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Research paper

Estimating national-level syringe availability to injecting drug users and injection coverage: Switzerland, 1996–2006

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ABSTRACT

Background: Measuring syringe availability and coverage is essential in the assessment of HIV/AIDS risk reduction policies. Estimates of syringe availability and coverage were produced for the years 1996 and 2006, based on all relevant available national-level aggregated data from published sources.
Methods: We defined availability as the total monthly number of syringes provided by harm reduction system divided by the estimated number of injecting drug users (IDU), and defined coverage as the proportion of injections performed with a new syringe, at national level (total supply over total demand). Estimates of supply of syringes were derived from the national monitoring system, including needle and syringe programmes (NSP), pharmacies, and medically prescribed heroin programmes. Estimates of syringe demand were based on the number of injections performed by IDU derived from surveys of low threshold facilities for drug users (LTF) with NSP combined with the number of IDU. This number was estimated by two methods combining estimates of heroin users (multiple estimation method) and (a) the number of IDU in methadone treatment (MT) (non-injectors) or (b) the proportion of injectors amongst LTF attendees. Central estimates and ranges were obtained for availability and coverage.
Results: The estimated number of IDU decreased markedly according to both methods. The MT-based method (from 14,818 to 4809) showed a much greater decrease and smaller size of the IDU population compared to the LTF-based method (from 24,510 to 12,320). Availability and coverage estimates are higher with the MT-based method. For 1996, central estimates of syringe availability were 30.5 and 18.4 per IDU per month; for 2006, they were 76.5 and 29.9. There were 4 central estimates of coverage. For 1996 they ranged from 24.3% to 43.3%, and for 2006, from 50.5% to 134.3%.
Conclusion: Although 2006 estimates overlap 1996 estimates, the results suggest a shift to improved syringe availability and coverage over time.

Introduction

Needle and syringe programmes (NSP), combined with opioid substitution therapy (OST), HIV testing and counselling (VCT), and anti-retroviral therapy (ART), are essential tools for countries aiming to improve HIV prevention, treatment, and care of injecting drug users (IDU) (World Health Organization (WHO), United Nations Office on Drugs and Crime (UNODC), & Joint United Nations Programme on HIV/AIDS (UNAIDS), 2009). They are effective in preventing the transmission of blood-borne diseases such as HIV (Committee on the prevention of HIV infection among injecting drug users in high-risk countries, 2006; Wodak & Cooney, 2006). However, NSP seem to have less of an impact on hepatitis C virus (HCV) transmission (Palmateer et al., 2010) because of its higher viral infectivity and parenteral transmission efficacy (Thomas et al., 2000). No significant relationship between NSP and reduction of HCV transmission has been proven; however there could be an indirect effect on HCV transmission as NSP users were less likely to share needles (Holtzman et al., 2009). One study suggested a combined effect of OST and NSP on HCV transmission (van den Berg, Smit, van Brussel, Coutinho, & Prins, 2007).

In Switzerland, as elsewhere in Europe (Germany, the Netherlands) (Hedrich, Pirona, & Wiessing, 2008), the first harm reduction interventions were introduced soon after AIDS epidemic emerged (Uchtenhagen, 1995). In Switzerland, the first NSP were implemented in the mid 1980s when pharmacies were authorized to sell clean sterile injection equipment to IDU. Today, Switzerland has a comprehensive system of sterile injection equipment distribution, including NSP, pharmacies, and distribution/use of syringes in medically prescribed heroin programmes (Zobel et al., 2003).

In Switzerland, most NSP are located in low threshold facilities (LTF), which aim to identify and contact problem drug users, not limited to IDU, and to intervene with "hidden" population of drug users not in contact with treatment facilities. LTF may provide

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other harm reduction interventions such as drug consumption rooms, overdose prevention, risk reduction counselling, condom distribution, counselling on safe disposal, and facilitating accessibility to OST. LTF may extend their NSP through vending machines or outreach workers. Some treatment facilities also have a NSP. Since 1993, a national monitoring system of syringe distribution has been in place.

More than 98% of IDU in Switzerland are heroin users (Balthasar et al., 2007), cocaine being added (or not) secondarily.

