# Return on investment of needle-syringe programs in the Philippines

David P. Wilson, Josephine Reyes, Cliff C. Kerr, Richard T. Gray

2013

The Kirby Institute, University of New South Wales, Sydney Australia

## Introduction

The HIV epidemic in the Philippines

The Philippines is one of nine countries in the world documented by UNAIDS with increasing HIV cases. The UNAIDS Report on the Global AIDS epidemic 2010 reported a 25% increase of HIV cases between 2001 and 2009. While the national HIV prevalence remains below 0.1% of the adult population, HIV prevalence among the most-at-risk populations (MARPs) has substantially increased from 0.08% in 2007 to 0.47% in 2009. The primary drivers for the increase in HIV cases are unprotected sexual intercourse between men having sex with men (MSM), needle sharing among injecting drug users (IDUs), followed by unprotected sex with female sex workers (FSWs).

HIV among IDUs in the Philippines

The most alarming trend of HIV infections has been among IDUs – from seven reported cases during 1984-2006 to 147 reported cases for 2010 alone. In Cebu, HIV prevalence among IDUs has increased from 0.59% (n=341) in 2009 [1] to 53.16% (n=301) in 2011 [2]. This trend could continue to grow, as seen in other parts of the world [3], if not checked in time with effective interventions. The HIV epidemics in the Philippines are predominantly urban in distribution, severely affecting such major urban hubs as Metro Manila and Metro Cebu. This is likely due to the fact that risk behaviors are more prevalent in urban areas (due to larger networks of sexual partners), and drugs more widely available. In Metro Manila, there are an estimated 1,252 IDUs (about 7.5% of the national total for IDUs). In Metro Cebu, there is an estimated 6,000 IDUs.

Needle-syringe programs

Needle-syringe programs (NSPs) are a public health measure designed to reduce the spread of HIV infections among IDUs. NSPs operate in many different modes in different contexts and they may provide a range of services that include the provision of injecting equipment, education and information on reduction of drug-related harms, referral to drug treatment, medical care and legal and social services [4]. Equipment provided by NSPs usually includes needle-syringes, swabs, sterile water, and sharps bins for the safe disposal of injecting equipment.NSPsmay also act as a pivotal entry point for drug treatment and rehabilitation[5].

The primary aim of NSPs is to prevent the shared use of injecting equipment in order to reduce the risk of acquiring blood-borne infections among IDUs. Sharing of syringes by IDUs is an important mode of global transmission of blood-borne viruses, such as HIV and hepatitis C virus [6,7]. IDUs are unlikely to use another person's syringes if they have convenient access to sterile needle-syringes [8,9].

Evidence from 20 years of research shows that NSPs are a safe and effective means to reduce prevalence of HIV and other blood-borne infections among injecting drug users in some developed and developing country settings [10,11,12,13,14,15,16]. In a systematic review, 6 out of 11 studies found that NSPs were protective against HIV transmission [16,17,18,19,20,21]. There are large differences in HIV epidemics among IDUs between different international settings [3,6,7]. However, ecological studies suggest that where NSPs are not easily accessible, HIV prevalence tends to be substantially greater than in locations where NSPs are available [5,14,20,22,23,24,25,26,27]. Successful NSP interventions in some developing countries have been set up in some areas of Nepal[28], Thailand[29], Vietnam[30] and Bangladesh[12]. Implementation of NSPs were shown to be cost-effective in developed countries [31,32,33,34] and in at least one resource-poor setting [35].

**Table 1. Effectiveness of NSPs.**

| Region | NSP implementation | Outcome indicator(s) |
|---|---|---|
| **Asia-Pacific region** | | |
| Kathmandu, Nepal [28] | 4 years, 127 IDUs (first NSP in Asia) | Prevalence decreased from 1.6% to 0%;<br>Average injections decreased from 24 to 18<br>Shared needles per month decreased from ~13 to 6 |
| Northern Thailand [29] | 1 year, 25 IDUs | Prevalence decreased from 33% (5/15) to 32% (8/25)<br>Only 1 new HIV case |
| Vietnam [30] | 7 months, ~11,000 IDU contacts made | ~21,000 syringes distributed, ~17,000 syringes collected (~81% syringe return rate) |
| Bangladesh [12] | 1 year, ~600 male IDUs | Average proportion of shared injections in NSP sites: 28%; in Non-NSP sites: 56%; IDUs who share in NSP sites: 70%; in Non-NSP sites: 87% |
| Australia [36] | Late 1980s to 2000 | 25,000 HIV infections averted; 500 deaths averted |
| **Other regions** | | |
| Amsterdam [37] | 3 years, 263 IDUs (first NSP in the world) | Prevalence decreased from 50% to 24%;<br>Borrowing used syringe decreased from 56% to 16%<br>Lending used syringe decreased from 44% to 8% |
| South Sweden[17] | 3 years, ~180 IDUs | Prevalence maintained at ~1%<br>No new HIV cases<br>Frequent sharing decreased from 40% to 18%<br>Occasional sharing decreased from 8% to 1% |
| Connecticut, USA [18] | 1 year, ~300 IDUs | Prevalence decreased from ~64% to ~49%; ~57% syringe return rate |
| New York, USA [19] | 2 years, ~300 IDUs | **Prevalence:** Users of NSP: 1.6%; Non-users of NSP: 5.3%;<br>**Incidence**: Users of NSP: ~1.5 person-yrs; Non-users: ~5.5person-yrs |
| Chicago, USA [21] | 2 years; ~2,300-3,700 IDUs | **Prevalence** maintained at ~13%<br>**RR ratio of HIV seroconversion**:<br>• NSP users: 0.57;<br>• reduction of injection frequency: 0.33;<br>• not using previously used needles: 0.29;<br>• cleaning of used needles: 3.7 |
| Odessa, Ukraine [11] | 1 year | HIV prevalence decreased from 54% to 53%;<br>HIV incidence among IDUs decreased by 22%; 792 HIV infections averted |
| Multiple countries literature review (Global); Regression analysis [20] | | Average prevalence among cities with NSPs: maintained at 15.7%<br>Average prevalence among cities without NSPs: from 18.4% to 24.9% |

NSPs in multi-component programs (combined with services such as outreach and education in risk reduction, distribution of condoms, and referrals to substance abuse treatment with reduction in drug-related risk behaviour) have been recommended for implementation where feasible because of consistent evidence associating these programs with reductions in risk behaviour consequently leading to reductions in HIV prevalence [38,39]. For example, reports from implementation of peer education coupled with NSPs in Vietnam and China on 2002-2003 show significant declines in drug-related risk behaviours and reductions in HIV prevalences among IDUs in Vietnam and China[40].

HIV prevention strategies specific to IDUs also include drug dependence treatment. Maintenance opiod substitution therapy (OST) is effective in controlling drug dependence that can help reduce the frequency of injection, therefore reducing the risk for HIV infection [38]. Further benefits include improved access and adherence to antiretroviral therapy (ART). To achieve at least low-level target of OST programmes (20%) in Cebu would need to reach at least 1,200 in Cebu or 4,000 in whole of the Philippines.

Harm reduction in the Philippines

To date, harm reduction programs for IDUs (namely, NSPs and opioid substitution therapy) have not been endorsed within the Philippines due to R.A. No. 8504 (the Philippines AIDS Prevention and Control Act of 1998)[41] and R.A. No. 9165 (the Comprehensive Dangerous Drugs Act of 2002)[42]. A 2004 report by the Philippines National AIDS Council estimated that only 48% of IDUs reported using sterile injecting equipment the last time they injected, and most IDUs reported that they regularly share injecting equipment. A 2008 report published by the Joint United Nations Programme on HIV/AIDS (UNAIDS) indicated that the prevalence of sharing injecting equipment is still very high, with 29% of IDUs self-reporting use of an unsterile needle/syringe the last time they injected. Sharing HIV-contaminated injecting equipment is an efficient mode of HIV transmission, with a 0.5% to 5% chance of transmission (see Table S1).

Reports on the success of implementation of NSPs in Thailand and Vietnam cite the importance of cooperation between government and nongovernment agencies as well as gaining local acceptance by key community people and law enforcement groups[29,30]. Despite protection under RA 8504, stigma and discrimination in various sectors (work, community, health services, etc.) against people living with HIV, including those who inject drugs, may be among the barriers that hinder effective implementation of HIV/AIDS interventions such as NSPs[43]. There is no evidence that NSPs can lead to more drug users, more frequent injection among established users, expanded networks of high-risk users or more discarded needles in community [38].

This study aims to assess the potential cost-effectiveness and return on investment of implementing NSPs in the Philippines. Specifically, assessments are conducted for Cebu city and nationally in the Philippines.

## Methods

This study uses mathematical modeling informed by behavioral and epidemiological data from the Philippines and international observations in comparable settings of relative costs and influence of NSPs to evaluate the potential impact of NSPs in the Philippines. The evaluation includes two main analytical components. A *cost-effectiveness analysis* assesses the potential impact of scenarios of increased coverage of needle-syringe distribution for HIV prevention among IDUs. Cost-effectiveness analysis involves estimation of the cost and the expected effect. The effect is estimated through a modeling approach coupled with assumptions on the relative reduction in average levels of receptive syringe sharing that are caused by increased coverage and intensity of NSPs among IDUs. A population-level feedback model is used to examine the medium-term impacts, including prevention of secondary transmissions, which may occur as a result of short-term interventions. An incremental cost-effectiveness ratio (cost per quality adjusted life year gained) of NSP coverage levels compared to the status quo of no NSPs is calculated. Economic benefits considered are the amount of disability years averted as well as health care costs (based on Table 2) saved.The second model component is a *return-on-investment analysis*. This component builds upon the results of the cost-effectiveness analysis to assess the economic rationale to finance this strategy in allocating sufficient resources to address the epidemic at the most appropriate scale and ascertain the long-term economic benefits of investment in prevention.

