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Estimate of the prevalence of injecting drug use in Belgium

by

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Abstract

Objective: *To estimate the number of injecting drug users (IDUs) aged 15-54 years in Belgium in 1995.*

Method: *The number of IDUs has been inferred from the number of alive HIV persons, the prevalence rate of IDU among HIV patients, and the prevalence rate of HIV seropositivity among IDUs. Data were provided by the national HIV/AIDS register and by the database on treatment demands recorded by the monitoring system of the French Community. The 95% confidence limits (95% CL) of the estimate were constructed using the bias-corrected and accelerated bootstrap method.*

Results: *In 1995, the number of IDUs, 15-54 years old, was estimated to be 20,000 (95% CL: 10,300 – 46,300) yielding to a prevalence rate of 0.36% (95% CL: 0.18-0.83%).*

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***Discussion**: The Belgian HIV/AIDS register exhaustively records confirmed HIV seropositive and AIDS cases. The prevalence of IDU among HIV patients can therefore be directly estimated from this database. A sample of drug users demanding a treatment in the French Community provided an estimate of the prevalence of self-reported HIV seropositivity in the population of IDUs living in Belgium. This estimate could be used at a national level since the results obtained later in a survey conducted in Flanders were quite comparable to those found in the French Community. In addition, self-reported HIV seropositivity was found to be a good indicator of HIV status based on saliva and blood testing. Confidence limits of the estimated prevalence of IDU were mainly dependent on the reliability of the estimated prevalence of HIV seropositivity among IDUs.*

Keywords

Epidemiology, prevalence, injecting drug use, HIV, treatment demand, Belgium.

Introduction

Quantitative information on the extent of the problematic drug use is a requisite to consistently make decisions for public health actions, service provision and policy development. While the prevalence of problematic drug use may be estimated through several different approaches, only one method can presently be applied in Belgium (1). This method, which demonstrates to be feasible, involves the use of data extracted from the national HIV/AIDS database in combination with information provided by data on treatment demands. The present report aims to provide an estimate of the number of injecting drug users aged 15-54 years in Belgium in 1995 and to give details on the computational aspects of this method.

Material and Method

Point estimate of the prevalence rate of injecting drug use

Let us consider a population in which people may possess two characteristics, A and B, not mutually exclusive. Let:

- N_B the number of people who possess characteristic B,
- N_{AB} the number of people having both characteristic A and characteristic B,
- p(B) the proportion of all people who possess characteristic B, and
- p(AB) the proportion of all people who possess both characteristic A and characteristic B.

Then the probability that a randomly selected individual has characteristic A, given that he has characteristic B, or conditional on his having characteristic B, p(A/B), is given by:

$$p(A/B) = \frac{p(AB)}{p(B)} = \frac{N_{AB}}{N_B}$$

Referring to the interrelations between the populations of injecting drug users (IDUs) and HIV positive patients, let the number of IDUs be denoted by n_{IDU}, and the number of people being both HIV positive and IDUs by $n_{HIV \cap IDU}$ (Fig. 1). The prevalence rate of HIV seropositivity conditional on being IDUs may then be found applying the definition of the conditional probability:

$$p(HIV/IDU) = \frac{n_{HIV \cap IDU}}{n_{IDU}}$$

On the other hand, $n_{HIV \cap IDU}$, expressed as a function of the number of HIV positive patients and the prevalence of injecting drug use (IDU) among HIV, can similarly be obtained by another application of the definition of conditional probability:

$$n_{HIV \cap IDU} = n_{HIV} \cdot p(IDU/HIV)$$

with n_{HIV} denoting the number of HIV positive patients in the population and p(IDU / HIV) the prevalence rate of IDU conditional on being HIV positive. Replacing $n_{HIV \cap IDU}$ in (1) and rearranging provides the formula from which the number of IDUs may be estimated:

$$n_{IDU} = n_{HIV} \cdot \frac{p(IDU/HIV)}{p(HIV/IDU)}$$

The prevalence rate of IDU is then obtained dividing n_{IDU} by the population aged 15-54 years (5,602,499 in 1995).