Coverage is widely used as a proxy indicator for measuring effectiveness of HIV prevention programmes amongst IDU and there is consensus concerning the efficacy of estimating coverage (Bluthenthal, Anderson, Flynn, & Kral, 2007; Sharma, Burrows, & Bluthenthal, 2007). However, as stated by Sharma et al. (2007), there is significant variation in the definition of coverage amongst authors. For example, injection coverage has been estimated at an individual level as the number of syringes retained from the last NSP visit combined with the monthly number of visits and injections (Bluthenthal, Anderson, et al., 2007; Bluthenthal, Ridgeway, et al., 2007) or as the percentage of injections performed with a new sterile needle/syringe (Vickerman, Hickman, Rhodes, & Watts, 2006). At a population level, coverage may be understood as the percentage of IDU (in a defined geographic area) reached by a programme (in a defined period of time) (Sharma et al., 2007). World Health Organization (WHO) defines coverage as the "number of syringes distributed per IDU per year" in a defined geographic area (World Health Organization (WHO) et al., 2009). Data on coverage following the WHO terminology have been published recently (Mathers, Ali, Wiessing, Hickman, & Mattick, 2010). However, to our knowledge, national estimations of injection coverage adjusted for injection frequency (i.e. for "true needs") are lacking. In our paper, we consider coverage as an estimate of the proportion of injections performed with a new syringe and we include injection frequency in the calculation. We called "availability" coverage unadjusted for injection frequency.

Conceptually, on the basis of the "one shot = one syringe" postulate, the goal of coverage should be 100% of injections. Some authors suggest that a lower coverage level could have a significant impact on the HIV epidemic (Heimer, 2008), as there is a synergy between using clean syringes and safer behaviour acquired through NSP use (Heimer, 2008). A mathematical model suggests a possible correlation between coverage level and HIV prevalence: increasing syringe distribution coverage would have a limited effect on HIV prevalence until a threshold is reached; this threshold is estimated to be approximately 20% of injections (Vickerman et al., 2006). An increase in syringe availability is significantly linked with a decrease in syringe reuse and injection-related HIV risk (Bluthenthal, Anderson, et al., 2007). Thus, accurate and valid measurement of injection coverage is of key importance. However, whatever the definition of coverage, its measurement inherently contains many uncertainties, that can be dealt with using ranges rather than point estimates.

The objective of this paper is to use all available national sources to estimate syringe availability (i.e. coverage unadjusted for injection frequency) and injection coverage in Switzerland during two different years, 1996 and 2006, using an aggregate approach.

Methods

In order to compute national-level measures of the number of IDU and availability and coverage of syringes, we relied on national-level aggregated data for all components in the computations. We defined "Demand" (D) as the computed total number of syringes needed by the entire IDU population to perform safe injections (i.e. with a new syringe) and "Supply" (S) as the aggregated total number of syringes provided by the various channels of the system. All computations were adjusted to a monthly (30 day) basis and were run separately with data from 1996 and 2006.

At the aggregate level, the availability of syringes is defined as the average monthly total number of syringes available through the various channels of the system. At the aggregate level, coverage is defined as the ratio of supply over demand, and is considered an estimate of the proportion of injections performed with a new syringe. These estimates require combinations of the following parameters: estimated size of the IDU population in Switzerland, average injection frequency and total number of syringes available through different sources at the national level.

Estimates of availability and coverage were obtained for 1996 and 2006, which are the two years for which full information is available. Table 1 gives a brief description and evaluation of the data sources used. Abbreviations in parentheses refer to elements of Table 2 and Table 3.

Demand: estimated monthly number of syringes needed by IDU (D)

This estimate combines two parameters: the number of IDU (I) and the number of injections performed per IDU (J). We calculated the demand (D) by multiplying these two parameters ($I \times J$).

We used two different methods to estimate the number of current IDU (I), based on official estimates of heroin users in Switzerland obtained by multiple estimation methods (Maag, 2003): (Ia) by subtracting the number of drug users on methadone treatment – assumed to no longer be injecting – from the estimated number of heroin users (MT-based method); (Ib) by applying the proportion of current IDU amongst LTF attendees to the estimated number of heroin users (LTF-based method).