<u>Key assumptions</u>

***What is the potential impact of distributing needle-syringes to IDUs on their risk behaviors?***

In most settings there is little-to-no evidence that the existence or degree of implementation of NSPs affect the number of people who inject drugs or the frequency at which they inject (see Table 1). It is assumed that needle-syringe distribution by NSPs would affect the frequency at which IDUs share injecting equipment. A review of available data from countries in the region where NSPs have been implemented resulted in the following data relationship; there is clearly a decreasing association of extent of sharing of injecting equipment as the number of needle-syringes distributed increases.

The effect of number of needle-syringes (ns) distributed on the sharing rates are analysed based on available data from Malaysia, Thailand, Cambodia, Vietnam, Myanmar and Indonesia (Figure S1). A best fitting rate of relative decline in sharing with NSP coverage was obtained (Figure 1).

***How much will it cost to implement NSPs in the Philippines?***

A review was conducted of the estimated unit costs to reach IDUs and the cost per needle-syringe distributed per IDU in other Asian countries, scaled by per capita GDP (Figure 3). Based on the GDP in the Philippines, it was estimated that the cost per IDU reached with NSPs would be approximately US$122 ($76-198, 95%CI) but the overall unit cost per needle-syringe distributed would be approximately US$0.50 ($0.44-0.94). A recent costing study of HIV programs in the Philippines [44] reported a unit cost per needle syringe as $US0.15 (PhP

6.00), which was then used to produce the assumptions for the expected relationship between NSP coverage and risk behavior in the Philippines over time (Figure S2).

**Figure 1.** Number of needle-syringes (ns) distributed and the decrease in the sharing among IDUs in the Philippines

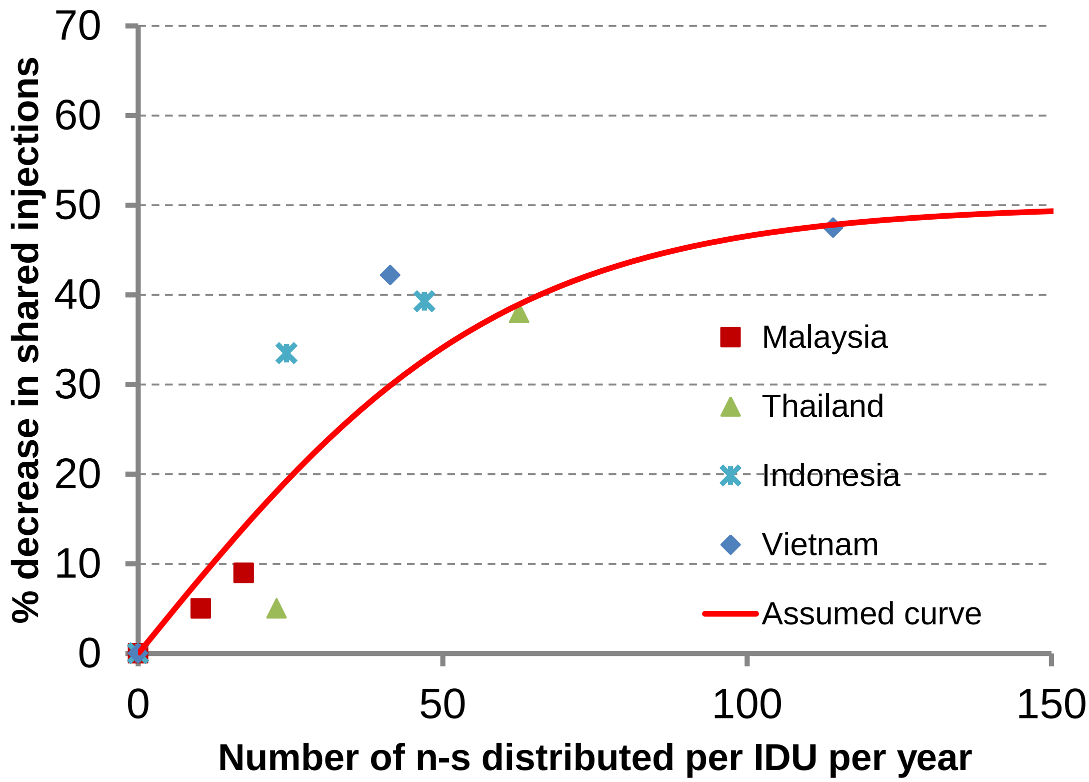
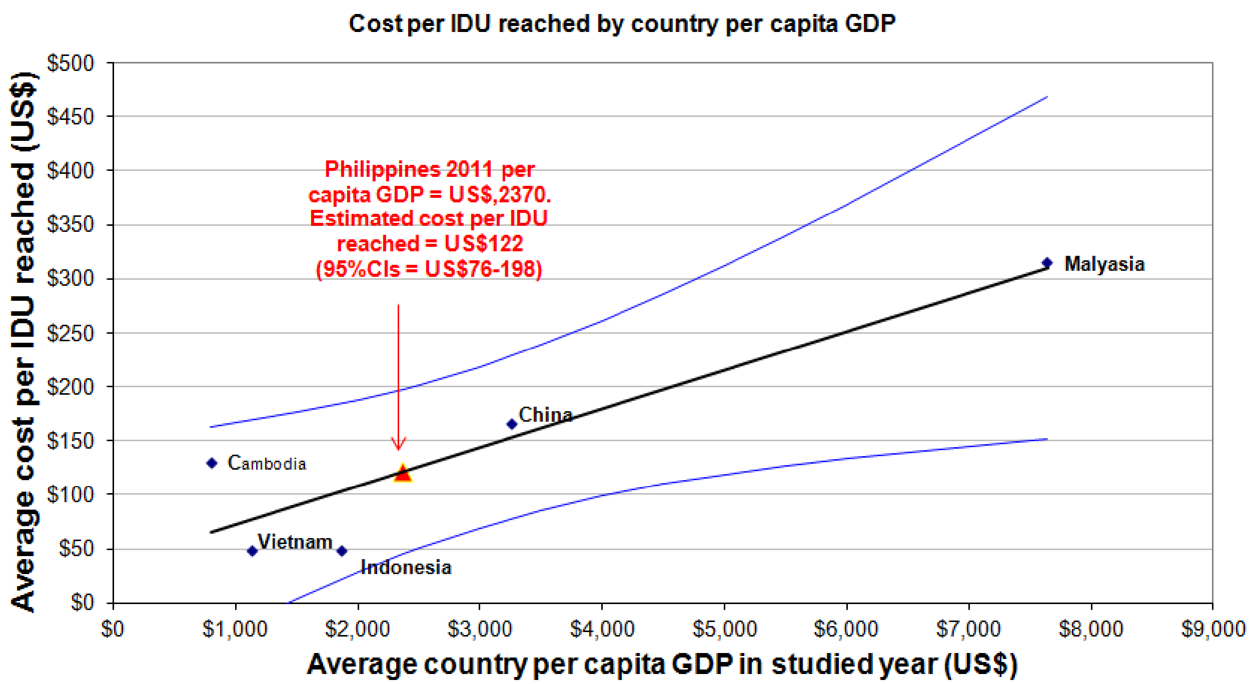



**Figure 2. Cost per IDU reached per capita**



Mathematical model

A mathematical model was developed to describe HIV transmission, the distribution of the IDU population across health states over time, and the associated healthcare costs under actual conditions and according to the hypothetical scenarios of NSPs operating to coverage levels of N= 12.5, 25, 50, or 100 needle-syringes per IDU per year. Very few countries currently achieve levels of syringe distribution that could be considered as high coverage (>= 200 needle-syringes distributed per IDU per year) [45].

The model consists of a number of linked subpopulations ("compartments"), categorized by infection, diagnosis, disease progression (in terms of CD4 categories), and treatment states. A schematic of the model is shown in Figure S1.

The rates of transition between compartments are defined by parameters based on available data. These can be divided into biological parameters (including transmission probabilities, HIV-related death rates, transition probabilities, and treatment effectiveness) and behavioral parameters (including the frequency of injections, the fraction of IDUs who engage in receptive syringe sharing, and the fraction of syringes that are cleaned prior to sharing). The model estimates the change in the number of IDUs in each compartment due to disease progression, initiation of treatment, death or aging, and incidence of infection. The model also calculates the expected numbers of HIV transmissions through probabilities associated with risk behaviors (see Table S1)

Economic analysis was carried out to estimate the cost-effectiveness of NSPs from a health sector perspective. Average annual costs for different HIV health states were estimated based on a recent costing study on HIV programs in the Philippines[44]. The cost per year of first-line ART is estimated as ~$US410 per year per individual; second-line ART at ~$US840 (see Table 2).

**Table 2. Healthcare costs**

| | Cost, US$ per year |
|---|---|
| HIV testing | 6.3 (3.1-12.7) |
| CD4>500 | 168.5 (126.4-210.6) |
| 500>CD4>350 | 168.5 (126.4-210.6) |
| 350>CD4>200 | 168.5 (126.4-210.6) |
| CD4<200 | 168.5 (126.4-210.6) |
| 1st-line ART | 407.9 (305.9-509.9) |
| Subsequent ART | 836.6 (627.4-1045.7) |

All costs were estimated in 2012 US dollars and inflated to 2012 US dollars using the health consumer price index. Health state utilities were used to adjust the absolute life expectancy to derive disability-adjusted life years (DALYs)[46] (see Table 3).