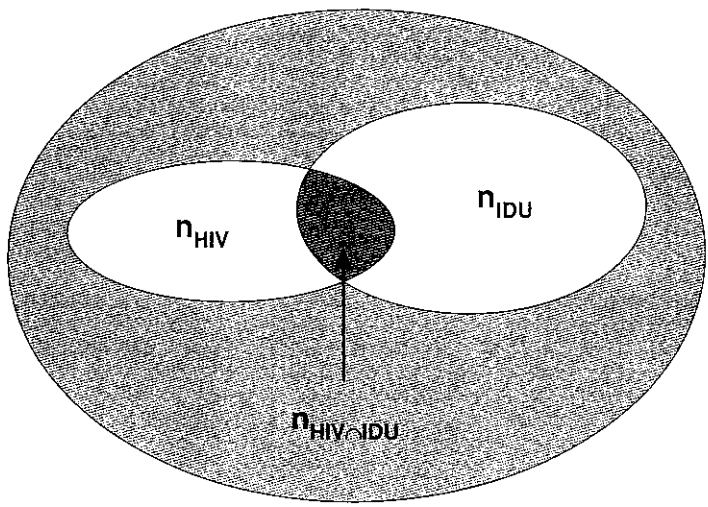

Fig. 1: The interrelationship between the population of HIV positive cases and that of injecting drug users. The number of IDUs is denoted by n_{IDU}, the number of HIV positive patients by n_{HIV}, and the number of people being both HIV positive and IDU by $n_{HIV \cap IDU}$. The unknown is n_{IDU}.

It should also be emphasized that this estimate is merely based on an application of the multiplier method where the prevalence rate of HIV positive cases among IDUs plays the role of the multiplier (1).

Confidence limits of prevalence rate estimates

The HIV/AIDS database is deemed to include all the population of diagnosed HIV positive cases but the prevalence rate of IDU in the HIV population could only be estimated in a sample of this population (IDU status is not known for all the HIV cases). The variance of the prevalence rate of IDU among HIV patients was therefore calculated using the finite population correction. This factor is introduced in the classical formula of the variance of a simple random sample to account for the effect of the proportion of the population in the sample. It is equal to (N-n)/(N-1) where N is the size of the population and n is the size of the sample. The effect of this correction is to reduce the sampling variance substantially as this factor approaches 0, i.e. as the sample size approaches the population size. The 95% confidence limits of the prevalence rate of IDU among HIV patients were then constructed using the normal approximation.

Bootstrapping was used to calculate the confidence interval of the other estimates (prevalence rate of HIV seropositivity among IDUs, and ratio of the prevalence rate of IDU among HIV patients to that of HIV seropositivity among IDUs). In the bootstrap, B new samples, each of the

same size as the observed data, are drawn with replacement from the observed data (2). The statistic is calculated for each new set of data, yielding a bootstrap distribution for the statistic. The 95% bootstrap confidence interval of the statistic is based on the 2.5% and 97.5% empirical percentiles of the bootstrap replications of the statistic. In order to obtain confidence intervals with good theoritical coverage properties as well as reasonable stability in practice, these percentiles should be corrected to account for the bias and the acceleration (the bias is defined to be the difference between the mean of the bootstrap replications of the statistic and the observed statistic; acceleration accounts for the rate of change of the standard error of the bootstrap estimate with respect its true value). These intervals are called bias-corrected and accelerated intervals or "Bca intervals" (2). The computation of these intervals typically requires 1000 bootstrap replications. Bootstrapping fundamentally assumes that the observed data are representative of the underlying population. By resampling observations from the observed data, the process of sampling observations from the population is mimicked.

Parametric bootstrap was used to sample the number of prevalent cases of IDU among HIV patients. In other words, the binomial distribution of the number of IDUs among HIV cases was approximated by a normal distribution and the parametric estimates of this normal distribution were used to randomly generate the number of IDUs among the replicated samples of HIV cases. On the other hand, non-parametric bootstrapping was used for the replications of the prevalence rate of HIV in the sample of IDUs. A population of size n, equal to that of the investigated sample of IDUs, was created with HIV positive cases represented by ones and HIV negative cases by zeroes. Samples of size n were drawn with replacement from this population to obtain bootstrap replicates of the number of HIV prevalent cases.