Estimation of the number of IDU requires collection of different parameters: for the MT-based method (Ia), the number of heroin users (Ia1) and the number of methadone treatment attendees (Ia2) are needed. For the LTF-based method (Ib), the number of heroin users (Ib1 = Ia1) and the proportion of current IDU amongst drug users (Ib2) are needed.

To estimate the number of heroin users (Ia1–Ib1) for the year 1996, we used official estimate from the Federal Office of Public Health (FOPH) based on a multiple estimation method. Their overall estimate of that number is based on six complementary data sources: HIV-infected drug users, number of persons in methadone treatment, number of persons in residential or in out-patient drug treatment programmes, police data (denunciations), drug-related deaths, and a demographic survey. That research was performed in 1997 and estimated the number of heroin users to be between 24,000 and 35,000, with a mean of 28,500 (Maag, 2003).

For the year 2006, we used the latest official estimate of the FOPH in 2002 which assessed the number of heroin users to be between 18,500 and 25,000, with a mean of 22,000 (Maag, 2004). Only three data sources were used by Maag: number of persons in methadone treatment, drug-related deaths, police data (denunciations).

To obtain the number of methadone treatment attendees (Ia2), we used the register-based annual number of treatments in Switzerland published annually by the FOPH. Methadone treatments are submitted to authorization, renewed each year, and each treatment is registered annually at the regional level and then collected at the national level. That yearly total represents all patients having received an authorization for treatment (new or annually renewed) in the year considered.

To estimate the proportion of current IDU amongst drug users in LTF (Ib2), we used data collected through a repeated national survey amongst LTF attendees (1994, 1996, 2000, and 2006) (Dubois-Arber et al., 2008). All LTF attendees were asked to answer an anonymous

Table 1
Data sources used in estimating the number of IDU and the supply and demand of syringes in Switzerland.

Data used	Source		Type	Coverage	Collection periodicity	Reference period	Remarks
Heroin using population	(Maag, 2003; Maag, 2004)	FOPH point estimate based on multiple sources (6)	Estimate	National	**1997, 2002**	Depending on sources	Estimate with confidence interval
Number of drug users in methadone treatment	[a]	FOPH routine statistics	Register	Reported at regional level but collected at national level	Continuous/ annual publication	Yearly total	Exact figures
Proportion of current IDU amongst LTF users	(Dubois-Arber et al., 2008)	Survey of LTF attendees	Survey	National (participation rate 81% in 1996, 66% in 2006)	1994, **1996**, 2000, **2006**	Last 6 months	Confidence interval
Number of injections performed per IDU	(Balthasar et al., 2007)	Survey of LTF attendees	Survey	National	1994, **1996**, 2000, **2006**	Last 7 days	Confidence interval
Number of syringes distributed by NSP to IDU		NSP monitoring	NSP statistics	National (100% of known LTF)	Continuous	Yearly total	Exact figures
Number of syringes sold to IDUs by pharmacies	(Samitca et al., 2006)	National pharmacy survey	Sales statistics	National (participation rate approximately 70%)	1995, **1997**, **2005**	Monthly average on the basis of the last 3 months	Exact figures
Number of syringes used in the heroin treatment programmes (=number of persons in treatment × mean number of daily injections)	(OFSP, 2007)	Medically prescribed heroin programmes reports (treatment)	Register	National		Situation on December 31th of the year in consideration	Estimate with confidence interval
	[b]	Consultation of the medically prescribed heroin programmes managers (number of injections)	Estimate	National		Yearly total	

In bold: data used in estimations. References are indicated in brackets.
FOPH: Swiss Federal Office of Public Health. LTF: low threshold facilities. NSP: needle and syringe programmes.
[a] Available at http://www.bag.admin.ch/themen/drogen/00042/00632/06217/index.html?lang=de.
[b] Personal communication from the medically prescribed heroin programmes (HeGeBe) managers.

questionnaire. The participation rate was 81% ($N = 944$) in 1996 and 66% ($N = 1083$) in 2006. The questionnaire included questions on the occurrence of injection during the previous 6 months and on the number of injections per week. The proportion of current IDU is defined as the proportion of current injectors amongst LTF attendees (Jeannin, Meystre-Agustoni, Lociciro, & Dubois-Arber, 2009). The confidence interval 95% (95%CI) of the proportion was calculated.