**Table 3. Health utilities**

| | Disability-adjusted life years (DALYs) |
|---|---|
| Uninfected IDUs | 0 (0-0) |
| Untreated HIV, CD4>200 | 0.221 (0.146-0.31) |
| Untreated HIV, CD4<200 | 0.547 (0.382-0.715) |
| Treated HIV, (any CD4 level) | 0.053 (0.034-0.079) |

The incremental cost-effectiveness ratio (ICER), expressed as cost per DALY averted, is the difference in costs between the hypothetical NSP scenario and the status quo (no NSP) divided by the difference in DALYs between the same two scenarios. Analyses were performed for two time frames: 2013-2018 to study the impact of a five-year program and 2013-2113 to examine the lifetime costs and consequences for the population related to an investment over the period 2013-2023. Costs and QALYs were discounted at an annual rate of 3%. Latest cost-effectiveness thresholds from WHO-CHOICE (2005) for the Philippines, belonging to subregion SEARO B are $4,959 (GDP per capita) and $14,876 (3 x GDP per capita)

The model was calibrated using a Bayesian melding procedure [47] to reflect the HIV epidemics among IDUs in Cebu city and all of the Philippines over the period 2000-2012. Credible intervals and upper and lower bounds for each parameter were derived and used to define cumulative distribution functions (CDFs) for each model parameter (i.e., the priors). CDFs for each prevalence data point were defined similarly. A total of 1,000 simulations were conducted, with parameter values chosen randomly based on the parameters' inverse CDFs. The likelihood, as a measure of goodness-of-fit, of each simulation was defined as the product of the likelihood of each parameter value and the likelihood of each prevalence point, as defined by their respective CDFs. The posterior parameter distribution was obtained by randomly sampling 1,000 times over the original simulations, with each simulation weighted by its likelihood. This resulted in 100 unique simulations being used for the final analysis. The values and interquartile ranges (IQRs) are derived from this posterior distribution of simulations (see Tables S2 and S3).

## Results

A summary of the model-derived results of the potential cost-effectiveness and return on investment of NSPs is shown in Tables 1 and 2 for Cebu and all of the Philippines, respectively. The expected HIV prevalence and total cumulative number of new HIV infections among IDUs in Cebu and the rest of the Philippines associated with different levels of NSP scale-up is shown in the Figure 3.

**Figure 3. HIV prevalence and total cumulative number of new HIV infections among IDUs in Cebu and All of the Philippines.**

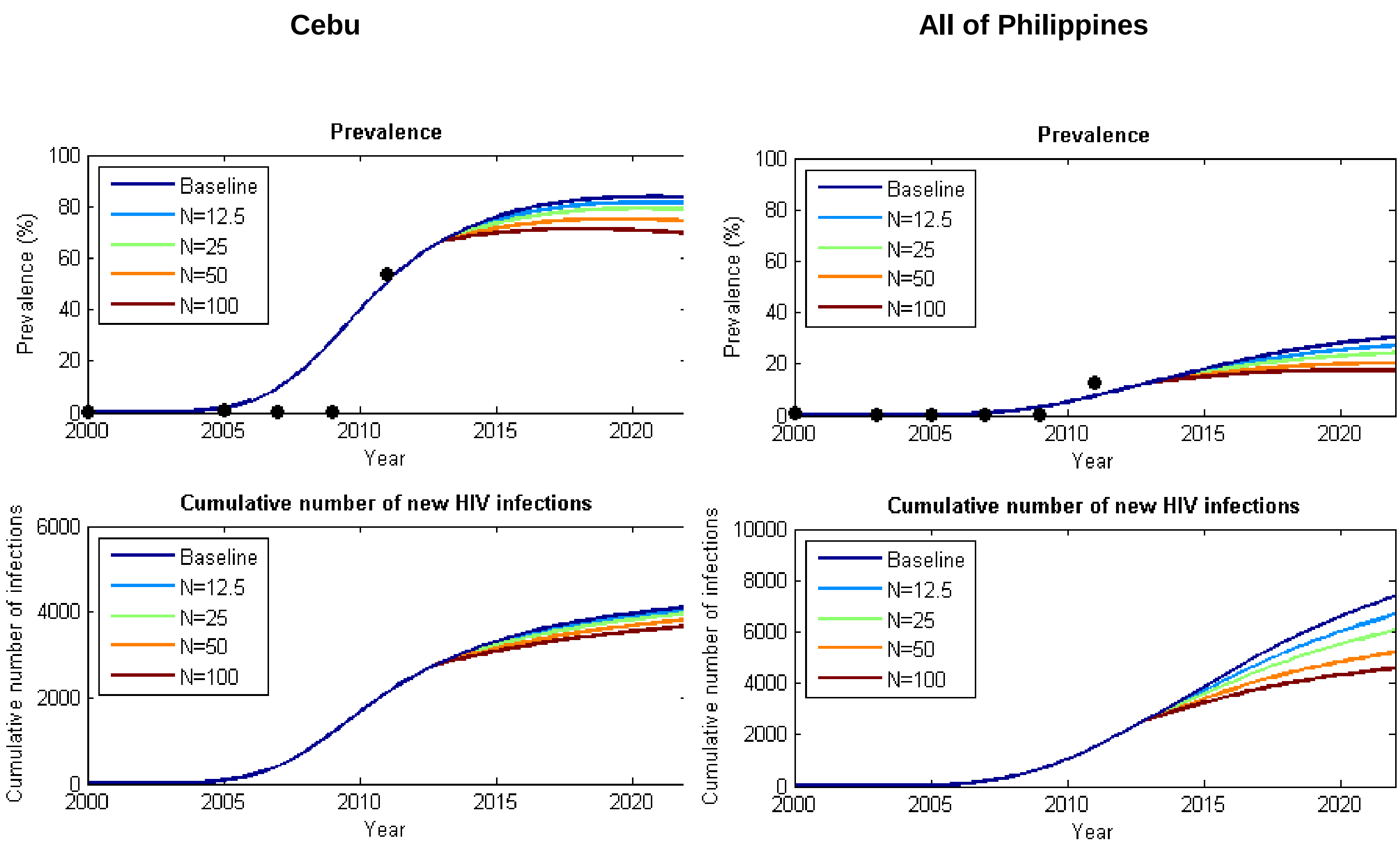


**Table 1: Epidemiological and economic indicators for the scenarios in Cebu**

| Number of needle-syringes distributed per IDU per year | N=0 | N=12.5 | N=25 | N=50 | N=100 |
|---|---|---|---|---|---|
| **2013-2018** | | | | | |
| **Total needle-syringes distributed:** | N/A | 237,687 (220,567 - 244,166) | 475,684 (441,301 - 488,642) | 952,350 (883,136 - 978,236) | 1,906,396 (1,767,241 - 1,958,119) |
| **Total NSP cost ($):** | N/A | 35,653 (33,085 - 36,625) | 71,353 (66,195 - 73,296) | 142,853 (132,470 - 146,735) | 285,959 (265,086 - 293,718) |
| **Cumulative new infections:** | 1,002 (551 - 1,228) | 918 (491 - 1,100) | 828 (438 - 980) | 705 (357 - 796) | 589 (300 - 651) |
| **Infections averted:** | N/A | 79 (44 - 111) | 154 (87 - 219) | 282 (150 - 392) | 402 (210 - 549) |
| **Prevalence (%):** | 75 (64 - 84) | 73 (61 - 82) | 70 (58 - 80) | 66 (54 - 77) | 63 (49 - 75) |
| **Cumulative deaths:** | 455 (379 - 575) | 450 (375 - 571) | 445 (372 - 568) | 438 (366 - 563) | 432 (360 - 558) |
| **Cumulative started 1st-line:** | 718 (588 - 878) | 708 (578 - 873) | 699 (568 - 869) | 685 (553 - 862) | 675 (541 - 856) |
| **Cumulative started 2nd-line:** | 8 (6 - 13) | 8 (6 - 13) | 8 (6 - 13) | 8 (6 - 13) | 8 (6 - 13) |
| **Total DALYs averted:** | N/A | 48 (26 - 64) | 92 (51 - 124) | 166 (93 - 217) | 235 (133 - 300) |
| **Total health care costs saved ($):** | N/A | 37,161 (20,202 - 49,861) | 71,770 (40,092 - 96,910) | 129,659 (73,063 - 169,867) | 183,422 (104,230 - 234,069) |
| **ICER ($/DALY):** | N/A | Cost-saving (Cost-saving - 451) | Cost-saving (Cost-saving - 461) | 40 (Cost-saving - 640) | 392 (181 - 1,302) |
| **Return on investment ($/$):** | N/A | 1.07 (0.64 - 1.39) | 1.05 (0.63 - 1.34) | 0.95 (0.55 - 1.17) | 0.67 (0.38 - 0.81) |
| **2013-2113 (Lifetime)** | | | | | |
| Cumulative deaths: | 2,168 (1,854 - | 2,115 (1,816 - 2,239) | 2,047 (1,755 - 2,193) | 1,924 (1,670 - 2,101) | 1,804 (1,536 - 2,012) |
| Cumulative started 1st-line: | 2,060 (1,704 - | 1,984 (1,678 - 2,108) | 1,915 (1,651 - 2,055) | 1,787 (1,538 - 1,948) | 1,695 (1,492 - 1,852) |
| Cumulative started 2nd-line: | 1,295 (1,148 - | 1,266 (1,109 - 1,336) | 1,215 (1,070 - 1,314) | 1,124 (973 - 1,264) | 1,049 (890 - 1,208) |
| Total DALYs gained: | N/A | 194 (127 - 290) | 395 (265 - 580) | 746 (491 - 1,040) | 1,117 (678 - 1,493) |
| Total health care costs saved ($): | N/A | 420,896 (277,481 - 642,678) | 846,766 (573,540 - 1,288,208) | 1,553,002 (1,033,322 - 2,274,189) | 2,261,187 (1,397,676 - 3,235,997) |
| ICER ($/DALY): | N/A | Cost-saving | Cost-saving | Cost-saving | Cost-saving |
| Return on investment ($/$): | N/A | 6.21 (4.59 - 9.00) | 6.33 (4.37 - 9.04) | 6.02 (3.74 - 8.12) | 4.27 (2.75 - 5.84) |

