degenhardt et al., 2010; European Harm Reduction Network, 2015; WHO, 2015). The transition from privately funded pilot programs to programs that are funded nationally constitutes a structural macro level shift in approaches to delivering harm reduction services with major implications for aggregate national-level rates of HIV (European Harm Reduction Network, 2015). The adoption of social policies on the local, community and national level facilitate the implementation of NSP and OAT programs. Implementation of harm reduction programs increase access to the proper resources for building sustainable individual behavior change thereby reducing rates of HIV infection and other drug-related harms among PWID (Beletsky et al., 2015). By 2009, OAT existed in 70 nations and NSPs (formal and pilot) existed in 82 nations, with an estimated 61 per 100 PWID receiving OAT in Europe (Mathers et al., 2010).

On an aggregate level, no studies to date have examined the minimum coverage of OAT required to make an impact on the incidence of HIV cross-nationally. Nonetheless, ensuring open and rapid access to OAT is critical to maintain the effectiveness of OAT as primary HIV prevention (Bruce, 2010). Beyond the scope of harm reduction programs, total expenditures on the provision of

healthcare programs may be associated with incidence rates of HIV among PWID as well as in the general population. Public and private expenditures on health could indicate a society's commitment to promoting general population health (Or, 2000a, 2000b). Moreover, measurement of total expenditures on health indicates the level of financial resources allocated by local, regional, national governments and the private sector to improve health (Lu et al., 2010; Or, 2000a, 2000b). Studies have found that increasing health spending may attenuate rates of preventable deaths, particularly for heart disease, diabetes and infant mortality (Mays & Smith, 2011; Or, 2000a). However, research into the cross-national effects of healthcare expenditures on incidence rates of HIV is lacking. A significant relationship between greater spending on healthcare and lower incidence rates of HIV may provide some preliminary evidence for allocating more financial resources to healthcare.

Despite mounting scientific and theoretical support, the existing body of literature elucidating the effects of harm reduction programs on incidence rates of HIV suffers from several methodological shortcomings. A majority of studies have investigated the effects of harm reduction programs using cross-sectional, individual-level designs without a comparison group. Several studies have explored the link between incidence rates of HIV and harm reduction interventions through a cohort study methodology (Frischer & Elliott, 1993; Huang et al., 2014; Judd et al., 2004; Pollack et al., 2002; Van Den Berg et al., 2007) and pre-post study designs without control groups (e.g. Gibson et al., 2001; Millson et al., 2007). Most of these studies rely upon self-reported data, are based on cross-sectional designs, and focus on a single country or small number of nations. These studies neglect to consider the impact of policies cross-nationally and economic drivers as contributors to the epidemic.

Though some researchers have generated insights into cross-national drivers of incidence rates of HIV using epidemiologic techniques (e.g. Alistar, Owens, & Brandeau, 2011; Grassly et al., 2003; Strathdee et al., 2010; Vickerman et al., 2006), none have used longitudinal incidence data across countries to explore the relationship between harm reduction and HIV rates. This study aims to address a substantive and methodological gap in the existing literature by examining the impact of years of methadone maintenance therapy (MMT) implementation, years of NSP implementation, and client utilization rates for MMT on HIV incidence rates among 28 European countries from 1995 to 2011 after adjusting for Gross Domestic Product (GDP) and total healthcare expenditures.

## Methods

### Data and measures

Data for this study were extracted from several publically available sources. The World Health Organization (WHO) Regional Office for Europe, and the European Center for Disease Control (ECDC) jointly compile HIV/AIDS surveillance data on the number of new cases of HIV infection in the general population for all 53 nations in the WHO European Region from 1985 to the present (World Health Organization [WHO], 2015). Annual numbers of new HIV cases for the 28 countries included in this study were divided by the total population and multiplied by 100,000 to produce a population-adjusted overall HIV incidence rate using yearly population data provided by the World Bank.

The European Monitoring Center for Drugs and Drug Addiction (EMCDDA) provided data reporting the year of introduction of harm reduction programs from 30 independent nations, annual number of clients enrolled in MMT from 1995 to 2011, and the number of cases of HIV infection among PWID. Incidence rates of HIV among PWID were converted from per-million to per 100,000. Retrospective

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