Injection frequency (J) was estimated by using data collected through the same national survey amongst LTF attendees. In the questionnaire the respondents were asked about the number of injections performed during the previous 7 days. The 95%CI was calculated and results standardized to a monthly (30 days, i.e. 30/7) basis.

In our study we used the mean number injections reported (Balthasar et al., 2007) ($J1$). We also provided estimates with a truncated mean ($J2$), considering that the extreme values (more than 70 injections per week) were unrealistic outliers. Consequently, for 1996 we excluded 10 of the 800 respondents, and for 2006 we excluded 16 of the 586 respondents.

Supply: estimated monthly number of syringes distributed by the system (S)

This requires the total number of needles/syringes distributed/sold by the whole distribution system, including NSP (Sa), pharmacies (Sb), and syringes used in medically prescribed heroin programmes (Sc). We calculated the supply (S) by adding the data of those three data sources (Sa + Sb + Sc).

All needles/syringes distributed by NSP (Sa) have been monitored at the national level since 1993 (Zobel et al., 2003). This includes syringes distributed through vending machines and outreach workers. The number of NSP varied over time, from 28 in 1993 to 40 in 2009.

All NSP report annually to the Institute of Social and Preventive Medicine (IUMSP) the number of syringes distributed, on the basis of their continuous monitoring system. The average number of syringes distributed monthly to IDU was calculated by dividing the yearly total number of syringes distributed by 12.

Syringes sales by pharmacies at national level (Sb) have been estimated in a repeated national survey conducted in 1995 (IPSO Sozialforschung, 1995), 1997 (Chollet-Bornand, Gervasoni, & Dubois-Arber, 1997) and 2006 (Samitca, Jeannin, Arnaud, & Dubois-Arber, 2006). This survey used a postal questionnaire sent to all pharmacies in Switzerland. Pharmacies were asked to report on the monthly number of syringes and other sterile equipment sold to IDU based on the last three months of the previous year. The participation rate was 61% in 1995, 73% in 1997, and 76% in 2005. The total number of syringes distributed that we used in our study has been adjusted based on the participation rate.

The annual number of syringes distributed/used through medically supervised heroin prescription programmes (Sc3) is obtained by combining the number of patients (Sc1) in treatment as reported in annual reports of the programme (situation on December 31st of each year) (Office fédéral de la santé publique (OFSP), 2007) and an

Table 2
Estimation of number of injecting drug users (IDU) and supply and demand of syringes in Switzerland.