**Table 2: Epidemiological and economic indicators for the scenarios in all of the Philippines**

| Number of needle-syringes distributed per IDU per year | N=0 | N=25 | N=50 | N=100 | N=200 |
|---|---|---|---|---|---|
| **2013-2018** | | | | | |
| Total needle-syringes distributed: | N/A | 1,237,280 (1,151,004 - 1,258,203) | 2,475,139 (2,303,039 - 2,516,526) | 4,951,965 (4,609,273 - 5,033,391) | 9,906,691 (9,224,135 - 10,067,329) |
| Total NSP cost ($): | N/A | 185,592 (172,651 - 188,731) | 371,271 (345,456 - 377,479) | 742,795 (691,391 - 755,009) | 1,486,004 (1,383,620 - 1,510,099) |
| Cumulative new infections: | 3,098 (701 - 4,244) | 2,685 (596 - 3,919) | 2,330 (510 - 3,548) | 1,833 (394 - 2,973) | 1,448 (308 - 2,447) |
| Infections averted: | N/A | 309 (104 - 427) | 612 (191 - 815) | 1,088 (307 - 1,413) | 1,519 (393 - 1,908) |
| Prevalence (%): | 26 (5 - 72) | 24 (5 - 70) | 22 (4 - 67) | 20 (4 - 64) | 18 (3 - 61) |
| Cumulative deaths: | 226 (37 - 897) | 221 (36 - 889) | 216 (35 - 881) | 209 (34 - 869) | 203 (33 - 859) |
| Cumulative started 1st-line: | 2,464 (475 - 7,761) | 2,340 (448 - 7,592) | 2,230 (426 - 7,432) | 2,074 (395 - 7,183) | 1,949 (370 - 6,964) |
| Cumulative started 2nd-line: | 24 (4 - 96) | 24 (4 - 95) | 24 (4 - 95) | 23 (4 - 94) | 23 (4 - 93) |
| Total DALYs averted: | N/A | 166 (38 - 198) | 315 (71 - 373) | 524 (117 - 651) | 692 (152 - 908) |
| Total health care costs saved ($): | N/A | 163,664 (37,238 - 198,836) | 306,965 (69,127 - 384,420) | 512,682 (113,825 - 682,362) | 677,894 (148,878 - 949,913) |
| ICER ($/DALY): | N/A | 131 (Cost-saving - 3,948) | 204 (Cost-saving - 4,338) | 439 (1 - 5,495) | 1,168 (470 - 8,942) |
| Return on investment ($/$): | N/A | 0.88 (0.20 - 1.16) | 0.83 (0.18 - 1.14) | 0.69 (0.15 - 1.00) | 0.46 (0.10 - 0.68) |
| **2013-2113 (Lifetime)** | | | | | |
| Cumulative deaths: | 3,535 (691 - 7,958) | 3,168 (595 - 7,669) | 2,853 (520 - 7,372) | 2,423 (429 - 6,874) | 2,103 (366 - 6,495) |
| Cumulative started 1st-line: | 7,038 (1,564 - | 6,255 (1,330 - 12,638) | 5,586 (1,150 - 12,202) | 4,670 (928 - 11,524) | 3,990 (778 - 10,886) |
| Cumulative started 2nd-line: | 4,450 (1,075 - | 3,968 (918 - 7,508) | 3,556 (797 - 7,187) | 2,993 (648 - 6,647) | 2,575 (548 - 6,333) |
| Total DALYs averted: | N/A | 819 (369 - 1,367) | 1,632 (695 - 2,529) | 2,802 (1,181 - 4,115) | 3,820 (1,472 - 5,312) |
| Total health care costs saved ($): | N/A | 2,673,748 (1,238,894 - 4,793,797) | 5,338,922 (2,398,640 - 8,865,259) | 9,707,835 (4,062,186 - 14,413,034) | 12,946,558 (5,346,713 - 18,546,550) |
| ICER ($/DALY): | N/A | Cost-saving | Cost-saving | Cost-saving | Cost-saving |
| Return on investment ($/$): | N/A | 8.03 (3.71 - 12.84) | 8.00 (3.52 - 11.86) | 6.82 (2.81 - 9.63) | 4.68 (1.74 - 6.19) |

The results suggest that if NSPs were implemented in Cebu to a **low-to-moderate level, at N=12.5** needle-syringes distributed per IDU per year, for five years then

- The programs would cost an estimated US$35,653 (33,085 - 36,625)
- Approximately 79 (44 - 111) HIV infections may be averted (at a cost of $451 per infection averted)
- The financial return in healthcare costs by 2018 that do not need to be spent due to infections averted would amount to $1.07 (0.64 - 1.39) for every $1 invested

Furthermore, the HIV infections averted during the program implementation would yield further benefits in the longer-term of reduced HIV-related healthcare costs. With 3% discounting, it was estimated that for every $1 invested in low-to-moderate coverage NSPs in Cebu that $1 would be returned plus an additional $5.21 (3.59 - 8.00) in healthcare costs that are saved.

If NSPs were implemented in Cebu to a **moderate-to-high level, at N=50** needle-syringes distributed per IDU per year, for five years then

- The programs would cost an estimated US$142,853
- Approximately 282 (150 - 392) HIV infections may be averted

Over a lifetime horizon, $6.02 (3.74 - 8.12) would be returned in healthcare savings for every $1 invested. Although the return on investment ratio is less for greater NSP coverage, the absolute total healthcare costs savings are greater ($1.6 million for N=50 compared with $420,000 for N=12.5).

- The results for national Philippines are qualitatively similar to results for Cebu, but with larger magnitudes in costs and savings.
    - The estimated return on investment is slightly greater for all of the Philippines than Cebu over long time horizons but the cost-effectiveness ratio is lower for Cebu than all of the Philippines for short time horizons due to the currently high incidence among IDUs in Cebu.
- Over short time horizons, of a 5-year period of program implementation, NSPs were estimated to be cost-saving for scenarios with N<=25 for both Cebu and national Philippines. NSPs with N=50-100 were estimated to cost $131-1168 per DALY averted in the Philippines and $40-392 per DALY averted in Cebu.
    - Whether these ratios are deemed to be cost-effective may be questionable according to some willingness to pay thresholds. However, according to the WHO-CHOICE criteria (cost-effective if less than 3 times per capita GDP and very cost-effective if less than 1 times per capita GDP) these programs are cost-effective over short time horizons [48].
    - The longer NSPs are operating the lower the cost-effectiveness ratio (more cost-effective).
- Over a lifetime horizon, all NSP implementation scenarios were deemed to be cost-saving with considerable healthcare cost savings.
    - High-level NSPs (N>=50) would likely be cost-effective in the short-term and become cost-saving within 10-20 years of their commencement.

## References


1. (2009) Integrated Behavioural and Serologic Surveillance (IHBSS). Manila, Philippines: Department of Health.
2. (2011) Philippines Country Review: December 2011. HIV and AIDS Data Hub for Asia-Pacific.
3. Ball AL, Rana S, Dehne KL (1998) HIV prevention among injecting drug users: responses in developing and transitional countries. Public Health Rep 113: 170-181.
4. Kidorf M, King VL (2008) Expanding the public health benefits of syringe exchange programs. Can J Psychiatry 53: 487-495.
5. Heimer R (1998) Syringe exchange programs: lowering the transmission of syringe-borne diseases and beyond. Public Health Rep 113 Suppl 1: 67-74.
6. Wasley A, Alter MJ (2000) Epidemiology of hepatitis C: geographic differences and temporal trends. Semin Liver Dis 20: 1-16.
7. Aceijas C, Stimson GV, Hickman M, Rhodes T (2004) Global overview of injecting drug use and HIV infection among injecting drug users. AIDS 18: 2295-2303.
8. Des Jarlais C, Perlis T, Friedman SR, Chapman T, Kwok J, et al. (2000) Behavioral risk reduction in a declining HIV epidemic: injection drug users in New York City, 1990-1997. Am J Public Health 90: 1112-1116.
9. Donoghoe MC, Stimson GV, Dolan K, Alldritt L (1989) Changes in HIV risk behaviour in clients of syringe-exchange schemes in England and Scotland. AIDS 3: 267-272.
10. Kwon JA, Iversen J, Maher L, Law MG, Wilson DP (2009) The impact of needle and syringe programs on HIV and HCV transmissions in injecting drug users in Australia: a model-based analysis. J Acquir Immune Defic Syndr 51: 462-469.
11. Vickerman P, Kumaranayake L, Balakireva O, Guinness L, Artyukh O, et al. (2006) The cost-effectiveness of expanding harm reduction activities for injecting drug users in Odessa, Ukraine. Sex Transm Dis 33: S89-102.
12. Jenkins C, Rahman H, Saidel T, Jana S, Hussain AM (2001) Measuring the impact of needle exchange programs among injecting drug users through the National Behavioural Surveillance in Bangladesh. AIDS Educ Prev 13: 452-461.
13. Wodak A, Cooney A (2006) Do needle syringe programs reduce HIV infection among injecting drug users: a comprehensive review of the international evidence. Subst Use Misuse 41: 777-813.
14. Bastos FI, Strathdee SA (2000) Evaluating effectiveness of syringe exchange programmes: current issues and future prospects. Soc Sci Med 51: 1771-1782.
15. Wodak A (2006) Lessons from the first international review of the evidence for needle syringe programs: the band still plays on. Subst Use Misuse 41: 837-839.
16. Wodak A, Cooney A (2004) Effectiveness of sterile needle and syringe programming in reducing HIV/AIDS among injecting drug users.
17. Ljungberg B, Christensson B, Tunving K, Andersson B, Landvall B, et al. (1991) HIV prevention among injecting drug users: three years of experience from a syringe exchange program in Sweden. Journal of acquired immune deficiency syndromes 4: 890-895.
18. Heimer R, Kaplan EH, Khoshnood K, Jariwala B, Cadman EC (1993) Needle exchange decreases the prevalence of HIV-1 proviral DNA in returned syringes in New Haven, Connecticut. The American journal of medicine 95: 214-220.
19. Des Jarlais DC, Marmor M, Paone D, Titus S, Shi Q, et al. (1996) HIV incidence among injecting drug users in New York City syringe-exchange programmes. Lancet 348: 987-991.
20. Hurley SF, Jolley DJ, Kaldor JM (1997) Effectiveness of needle-exchange programmes for prevention of HIV infection. Lancet 349: 1797-1800.
21. Monterroso ER, Hamburger ME, Vlahov D, Des Jarlais DC, Ouellet LJ, et al. (2000) Prevention of HIV infection in street-recruited injection drug users. The Collaborative Injection Drug User Study (CIDUS). Journal of acquired immune deficiency syndromes (1999) 25: 63-70.
22. Bruneau J, Lamothe F, Franco E, Lachance N, Desy M, et al. (1997) High rates of HIV infection among injection drug users participating in needle exchange programs in Montreal: results of a cohort study. Am J Epidemiol 146: 994-1002.