In addition, the 95% confidence limits of the ratio were also computed assuming that the numerator was a known constant, i.e. that the prevalence rate of IDU in the HIV population is exactly known.

The computations were carried out using S-Plus 4.0 software package (3).

Data

HIV/AIDS database

In Belgium, diagnosed seropositive HIV persons and AIDS cases are registered in two integrated databases at the Scientific Institute of Public

Health in Brussels (4). Approximately 600,000 blood samples are yearly screened for HIV antibodies with the ELISA assay, excluding testing related to blood donations. Eight reference laboratories are recognised by the Ministry of Public Health to confirm the results of these positive ELISA tests. Since they are the only laboratories subsidised for this confirmation, their reporting on new positive HIV individuals gives the number of newly diagnosed seropositives in the country. Data on age, sex, nationality, residence, and possible route of transmission are collected through a standardised form sent by these laboratories to the physician of each new HIV patient. On the other hand, the newly diagnosed AIDS cases are notified in an independent way by clinicians on a standardised form. They are validated by a Commission of experts referring to the definition of the Centres for Diseases Control, adopted by the European Centre for the Epidemiological Surveillance of AIDS (5). A follow-up survey is conducted each year to collect data on last consultation and possible death of reported AIDS cases. Since a common code is used to record each case, whether HIV-positive or AIDS, it is possible to avoid multiple counting and also to link the two databases.

Treatment demands from drug users

Since 1992, the "Comité de Concertation sur l'Alcool et les autres Drogues" (CCAD) has set up, in the French Community, a registration system on treatment demands from drug users. Units participating to this registration include out-patient services (half of them are specialised mental health services), in-patients services (therapeutic communities and psychiatric hospitals), low threshold services, networks of general practitioners, day centres and one structure working inside the prisons. A standardised form, called "Fiche commune CCAD", based on the Pompidou Protocol on the "First treatment demand" indicator is used to collect data (6, 7). Till end 1996, multiple counting could be detected in this database because registered addicts were identified with a code built with the first letters of their names, gender and birth date. Data could therefore be analysed after having eliminated multiple counting. However, since 1997, the CCAD had to drop this identifier owing to the new Belgian law on private life protection. The sample of IDUs having demanded treatment in 1995 was extracted from the CCAD database to provide an estimate of the prevalence rate of HIV among lifetime IDUs, i.e. drug users having injected at least once during their life.

Results

From the HIV/AIDS database, the cumulated number of alive HIV patients, aged 15-54 years in 1995 – including AIDS cases and non-AIDS

cases – was estimated to amount to 6421. Details of this estimation are given in tables 1 and 2. The prevalence rate of IDU among HIV patients 15-54 years old, with known IDU status, was estimated to be 9.25% (table 2). The 95% confidence limits were in the range 8.69 – 9.81% using the finite population correction. The distribution of the number of IDU cases among HIV patients can therefore be well approximated by a normal distribution with mean equal to 366 and standard deviation equal to 11. This distribution was used in the parametric bootstrapping to generate a random number of IDUs in a sample of 3995 HIV patients at each bootstrap resample.

TABLE 1

Estimated number of alive diagnosed AIDS cases aged 15-54 years in 1995

Population	Cumulated number of cases
All registered cases	1732
Cases known to be alive	504
Cases known to be dead	1003
Withdrawals (known by follow-up survey)	225
Expected number of deaths among withdrawals *	181
Estimated number of dead AIDS cases	1184

* Mortality among this group was assumed to be the same as for known cases: for each year, the expected number of deaths among withdrawals was computed applying the mortality rate observed among cases with known issue.

TABLE 2

Injecting drug use in the population of HIV patients aged 15-54 years registered in Belgium (1995)

Population	Cumulated number of cases
All registered HIV patients	7595
Dead AIDS cases	1184
Alive HIVs registered patients	6421
Alive HIVs and known IDU status	3955
Alive IDUs among HIV patients	366

In 1995, 503 IDUs, older than 15 years, demanding treatment were recorded in the CCAD database. In this sample, 235 IDUs (46.7%) reported to have been tested for HIV and 7 of them reported to be HIV positive. The prevalence rate of HIV among IDUs was therefore estimated to be 2.97% with 95% confidence limits in the range 0.85 – 5.10% using non-parametric bootstrapping.