	1996			2006		
	Estimate	Min	Max	Estimate	Min	Max
Number of IDU (*I*)						
Ia) Number of non-MT IDUs, MT based						
Ia1) Number of heroin users (Maag, 2003; Maag, 2004)	28,500	24,000	35,000	22,000	18,500	25,000
Ia2) Number of MTs	13,682	13,682	13,682	17,191	17,191	17,191
Ia3) Estimated number of non-MT IDUs: Ia1–Ia2	14,818	10,318	21,318	4809	1309	7809
Ib) Number of IDUs, LTF based						
Ib1) Number of heroin users (Maag, 2003; Maag, 2004)	28,500	24,000	35,000	22,000	18,500	25,000
Ib2) Proportion of injectors (Dubois-Arber et al., 2008)	0.86	0.84	0.88	0.56	0.53	0.59
Ib3) Estimated number of IDUs: Ib1 × Ib2	24,510	20,109	30,875	12,320	9813	14,739
Number of injections per IDU per month (*J*)						
*J*1) Arithmetic mean	75.7	70.0	81.5	59.1[a]	52.1	66.2
*J*2) Truncated mean (truncated at 71 in the last 7 days)	70.4	65.7	75.1	57.0	51.7	62.3
Demand: Estimated monthly number of syringes needed by IDU (*D*)						
Da1) MT-based numb. of IDUs and arithmetic mean of injections: Ia3 × *J*1	**1,122,305**			**284,418**		
Da2) MT-based numb. of IDUs and truncated mean of injections: Ia3 × *J*2	**1,043,024**			**274,076**		
Db1) LTF-based numb. of IDUs and arithmetic mean of injections: Ib3 × *J*1	**1,856,370**			**728,640**		
Db2) LTF-based numb. of IDUs and truncated mean of injections: Ib3 × *J*2	**1,725,234**			**702,145**		
Dc1) Floor: min(Ia3, Ib3) × min(*J*1, *J*2)		677,505			67,662	
Dc2) Ceiling: max(Ia3, Ib3) × max(*J*1, *J*2)		2,516,483			976,215	
Supply: Estimated monthly number of syringes distributed by the system (*S*)						
Sa) Distributed or sold by LTF	284,044	284,044	284,044	210,881	210,881	210,881
Sb) Distributed or sold by pharmacies	122,006	122,006	122,006	84,057	84,057	84,057
Sc) Distributed through heroin treatment programmes (HeGeBe)						
Sc1) Number of HeGeBe patients	687	687	687	1308	1308	1308
Sc2) Mean number of injections/HeGeBe patient/month	66.7	43.6	89.9	55.9	29.6	82.2
Sc3) Total HeGeBe: Sc1 × Sc2	45,846	29,934	61,757	73,082	38,696	107,467
Sd) Estimated total supply: Sa + Sb + Sc3	**451,896**	435,984	467,807	**368,020**	333,634	402,405

Note: All figures have been converted to a monthly (30 days) basis.
In bold: central estimates. References are indicated in brackets.
IDU: injecting drug users; MT: methadone treatment; LTF: low threshold facilities; HeGeBe: medically prescribed heroin programmes.
[a] Standard deviation and 95%CI have been calculated on the basis on the actual database, with a mean number of injections of 15.05.

estimate of the number of injections made per month per patient (Sc2) obtained from the consultation of the persons responsible for medically supervised heroin prescription programmes. They provided us with the yearly number of injections performed in the programmes which we aggregated and then divided by the number of patients and then by 12 to obtain a monthly average. The 95%CI of the mean number of injections was calculated.

Table 1 presents all data sources used in estimating the number of IDU and the supply (*S*) and demand (*D*) of syringes in Switzerland. Table 2 summarizes the estimation of national-level number of IDU and supply (*S*) and demand (*D*) of syringes in Switzerland.

Results

Estimates of the number of IDU

The estimated number of IDU decreased significantly according to both methods (Table 2). Estimation based on methadone treatment (MT-based, Ia) found the number of IDU decreased from 14,818 [95%CI 10,318; 21,318] in 1996 to 4809 [95%CI 1309; 7809] in 2006. Based on the proportion of IDU amongst LTF attendees (LTF-based, Ib), the estimated number of IDU decreased from 24,510 [95%CI 20,109; 30,875] to 12,320 [95%CI 9813; 14,739] (Table 2).

The MT-based method (Ia) found a much greater decrease and smaller size of the IDU population compared to the LTF-based method (Ib): with the MT-based method, the estimate population of IDU is three times lower.

The two methods produced results which are sharply different for the years considered but the difference is greater in 2006: for 1996, the number of IDU estimated with the LTF-based method was 1.7 times the number estimated with the MT-based method. This ratio increased to 2.6 times in 2006.

Estimates of availability and coverage of syringes

Availability, defined as the number of syringes available to each IDU per month, increased from 1996 to 2006. Both central estimates and range limits were higher in 2006. According to the MT-based method to estimate the IDU population, availability has more than doubled (from 30.5 to 76.5) and according to the LTF-based method, availability increased by two thirds (from 18.4 to 29.9). The two range limits overlap, but we observe an upward shift (Table 3).

Coverage also improved from 1996 to 2006. All four combinations used for computing the central estimates of coverage show better coverage in 2006 than in 1996, with values at least doubling or tripling. In 1996, between 24.3% and 43.3% of injections were covered with new syringes. In 2006, the central estimates rank between 50.5% and 134.3%. As for availability, the limit ranges overlap, but there is an upward shift, confirming improvement in coverage. Note that, as supply is estimated from many independent sources, there is no inherent arithmetic constraint limiting it to estimated demand; hence estimated coverage may exceed 100%, as happened for the 2006 central estimates.