23. Hagan H, McGough JP, Thiede H, Weiss NS, Hopkins S, et al. (1999) Syringe exchange and risk of infection with hepatitis B and C viruses. Am J Epidemiol 149: 203-213.
24. van Ameijden EJ, van den Hoek JA, Hartgers C, Coutinho RA (1994) Risk factors for the transition from noninjection to injection drug use and accompanying AIDS risk behavior in a cohort of drug users. Am J Epidemiol 139: 1153-1163.
25. Wodak A, Cooney A (2006) Do needle syringe programs reduce HIV infection among injecting drug users: a comprehensive review of the international evidence. Subst Use Misuse 41: 777-813.
26. Vlahov D, Junge B (1998) The role of needle exchange programs in HIV prevention. Public Health Rep 113 Suppl 1: 75-80.
27. Gibson DR, Flynn NM, Perales D (2001) Effectiveness of syringe exchange programs in reducing HIV risk behavior and HIV seroconversion among injecting drug users. AIDS 15: 1329-1341.
28. Peak A, Rana S, Maharjan SH, Jolley D, Crofts N (1995) Declining risk for HIV among injecting drug users in Kathmandu, Nepal: the impact of a harm-reduction programme. AIDS 9: 1067-1070.
29. Gray J (1995) Operating needle exchange programmes in the hills of Thailand. AIDS care 7: 489-499.
30. Quan VM, Chung A, Abdul-Quader AS (1998) The feasibility of a syringe-needle-exchange program in Vietnam. Substance use & misuse 33: 1055-1067.
31. Holtgrave DR, Pinkerton SD, Jones TS, Lurie P, Vlahov D (1998) Cost and cost-effectiveness of increasing access to sterile syringes and needles as an HIV prevention intervention in the United States. Journal of acquired immune deficiency syndromes and human retrovirology : official publication of the International Retrovirology Association 18 Suppl 1: S133-138.
32. Gold M, Gafni A, Nelligan P, Millson P (1997) Needle exchange programs: an economic evaluation of a local experience. CMAJ : Canadian Medical Association journal = journal de l'Association medicale canadienne 157: 255-262.
33. Jacobs P, Calder P, Taylor M, Houston S, Saunders LD, et al. (1999) Cost effectiveness of Streetworks' needle exchange program of Edmonton. Canadian journal of public health Revue canadienne de sante publique 90: 168-171.
34. Jones L, Pickering L, Sumnall H, McVeigh J, Bellis MA (2008) A review of the effectiveness and cost-effectiveness of needle and syringe programmes for injecting drug users Centre for Public Health, Liverpool John Moores University.
35. Kumaranayake L, Vickerman P, Walker D, Samoshkin S, Romantzov V, et al. (2004) The cost-effectiveness of HIV preventive measures among injecting drug users in Svetlogorsk, Belarus. Addiction (Abingdon, England) 99: 1565-1576.
36. (NCHECR) NCiHEaCR (2002) ROI in NSP in Australia report Sydney, Australia: Department of Health and Ageing,.
37. Van den Hoek JA, van Haastrecht HJ, Countinho RA (1989) Risk reduction among intravenous drug users in Amsterdam under the influence of AIDS. Am J Public Health 79: 1355-1357.
38. (2006) Preventing HIV Infection among Injecting Drug Users in High Risk Countries: An Assessment of the Evidence: The National Academies Press.
39. (2007) Guide to starting and managing needle and syringe programmes. World Health Organization
40. Hammett TM, Des Jarlais DC, Kling R, Kieu BT, McNicholl JM, et al. (2012) Controlling HIV epidemics among injection drug users: eight years of Cross-Border HIV prevention interventions in Vietnam and China. PLoS One 7: e43141.
41. (1998) Republic Act 8504.The Philippine AIDS Prevention and Control Act of 1998.
42. REPUBLIC ACT NO. 9165 COMPREHENSIVE DANGEROUS DRUGS ACT OF 2002.
43. Ortega NL, Bicaldo BF, Sobritchea C, Tan ML (2005) Exploring the realities of HIV/AIDS-related discrimination in Manila, Philippines. AIDS care 17 Suppl 2: S153-164.
44. (2013) Costing HIV: Costing selected HIV prevention and treatment services in the Philippines. Manila, Republic of the Philippines: Department of Health.
45. Mathers B, Degenhardt L, Sabin M (2011) Context and progress of the global response to HIV among people who inject drugs.
46. Salomon JA, Wang H, Freeman MK, Vos T, Flaxman AD, et al. (2012) Healthy life expectancy for 187 countries, 1990-2010: a systematic analysis for the Global Burden Disease Study 2010. Lancet 380: 2144-2162.

47. Hallett TB, Gregson S, Mugurungi O, Gonese E, Garnett GP (2009) Assessing evidence for behaviour change affecting the course of HIV epidemics: a new mathematical modelling approach and application to data from Zimbabwe. Epidemics 1: 108-117.
48. CHOosing Interventions that are Cost Effective (WHO-CHOICE). World Health Organization. pp. Threshold values for intervention cost-effectiveness by Region.
49. Mathers BM, Degenhardt L, Phillips B, Wiessing L, Hickman M, et al. (2008) Global epidemiology of injecting drug use and HIV among people who inject drugs: a systematic review. Lancet 372: 1733-1745.

## Supplementary figures and tables

**Figure S1.** Relationship between number of needle-syringes distributed and sharing among IDUs.The IDU Reference Group estimates that there are 30 (7-68) needle-syringes distributed among 10 countries in South/South-east Asia where NSPs are implemented[49].

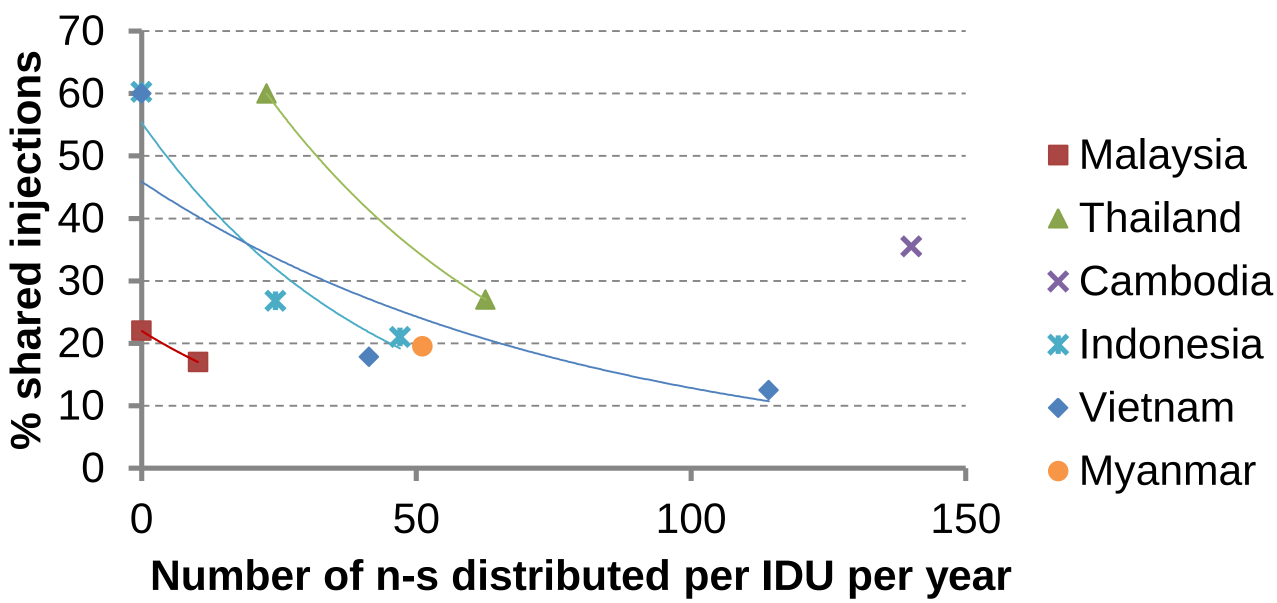



**Figure S2. Expected level of shared injections among IDUs over time according to different NSP coverage and intensity levels. N = number of needle-syringes distributed per IDU per year**