Applying formula 3 given in the material and method section, the number of IDUs aged 15-54 years in 1995 could therefore be estimated to amount to 20,000 [(6421 x 0.0925) / 0.0297], i.e. a prevalence rate of 0.36% for the population aged 15-54 years. When accounting for the variability of the prevalence rate of IDU among HIV cases, the 95% confidence limits were in the range 10,300 – 46,300 (prevalence rate: 0.18 – 0.83%). When the prevalence rate of IDU among HIV cases is assumed to be exactly known (no sampling variability), the 95% confidence interval is unexpectedly not improved: 9,150 – 34,900 (prevalence rate: 0.16 – 0.62%; the lower limit is lower than in the case of sampling variability).

Discussion

In the HIV/AIDS database, IDU status was known for only 62% of all the alive registered HIV cases (AIDS cases or not; table 2). However, the proportion of cases with known IDU status in the sub-group of AIDS cases reaches 98.5% and the prevalence rate of IDU in this sub-group was 8.85%; a figure being in the 95% confidence interval of the prevalence rate of IDU found in the sample of HIV patients. Such finding is not in favour of the existence of a bias resulting from the high proportion of missing values regarding the IDU status among all HIV patients.

The HIV/AIDS database includes 1058 notifications related to cases diagnosed before December 31, 1995, which cannot be handled owing to the poor information they provide (generally these notifications report only the date of the HIV test). Since these notifications were excluded from the present analysis, the cumulated number of alive HIV cases in 1995 could be underestimated. If such bias exists, it is expected to be negligible compared to the uncertainty caused by the small size of the investigated IDU sample in estimating the prevalence of HIV seropositivity in this population (see discussion below). Indeed, it must be emphasized that each of these notifications could reasonably not be assumed to correspond to an unregistered case because a seropositive patient can be tested, and consequently notified, several times. Furthermore, since 84% of these notifications were made between 1985 and 1989, it is very likely that most of these notifications are related to cases registered afterwards as AIDS cases.

Non-response to follow-up may also be a source of bias in the estimate of the cumulated number of alive HIV cases. However, this concerned only 25 AIDS cases from a total of 1732 registered cases (1.5%). Non-

response to follow-up could therefore be excluded as a potential source of bias. The present estimate of IDUs also assumed that all HIV cases, having not reach the AIDS stage, were alive.

The calculation of the prevalent number of IDUs is also dependent on the total number of alive HIV patients, whether being IDU or not. The HIV/AIDS register is deemed to exhaustively contain all diagnosed cases of HIV seropositivity. However, some HIV infected people could not have been registered at the time of the study owing to the delay between the onset of HIV infection and its diagnosis. It turns out that the number of prevalent cases of IDUs derived from the present study could slightly be underestimated. The importance of this bias cannot be assessed because there is no information on the number of infected people who are not diagnosed as seropositive HIV patients. However, this bias is expected to be rather small because there is a large number of laboratories carrying out HIV screening tests in Belgium and a large number of screening tests are yearly performed.

Treatment data recorded in the French Community were used to estimate a prevalence rate of 3% for being HIV positive among IDUs. Two sources of systematic error may however bias this estimate: (I) HIV seropositivity was reported by drug users (not confirmed by laboratory testing), and (ii) a geographical variation of the prevalence rate of HIV among IDUs could not be excluded, invalidating consequently the use of this estimate at a national level. Such possibilities are not likely to operate owing to the following results. A survey was conducted between September 1996 and March 1997 in Flanders among 225 IDUs aged 16-47 years (8). In this study, 186 drug users reported to have been tested for HIV and 5 of them, i.e. 2.7% of the sample, reported to be HIV seropositive. During this survey, a HIV test (saliva and blood) was also performed on all IDUs but no new case was detected, giving thus a more accurate estimate of 2.2%. This finding thus suggests that the prevalence rate of self-reported HIV seropositivity could be a good indicator of the prevalence of HIV seropositivity confirmed by laboratory testing. In addition, the prevalence rate of reported HIV positivity among IDUs registered in the database of the French Community during the period 1996-97, 2.1%, was quite similar to that found in the Flemish survey. This suggests that the prevalence rate of HIV among IDUs does not significantly differ in the two Communities.