Discussion

The methodology utilized in this study allowed us to estimate the monthly availability of syringes to each IDU in Switzerland and the coverage of syringes at a national level, taking into account inaccuracies in each data source used. We calculated central estimates and range limits. The global approach that we adopted did not allow for taking into account programmes' quality according

Table 3
Availability and coverage of syringes in Switzerland, 1996 and 2006.

	1996			2006		
	Estimate	Min	Max	Estimate	Min	Max
Availability (A)						
Aa) Based on MT-based number of IDU: Sd/Ia3	**30.5**	20.5	45.3	**76.5**	42.7	307.4
Ab) Based on LTF-based number of IDU: Sd/Ib3	**18.4**	14.1	23.3	**29.9**	22.6	41.0
Ac1) Floor: min(Aa, Ab)		14.1			22.6	
Ac2) Ceiling: max(Aa, Ab)			45.3			307.4
Coverage (C)						
Ca1) Central estimate: estimate Sd/Da1	**40.3%**			**129.4%**		
Ca2) Central estimate: estimate Sd/Da2	**43.3%**			**134.3%**		
Cb1) Central estimate: estimate Sd/Db1	**24.3%**			**50.5%**		
Cb2) Central estimate: estimate Sd/Db2	**26.2%**			**52.4%**		
Cc1) Floor: min(Sd)/max(D)		17.3%			34.2%	
Cc2) Ceiling: max(Sd)/min(D)			69.0%			594.7%

Notes: Figures for availability show number of syringes per month (30-day basis).
All calculations were made with full precision, but are shown with only one decimal. min(): minimum of. max(): maximum of.
MT: methadone treatment; IDU: injecting drug users; LTF: low threshold facilities.
In bold: central estimates.

to WHO definition. However, we consider that coverage is itself an important quality criterion.

Availability and coverage improved over the study period. All central estimates of coverage were higher in 2006 than in 1996. Although range limits were wide, we observed an upward shift, confirming the improvement in coverage from 1996 to 2006. Central estimates in 2006 range from 50.5% to 134.3%, implying that the situation is probably satisfactory.

Strengths and limitations

Most previous studies reported on the availability of syringes to IDU (defined as the number of syringes available to each IDU for a given period of time). Only some took into account coverage, defined as the number of injections covered with a new sterile syringe (i.e. adjusted for injection frequency). Estimation of coverage integrates the injection frequency in the calculation (Heimer, 2008), which we did in the current analysis. Furthermore, in our study, we estimated coverage at a national level and collected data concerning syringe supply from all available sources (NSP, pharmacies, and treatment programmes). Including injection frequency in coverage estimates increases uncertainty and add assumptions, especially regarding biases (in particular declaration bias) and generalisability of this data. However including injection frequency in coverage estimates also increases relevance as coverage then refers to actual reported needs in syringes by the IDU population. Overall, we think that adjusting coverage for injection frequency allows for more robust comparisons.

For our calculations we used several data sources. Errors and bias in any of them would limit the accuracy of our results. However some of these sources are registers, which are generally good quality data, especially for the number of persons in treatment as those treatments require authorizations (Table 1). For other data sources, we calculated confidence intervals, which were wide in some cases. Overall, we feel that this approach was robust and constituted an efficient use of available data.

Data concerning the number of syringes distributed (LTF, pharmacies, heroin treatment programmes) were collected by monitoring, and are considered reliable. The monitoring of these data is stable, continuous over long time periods, and has near exhaustive national coverage. In addition to these sources, syringes may be given in small amounts in immediate need situations by other institutions. This may produce a slight underestimation of the total supply.

Estimation of the IDU population is based on approximation of the heroin using population. This is justified, as more than 98% of current IDU in Switzerland have ever used heroin as their main drug (Balthasar et al., 2007) and are considered heroin dependents. Some of them may have used only cocaine in the last months (generally associated with methadone treatment).