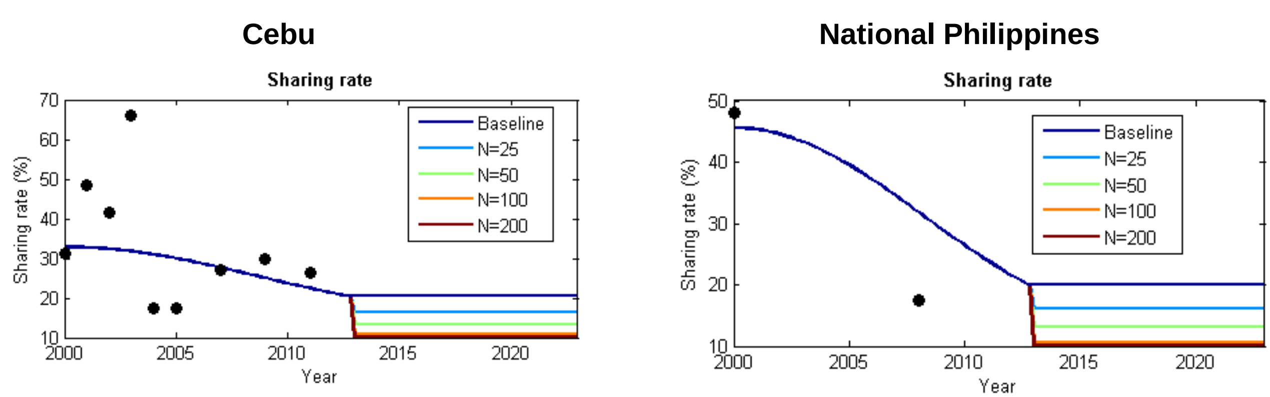
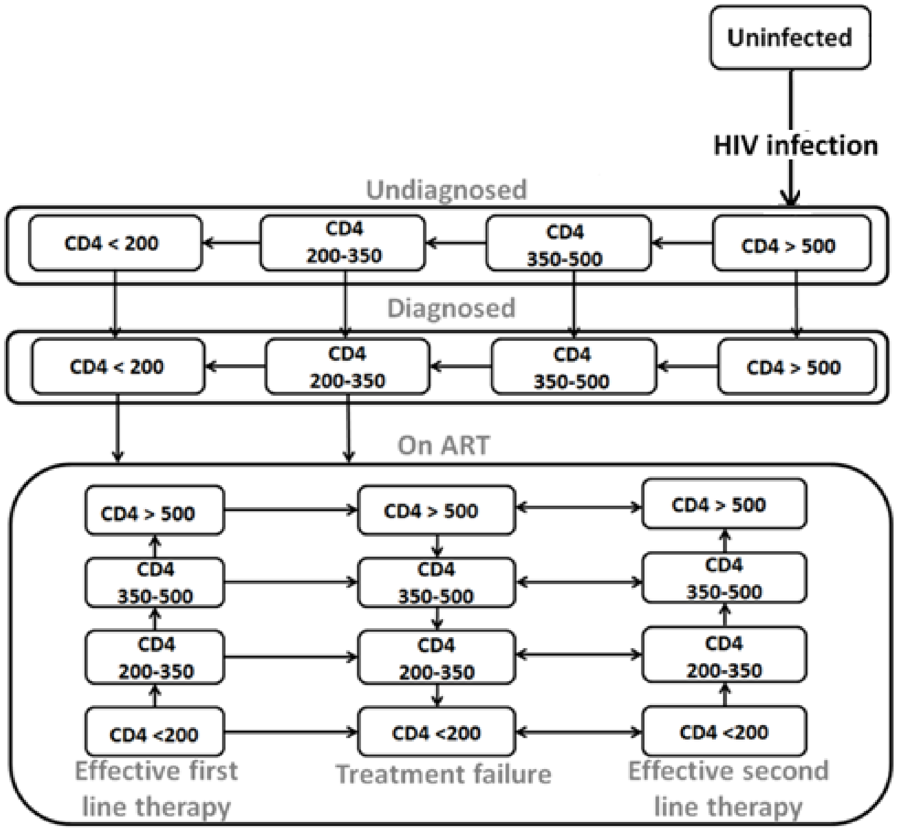


**Figure S3. Mathematical model of HIV transmission**



## Table S1. Constants

| Parameter | | Values | Footnotes |
|---|---|---|---|
| Sexual interaction-related transmissibility | Male & female (insertive) | 0.04% (0.01 - 0.05) | [1-4] |
| | Male & female (receptive) | 0.08% (0.05 - 1) | [1-7] |
| | Injecting | 0.8% (0.5 - 5) | [15-21] |
| Disease-related transmissibility | CD4>500 | 1.6% (1.2 - 1.8) | [22] |
| | 350<CD4<500 | 1% (0.8 - 1.2) | [22] |
| | 200<CD4<350 | 1% (0.8 - 1.2) | [22] |
| | CD4<200 | 3.8% (3.6 - 4) | [22] |
| | Treatment | 0.04% (0.02 - 0.1) | [23] |
| Disease progression rate: (% per year) | CD4>500) to 350<CD4<500 | 24.5% (22.6 - 26.4) | [24] |
| | 350<CD4<500 to 200<CD4<350 | 51% (47 - 55) | [24] |
| | 200<CD4<350 to CD4<200 | 51% (47 - 55) | [24] |
| Treatment recovery rate: (% per year) | 350<CD4<500 to CD4>500 | 45% (14 - 93) | [25] |
| | 200<CD4<350 to 350<CD4<500 | 70% (29 - 90) | [25] |
| | CD4<200 to 200<CD4 <350 | 36% (28 - 43) | [25] |
| Death rate: (% mortality per year) | Background | 1.45% (0.94 - 1.96) | [26] |
| | Injecting | 1% (0.75 - 1.25) | [27] |
| | CD4>500 | 0.0515% (0.035 - 0.068) | [28] |
| | 350<CD4<500 | 0.128% (0.092 - 0.164) | [28] |
| | 200<CD4<350 | 1.1% (0.2 - 2) | [28] |
| | CD4<200 | 50% (40 - 66) | *Assumption |
| | Treatment (CD4<200) | 4% (1 - 10) | *Assumption |
| Treatment failure rate: (% per year) | 1st-line | 4.5% (3 - 6) | [29] |
| | 2nd-line | 4.5% (3 - 6) | [29] |
| Protective effectiveness of per-exposure: | Condom | 95% (85 - 99) | [30-31] |
| | Circumcision | 60% (50 - 65) | [32-35] |
| | Increase STI cofactor | 3.5% (2 - 5) | [36-42] |
| Drug use: | Syringe cleaning effectiveness | 75% (70 - 80) | [43-45] |

**Footnotes:**


1 Gouws E, White PJ, Stover J, Brown T. Short term estimates of adult HIV incidence by mode of transmission: Kenya and Thailand as examples. Sex Transm Infect. Jun 2006;82 Suppl 3:iii51-55

2 Royce RA, Sena A, Cates W, Jr., Cohen MS. Sexual transmission of HIV. N Engl J Med. Apr 10 1997;336(15):1072-1078.

3 Padian NS, Shiboski SC, Glass SO, Vittinghoff E. Heterosexual transmission of human immunodeficiency virus (HIV) in northern California: results from a ten-year study. Am J Epidemiol. Aug 15 1997;146(4):350-357.