We used Maag's estimates of the heroin user population at national level as basis for our estimates of the IDU population (Maag, 2003, 2004). She used six complementary data sources to develop an overall estimate at national level of heroin users in 1997. However, for 2002, she used only three data sources. Nordt and Stohler used advanced statistical methods to estimate incidence of heroin use in the canton of Zurich and derived prevalence of heroin use for this canton only, assuming that the Zurich canton population represents one fourth of the Swiss heroin users population (Nordt & Stohler, 2006). Their results corroborate the 1997 Maag's results. They are higher for 2006. Consequently, we feel that Maag's 2002 estimates may be too low.

Concerning the number of IDU, the MT-based method tends to underestimate the IDU population – and overestimate the coverage – probably more in 2006 than in 1996. We subtracted the number of persons in treatment with methadone from the estimated number of heroin users, considering that persons in treatment should no longer be injecting. However, methadone treatment statistics in one Swiss canton showed that a sizable proportion of treated patients (between 10% and 20%) continue to inject (Huissoud, Gumy, Gervasoni, & Dubois-Arber, 2009). Moreover, the proportion of persons in methadone treatment amongst the LTF attendees was 47% in 1996 and 59% in 2006 (Balthasar et al., 2007).

The current IDU-based method of estimating IDU (based on surveys in LTF) probably overestimates the IDU population – and underestimates coverage – because whilst some LTF distribute material for heroin inhalers, it is probable that LTF attendees are not representative of the heroin using population as a whole.

In our results for the IDU population we found a great decrease between 1996 and 2006 according to both methods. For the reasons mentioned earlier, we feel that Maag's 2002 estimates was underestimated. Consequently, our estimate for the IDU population for 2006 is probably underestimated, and coverage is overestimated.

Regarding the number of injections (based on surveys in LTF), several sources of bias should be acknowledged. A selection bias (LTF may select the most frequent injectors) and a reporting bias (IDU may under report or over report their number of injections) are potential confounders. However these biases should be

Table 4
Main sources of bias in estimates used in computing syringes availability and injections coverage.

Estimation of	Bias	Influence on indicator estimate	Consequent impact on coverage estimate		
			Direction	1996	2006
Syringes supply	Other (scarce) sources of distribution	Underestimation	Underestimation	+	+
MT-based IDU population	Some persons in methadone treatment are still injecting	Underestimation	Overestimation	+	++
LTF-based IDU population	Selection of injectors	Overestimation	Underestimation	+	+
Number of injections	Selection of frequent injectors	Overestimation	Underestimation	++	+
	Use of mean number rather than median number	Overestimation	Underestimation	+	++
	7-day recall converted to monthly data	Underestimation/overestimation	Overestimation/underestimation	+	+

+: weak influence, ++: strong influence.
MT: methadone treatment; IDU: injecting drug users; LTF: low threshold facilities.

constant over time. We used two different computation of the mean number of injections reported by LTF attendees in our estimates. However there are some unrealistic outliers in the data and the truncated mean could be considered as representative of the total. We did not observe significant changes between results based on the arithmetic or truncated mean. We used the mean number of injections in our estimate, as it is mathematically correct. However, the median provides a better representation of the data as a whole. For 1996, median and mean were very close. However, in 2006 the median number of injection was lower than the mean. Finally, we standardized 7-day recall data into monthly data (30 days, i.e. 30/7). This could lead to a slight underestimation of the mean number of injection as the persons who performed less than one injection per week are not taken into account in the 7-day data; but this also leads to overestimation as frequent injectors are more likely to visit LTF and be included in the survey. In the end, we would argue that the number of injections we used in our estimate for 2006 was an overestimation. Table 4 summarizes the main sources of bias in estimates used in computing syringe availability and injections coverage.

Estimate of the number of IDU decreases markedly between 1996 and 2006 according to both methods, but the decrease was much greater according to the MT-based method. Furthermore, the number of IDU is much lower with the MT-based method, especially for 2006.