4 Leynaert B, Downs AM, de Vincenzi I, for the European Study Group on Heterosexual Transmission of HIV. Heterosexual

Transmission of Human Immunodeficiency Virus: Variability of Infectivity throughout the Course of Infection. Am. J. Epidemiol. July 1, 1998 1998;148(1):88-96.
5 Chesson HW, Pinkerton SD, Voigt R, Counts GW. HIV infections and associated costs attributable to syphilis coinfection among African Americans. Am J Public Health. Jun 2003;93(6):943-948.
6 Gray RH, Wawer MJ, Brookmeyer R, et al. Probability of HIV-1 transmission per coital act in monogamous, heterosexual, HIV-1-discordant couples in Rakai, Uganda. The Lancet. 2001;357(9263):1149-1153.
7 Wawer MJ, Gray RH, Sewankambo NK, et al. Rates of HIV-1 transmission per coital act, by stage of HIV-1 infection, in Rakai, Uganda. J Infect Dis. May 1 2005;191(9):1403-1409.
15 Hudgens MG, Longini IM, Jr., Vanichseni S, et al. Subtype-specific transmission probabilities for human immunodeficiency virus type 1 among injecting drug users in Bangkok, Thailand. Am J Epidemiol. Jan 15 2002;155(2):159-168.
16 Henderson DK, Fahey BJ, Willy M, et al. Risk for occupational transmission of human immunodeficiency virus type 1 (HIV-1) associated with clinical exposures. A prospective evaluation. Ann Intern Med. Nov 15 1990;113(10):740-746.
17 Cavalcante NJ, Abreu ES, Fernandes ME, et al. Risk of health care professionals acquiring HIV infection in Latin America. AIDS Care. 1991;3(3):311-316.
18 Gerberding JL. Incidence and prevalence of human immunodeficiency virus, hepatitis B virus, hepatitis C virus, and cytomegalovirus among health care personnel at risk for blood exposure: final report from a longitudinal study. J Infect Dis. Dec 1994;170(6):1410-1417.
19 Ippolito G, Puro V, De Carli G. The risk of occupational human immunodeficiency virus infection in health care workers. Italian Multicenter Study. The Italian Study Group on Occupational Risk of HIV infection. Arch Intern Med. Jun 28 1993;153(12):1451-1458.
20 Nelsing S, Nielsen TL, Nielsen JO. Occupational exposure to human immunodeficiency virus among health care workers in a Danish hospital. J Infect Dis. Feb 1994;169(2):478.
21 Tokars JI, Marcus R, Culver DH, et al. Surveillance of HIV infection and zidovudine use among health care workers after occupational exposure to HIV-infected blood. The CDC Cooperative Needlestick Surveillance Group. Ann Intern Med. Jun 15 1993;118(12):913-919.
22 Quinn TC, Wawer MJ, Sewankambo N, Serwadda D, Li C, Wabwire-Mangen F, et al. Viral load and heterosexual transmission of human immunodeficiency virus type 1. Rakai Project Study Group. N Engl J Med. 2000;342(13):921-9
23 McCormick AW, Walensky RP, Lipsitch M, Losina E, Hsu H, Weinstein MC, et al. The effect of antiretroviral therapy on secondary transmission of HIV among men who have sex with men. Clin Infect Dis. 2007;44(8):1115-22
24 Mellors JW, Munoz A, Giorgi JV, Margolick JB, Tassoni CJ, Gupta P, et al. Plasma viral load and CD4+ lymphocytes as prognostic markers of HIV-1 infection. Ann Intern Med 1997,126:946-954.
25 Mocroft A, Phillips AN, Gatell J, Ledergerber B, Fisher M, Clumeck N, et al. Normalisation of CD4 counts in patients with HIV-1 infection and maximum virological suppression who are taking combination antiretroviral therapy: an observational cohort study. Lancet 2007,370:407-413
26 From the Life Table of Indonesia (http://apps.who.int/whosis/database/life_tables/life_tables_process.cfm?path=whosis,life_tables&language=english) , the death rate between 15-49 was estimated
27 Mathematic Model of HIV Epidemic In Indonesia 2008-2014 2008.
28 Colette Smith, Antonella d'Arminio Monforte, Stephane de Wit, Nina Friis-Moller, Jens Lundgren, Andrew Philips, et al. Causes of death in the D:A:D study-initial results. In; 2008
29 Smith CJ, Phillips AN, Hill T, Fisher M, Gazzard B, Porter K, et al. The rate of viral rebound after attainment of an HIV load <50 copies/mL according to specific antiretroviral drugs in use: Results from a multicenter cohort study. Journal of Infectious Diseases 2005,192:1387-1397.
30 Davis KR, Weller SC. The effectiveness of condoms in reducing heterosexual transmission of HIV. Fam Plann Perspect. Nov-Dec 1999;31(6):272-279.
31 Fitch JT, Stine C, Hager WD, Mann J, Adam MB, McIlhaney J. Condom effectiveness: factors that influence risk reduction. Sex Transm Dis. Dec 2002;29(12):811-817.
32 Gray RH, Kigozi G, Serwadda D, et al. Male circumcision for HIV prevention in men in Rakai, Uganda: a randomised trial. Lancet. Feb 24 2007;369(9562):657-666.
33 Bailey RC, Moses S, Parker CB, et al. Male circumcision for HIV prevention in young men in Kisumu, Kenya: a randomised controlled trial. Lancet. Feb 24 2007;369(9562):643-656.
34 Auvert B, Taljaard D, Lagarde E, Sobngwi-Tambekou J, Sitta R, Puren A. Randomized, controlled intervention trial of male circumcision for reduction of HIV infection risk: the ANRS 1265 Trial. PLoS Med. Nov 2005;2(11):e298.
35 Weller SC. A meta-analysis of condom effectiveness in reducing sexually transmitted HIV. Soc Sci Med. Jun 1993;36(12):1635-1644.
36 Syafitri RI. Rolling-Out Community-Based Needle Syringe Program in Indonesia.
37 HIV/STI Integrated Biological Behavioral Surveillance (IBBS) among Most-at-Risk Groups (MARG) in Indonesia 2007.
38 Period R. Country report on the Follow up to the Declaration of Commitment On HIV/AIDS: Reporting Period: 2006-2007 United Nations General Assembly Special Session (UNGASS).
39 National Estimates of Adult HIV Infection, Indonesia 2002: Ministry of Health of the Republic of Indonesia: Directorate General of Communicable Disease Control and Environmental Health; 2003.
40 Sagung Sawitri AA, Sumantera GM, Wirawan DN, Ford K, Lehman E. HIV testing experience of drug users in Bali, Indonesia. AIDS Care. Aug 2006;18(6):577-588.
41 Pisani E, Dadun, Sucahya PK, Kamil O, Jazan S. Sexual behavior among injection drug users in 3 indonesian cities carries a high potential for HIV spread to noninjectors. J Acquir Immune Defic Syndr. Dec 1 2003;34(4):403-406.
42 NATIONAL HIV AND AIDS ACTION PLAN IN INDONESIA 2007 – 2010: INDONESIA NATIONAL AIDS COMMISSION; 2007

43 Abdala N, Gleghorn AA, Carney JM, Heimer R. Can HIV-1-Contaminated Syringes Be Disinfected? Implications for Transmission Among Injection Drug Users. JAIDS Journal of Acquired Immune Deficiency Syndromes 2001,28:487-494.
44 Siegel J, Weinstein M, Fineberg H. Bleach programs for preventing AIDS among iv drug users: modeling the impact of HIV prevalence. Am J Public Health 1991,81:1273-1279.
45 Abdala N, Crowe M, Tolstov Y, Heimer R. Survival of human immunodeficiency virus type 1 after rinsing injection syringes with different cleaning solutions. Subst Use Misuse 2004,39:581-600.
46 Johnson WD, Diaz RM, Flanders WD, et al. Behavioral interventions to reduce risk for sexual transmission of HIV among men who have sex with men. Cochrane Database Syst Rev. 2008(3):CD001230.

## Table S2. Parameters for Cebu

| Parameter | Year | Values | Comments and footnotes | |
|---|---|---|---|---|
| Population size of male IDUs | 2007 | 4500 (3,000-6,000) | Assumption: 90% are male and 10% are female [4] | [1-4] |
| | 2009 | 1,800 (1,400 - 2,300) | | |
| | 2011 | 6,000 (5,000 - 8,000) | | |
| Population size of female IDUs | 2007 | 500 (400 - 600) | | |
| | 2009 | 200 (150 - 250) | | |
| | 2011 | 670 (500 - 830) | | |
| HIV prevalence among IDUs | 2000 | 0 | Prevalence in year 2000 is assumed to be zero. | [5,6] |
| | 2005 | 0.83% (0.6% - 5%) | | |
| | 2007 | 0.40% (0.3% - 5%) | | |
| | 2009 | 0.59% (0.44% - 5%) | | |
| | 2011 | 53.8% (40.4% - 67.3%) | | |
| STI prevalence among IDUs | 2000 | 1.3% (1% - 5%) | Estimated STI prevalence from syphilis; lower limit-Gonorrhea. Higher limit-Chlamydia | [7] |
| | 2005 | 2.7% (2% - 10%) | | |
| | 2009 | 3.2% (2.4% - 4%) | | |
| Testing rate per year | 2009 | 3.8% (2.9% - 4.8%) | Ever tested for HIV | [8] |
| | 2010 | 4.8% (3.6% - 5.9%) | | [9] |
| Number of HIV diagnosis - male IDUs | 2008 | 1 | | [1] |
| | 2009 | 1 | | |

| | | | | |
|---|---|---|---|---|
| | 2010 | 142 | | |
| Number of HIV diagnosis - female IDUs | 2008 | 0 | | |
| | 2009 | 6 | | |
| | 2010 | 26 | | |
| Number of patients on first-line ART | 2008 | 6 | Cebu has ~13% of the national IDU population. Estimated IDU on ART in National is 66.65 (1.05-179) people. Hence, we may estimate there are 8.7 (0.14-23.4) IDUs on ART in Cebu. | [1,7,10] |
| Number of patients on second-line ART | 2008 | 1 | | |
| Average number of injections per IDU per year | 2009 | 475 (356 - 594) | A mean of 1.3 injections per day, or 475 injections in a year (median 0.1 injection per day or 3x a month). | [11] |
| % of IDUs who share needles | 2000 | 52% (39% - 65%) | Proportion of IDUs who shared injecting equipments | [12] |
| | 2001 | 81% (61% - 99%) | | [12] |
| | 2002 | 69% (52% - 86%) | | [12] |
| | 2003 | 66% (49.5% - 99%) | | [12] |
| | 2004 | 29% (22% - 36%) | Among all IDU in Cebu, 29% reported that they injected with a previously used needle or syringe the last time they injected. | [13] |
| | 2007 | 45% (34% - 99%) | | [1] |
| | 2009 | 49.85% (41% - 59%) | % who ever shared needles/syringes in the last injection | [1,14] |
| | 2011 | 44% (33% - 55%) | | [1] |
| % of reused syringes that are cleaned | 2004 | 48% (36% - 60%) | Percentage of IDUs who reported using sterile injecting equipment the last time they injected | [15] |
| | 2011 | 85% (64% - 99%) | | [16] |