Levels of availability and coverage

In 2006, the four central estimates for coverage rank between 50.5% and 134.3%. The central estimates based on the LTF-based method for IDU population are lower (50.5–52.4%) and very different than those derived from the MT-based method for IDU population (129.4–134.3%). In discussing the limitations of our method, we showed that the MT-based method overestimates coverage, especially for 2006. In the LTF-based method, the bias influence is less obvious, but certainly underestimates coverage. The true value is most likely somewhere between 50 and 130%.

Improvements in availability and coverage are partly due to an important decrease in syringe demand. Actually, we observe a significant decrease in the number of IDU, which mirrors the trend observed elsewhere in Europe in recent years (Wiessing, Klempova, Hedrich, Montanari, & Gyarmathy, 2010). The median and mean number of injections performed per week also decreased. In parallel, the syringe supply increased. Over the considered period, several LTF opened in Switzerland, especially in the French speaking part of the country, and the number of pharmacies selling clean injecting material also increased (Samitca et al., 2006).

Under the criteria established by WHO in collaboration with UNODC and UNAIDS (World Health Organization (WHO) et al., 2009), more than 200 syringes per IDU per year is a high level of availability. In 2006, our central estimates rank between 30 and 77 syringes per month per IDU. If we convert these results to yearly quantities, then our estimates rank between 360 and 924 syringes per IDU per year. This number is much higher than the average 52 syringes per year per IDU in the European Union reported by Wiessing et al. (2009) and is similar to Australian data from 2004 (385 per IDU per year) (Razali et al., 2007). A recent review for 2009 focused on the availability of syringes in the different regions of the world. It showed that, in Western Europe, an average of 59 syringes were distributed per estimated IDU per year, 23 in North America and 202 in Australasia (Mathers et al., 2010). The difference with our results is partly due to the fact that, in Switzerland, we included the whole system of syringes distribution in the calculation, which is not the case in the article by Mathers. Several authors agreed that the overall availability of syringes depends also on their availability through pharmacies (Hedrich et al., 2008; Sarang, Rhodes, & Platt, 2008), which should be taken in account when estimating availability and coverage of syringes.

Coverage improved over the period and reached a level between 50% and 130%; this suggests that the true coverage is probably satisfactory. There are no such estimates for other European countries; in the United States, the syringe coverage is much lower, around 3% (Tempalski et al., 2008; Wiessing et al., 2009). Furthermore, the low rate of shared injecting material (around 9% in the last 6 months) (Dubois-Arber et al., 2008) which is amongst the lowest in Europe (European Centre for Disease Prevention and Control, 2010), and the decrease in the number of new cases of HIV infections reported to the FOPH (about 30 new positive diagnosis amongst IDU in 2009 vs. 200 in 1996) (Office fédéral de la santé publique (OFSP), 2010) are confirmations of having reached a satisfactory level of syringe coverage.

Various factors influencing the accessibility to clean injecting material have been identified, including legal framework (Martinez et al., 2007; Neaigus et al., 2008), syringe distribution policies (Bluthenthal, Ridgeway, et al., 2007; Heimer, 2008; Heller, Paone, Siegler, & Karpati, 2009), and fear of police (Bluthenthal et al., 2004). Different studies showed that less restrictive policies (no limitation in the number of syringes exchanged, distribution rather than exchange) lead to better coverage (Bluthenthal, Ridgeway, et al., 2007; Heimer, 2008). In Switzerland, the satisfactory level of coverage that we observe is certainly due to a policy resolutely directed towards harm reduction since the emergence of the AIDS epidemic in the early 1980s, in particular a change in the law regarding the sale of syringes by pharmacies and the promotion of NSP.

In conclusion, our approach based on different data sources and incorporating the inaccuracies of each source, collected at a national level, allowed us to estimate global coverage with central estimates and range limits. Our results reveal a satisfactory and increasing level of syringe coverage amongst IDU in Switzerland.

Author's contributions

Sophie Arnaud: responsible for the identification of relevant data sources, data analysis and writing of the article.

André Jeannin: responsible for the procedure used in estimations, data analysis and contribution to the writing of the article.

Françoise Dubois-Arber: responsible for the study, design of the study, contribution to the analysis and to the writing of the paper.

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Conflict of interest

The authors have no conflict of interest to declare.

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