**Footnotes**

1 HIV situation in Cebu City
2 Poblete 2012, p.9, Figure 1
3 PNAC 2011 p.10 - Table 2. National Population Size Estimates for Most At-Risk Populations by Area & MARP, 2011
4 2011 Philippine MARP and PLHIV Estimates p.9.
5 Poblete 2012, p.11 Fig 4
6 IHBSS 2005, p.6 Fig. 5 n=243
7 IHBSS 2009, p.14
8 IHBSS 2009 - p.14
9 PNAC 2012 p.11, n=1278
10 IDU reference group http://www.idurefgroup.unsw.edu.au/contest-data-and-maps/Philippines/23

11 DOH 2011(a) p.19 - Number of partners per IDU per year, and number of acts per partner.
12 DOH 2003 p.22, BSS, 1997-2003
13 IHBSS 2005, p.13
14 IHBSS 2009, p.14
15 Mateo R, Sarol JN, Poblete R: HIV/AIDS in the Philppines. AIDS Education and Prevention 2004, 16:43-52 (2004 report by the Philippines National AIDS Council)
16 PNAC 2010 p.13 - 21. Percentage of IDUs who reported using sterile injecting equipment the last time they injected

## Table S3. Parameters for National Philippines

| Parameter | Year | Values | Comments and footnotes | |
|---|---|---|---|---|
| Population size of male IDUs | 2000 | 14,000 (9,000 - 18,000) | A review of the 2009, 2010 and 2011 IHBSS showed that around 10% of respondents had female partners who were also IDU. It was assumed that 10% of the estimated number of IDUs were female, and 90% were male. IDU population in 1998 is assumed equal to 2000. A nationwide study by the Dangerous Drug Board (DDB) of the Philippines reported that 2% to 4% of the general population use illegal drugs, and 0.89% of these drug users were IDUs (this rate is similar to a DOH study cited by the Asian Harm Reduction Network (AHRN) in 1998, showing that 0.1% of drug users are IDUs). Based on these estimates, there are 9,078 to 18,155 IDUs in the Philippines. | [1-7] |
| | 2005 | 23,000 (16,000 - 31,000) | | |
| | 2007 | 14,000 (7,000 - 20,000) | | |
| | 2009 | 17,000 (13,000 - 22,000) | | |
| | 2010 | 20,000 (15,000 - 25,000) | | |
| | 2011 | 14,000 (12,000 - 17,000) | | |
| Population size of female IDUs | 2000 | 1,500 (1,000 - 2000) | | |
| | | | | |
| | | | | |
| | 2009 | | | |
| | 2011 | | | |
| HIV prevalence among male IDUs | 2003 | 0% (0% - 0.01%) | Percentage of MARP who are HIV-infected. Males and female are distinct in the mathematical model to emphasize the difference in estimated prevalence between male and female IDUs in 2011. | [8-13] |
| | 2005 | 0.1% (0.06% - 5%) | | |
| | 2007 | 0.13% (0.1% - 5%) | | |
| | 2009 | 0.21% (0.2% - 5%) | | |
| | 2011 | 12.87% (10% - 16%) | | |
| HIV prevalence among female IDUs | 2003 | 0% (0% - 0.01%) | | |

| | | | | |
|---|---|---|---|---|
| | 2005 | 0.1% (0.06% - 5%) | | |
| | 2007 | 0.13% (0.1% - 5%) | | |
| | 2009 | 0.21% (0.2% - 5%) | | |
| | 2011 | 27% (20% - 34%) | | |
| STI prevalence among IDUs | 2000 | 12% (9% - 15%) | Proportion of HRG Who Reported Signs and Symptoms of STI | [14,15] |
| | 2002 | 5% (4% - 7%) | | |
| | 2003 | 10% (7.5% - 12.5%) | | |
| Testing rate per year | 2007 | 3.6% (1.5% - 4.9%) | received an HIV test in the last 12 months and who know the results | [16-19] |
| | 2008 | 4% (3% - 5%) | | [20] |
| | 2009 | 5.97% (1.4% - 15%) | | [21-23] |
| | 2010 | 30% (23% - 38%) | | [24] |
| Number of HIV diagnosis - male IDUs | 2008 | 10 | Assumption, slightly higher than Cebu data | NA |
| | 2009 | 10 | | |
| | 2010 | 200 | | |
| Number of HIV diagnosis - female IDUs | 2008 | 1 | | |
| | 2009 | 6 | | |
| | 2010 | 50 | | |
| Number of patients on first-line ART | 2008 | 67 | | [25] |
| Number of patients on second-line ART* | 2008 | 7 | Assumed 10% of first-line | NA |
| Average number of injections per IDU per year | 2009 | 475 (356 - 594) | A mean of 1.3 injections per day, or 475 injections in a year (median 0.1 injection per day or 3x a month). | [26] |
| % of IDUs who share needles | 2000 | 80% (60% - 99%) | | [27] |
| | 2008 | 29% (22% - 36%) | | [28] |
| % of reused syringes that are cleaned | 2004 | 48% (36% - 60%) | Percentage of IDUs who reported using sterile injecting | [29] |

| | | | | |
|---|---|---|---|---|
| | 2011 | 85% (64% - 99%) | equipment the last time they injected | [30] |

**Footnotes:**

1 PNAC 2011(b) p.9
2 PNAC 2011 p.8
3 DOH 2005, p.24 - Table 15.
4 Philippines Country Review 2008 - AIDS Data Hub p.3 ; Also see - PNAC 2011 - Table 9.
5 5th AIDS Medium Term Plan (2011- 2016) p.50 - Table 5; Also see - PNAC 2011 p.8; Also see - IHBSS 2009(a)
6 PNAC 2011(a), p.3
7 PNAC 2011 p.9 - Table 1.
8 (2) DOH 2005, p.12 - Table 10. HIV Prevalence Estimates Among Injecting Drug Users: 0% (0/230)
9 (1) EFS 2006 - HIV sentinel surveillance prevalence - IDU, 2005 = 0.1%
10 (2) DOH 2005, p.24Table 15. Country estimates of the size and prevalence of HIV infection in the HRG: 0.1%-2.9%, p.12 - Table 10. HIV Prevalence Estimates Among Injecting Drug Users: mean = 0.8%(2/243)
11 IHBSS 2009 (PPT) p.49 - Prevalence Rates per 100,000 population. HIV Prev 2007 = 133/10000 = 0.00133 = 0.133%
12 (3) Also see - PNAC 2008, p. 23 - 23. Percentage of most-at-risk populations who are HIV infected - DU: 0.13% (1/752)
13 (1) PNAC 2012 - p.12 - 2.5 Percentage of people who inject drugs who are living with HIV - 13.56% (174/1,283); Male PWID: 12.87% (157/1220); Female PWID: 26.98% (17/63)
14 DOH 2003 p.23 - Figure 10. Proportion of HRG Who Reported Signs and Symptoms of STI BSS, 1997-2003
15 UNAIDS 2005 Table 10
16 "(1) Philippines Country Review 2008 - AIDS Data Hub, p. 7 Figure 7: 4%"
17 (2) "IHBSS 2007 - IDU: 4% (33/752)"
18 "(3) PNAC 2010, p.10 8. Percentage of most-at-risk populations that have received an HIV test in the last 12 months and who know the results: IDU: 1.5% (14/958) "
19 "(4) 5th AMTP (final version for printing) as of April 29 2011.pdf - 4.9%; 5th AIDS Medium Term Plan (2011- 2016) p.22 Table 2. National Scorecard of Selected Key Indicators for the United Nations General Assembly Special Session on HIV and AIDS (UNGASS) Report "
20 PNAC 2011(b) p. 13 - The tables in the succeeding pages show program performance targets during 2009 and 2010 against the country's UA /AMTP IV targets.- 4% (813) UNGASS07
21 "(1) 5th AIDS Medium Term Plan (2011- 2016) p.22 Table 2. National Scorecard of Selected Key Indicators for the United Nations General Assembly Special Session on HIV and AIDS (UNGASS) Report - 1.4%"
22 (2) PNAC 2010, p.10 - 8. Percentage of MARPs that have received an HIV test in the last 12 months and who know the results - - IDU: 1.5% (14/958)
23 "(3) PNAC 2011(b) p. 13 - The tables in the succeeding pages show program performance targets during 2009 and 2010 against the country's UA /AMTP IV targets.- HIV Tested and know the results: 2009: 15%; 2010: 30%"
24 PNAC 2011(b) p. 13 - The tables in the succeeding pages show program performance targets during 2009 and 2010 against the country's UA /AMTP IV targets.- HIV Tested and know the results: 2009: 15%; 2010: 30%
25 IDU reference group website http://www.idurefgroup.unsw.edu.au/contest-data-and-maps/Philippines/24
26 DOH 2011(a) p.19 - Number of partners per IDU per year, and number of acts per partner.
27 EFS 2006, p.4 - Behavioural surveillance data in 1997 and 2001 indicated high prevalence of HIV/STI risk behaviour. Sharing of needles was reported by 80% of IDUs in 2001 and consistent use of condom for the past week was generally low (<35%) for all high risk groups for 2001
28 Wilson 2010 - p.3 - "A 2008 report published by the Joint United Nations Programme on HIV/AIDS (UNAIDS) indicated that the prevalence of sharing injecting equipment is still\ very high, with 29% of IDUs self-reporting use of an unsterile needle/syringe the last time they injected [39]"
29 Mateo R, Sarol JN, Poblete R: HIV/AIDS in the Philpinnes. AIDS Education and Prevention 2004, 16:43-52 (2004 report by the Philippines National AIDS Council)
30 PNAC 2010 p.13 - 21. Percentage of IDUs who reported using sterile injecting equipment the last time they injected