The large 95% confidence interval for the estimated number of IDU cases originates from both the low prevalence rate of HIV among IDUs and the small size of the IDUs sample from which this prevalence rate

was estimated. A larger sample of IDUs is therefore necessary to improve the precision of the estimated number of IDUs. Simulations were thus carried out to know to what extent the sample size of IDUs should be increased in order to attain a better precision. It was assumed that a fixed 3% prevalence rate for being HIV positive among IDUs was estimated from samples with increasing size (500; 1,000; 2,000 and 4,000 IDUs, respectively). On the other hand, the size of the sample of HIV patients used to calculate the prevalence of IDU among HIV patients remains unchanged (n = 3,995; Table 2). Then, the 95% confidence limits were computed by bootstrapping. The results show that increasing the size of the sample of IDUs to more than 1,000 IDUs does not increase drastically the precision of the estimate of the number of IDUs (Table 3).

TABLE 3

95% confidence limits of the prevalence of IDU as a function of the size of the sample of IDUs used to estimate the prevalence of HIV among IDUs

Size of the IDUs sample used to estimate the prevalence of HIV among IDUs	Prevalent cases of IDUs (thousands)	Prevalence rate of IDU (%)
235 *	10.3 – 46.3	0.018 – 0.82
500	12.6 – 34.8	0.22 – 0.62
1000	14.4 – 30.3	0.26 – 0.54
2000	15.3 – 25.9	0.27 – 0.46
4000	16.7 – 24.4	0.30 – 0.44

Notes: * present study

The sampling variability of the prevalence rate of IDU in the population of HIV patients may also influence the precision of the prevalence estimate of IDUs. This effect was also investigated as follows. The 95% confidence limits of the prevalence rate of IDUs was constructed by bootstrapping from a sample of 1,000 IDUs in which the HIV prevalence rate was 2.97% and the whole population of the 6,421 HIV patients in which the prevalence rate of IDU was 9.25%, assuming no sampling variability. In such conditions, the 95% confidence limits of the estimated number of IDUs were in the range 13,800 – 28,300. The upper limit of this interval is somewhat lower than that observed when calculations are carried out with sampling variability, i.e. with the sample of 3,995 HIV patients with known IDU status: 14,400 – 30,300 (Table 3). The lower limit is surprisingly lower than in the case of sampling variability; the same fact having already been observed in the "results" section when computing the 95% confidence interval of the estimated number of IDUs ignoring the sample variability of the prevalence of IDUs among HIV patients. This results from the magnitude of the bias which is higher when the bootstrap repli-

cations are made on the sample of IDUs ignoring the sampling variability of the prevalence of IDU among HIV patients. Indeed, a bigger bias may originate from the small prevalence of HIV among IDUs and the small size of the investigated sample of IDUs. It can also be observed that the bias decreases as the size of the IDU sample increases. For instance, if replications are carried out with a sample of 4,000 IDUs, ignoring sample variability of the prevalence of IDU among HIV patients, the 95% confidence interval (16,800 – 23,800) is slightly smaller than that obtained when the sampling variability is accounted for (16,700-24,400; Table 3). However, the improvement is not important.

In most European countries, the number of HIV patients being also IDUs is not directly available and must be estimated using the back calculation methodology (9). The prevalence rate of IDU using this approach was 0.34% in Denmark (1995), 0.38-0.48% in France (1995), and 0.42% in Ireland (1993). In Norway, the prevalence rate of IDU was estimated to be in the range 0.29 – 0.42% using the multiplier method with mortality data (1997). Our estimate of the prevalence rate of IDU (0.36%) is therefore consistent with values found in other European countries with other methods.

In conclusion, the method has revealed to be productive in estimating the number of prevalent cases of IDUs in Belgium. However, this estimate must be updated using the most recent data. In order to increase the size of the sample of IDUs, and consequently to increase the reliability of the estimated number of IDUs, data on treatment demands from all the registration systems exiting in Belgium should be included in the calculations. This could not be achieved in the present work because HIV status was not collected by all these systems before 1998. However, the utilization of more recent data will involve a new source of potential bias: indeed, the detection of multiple counting will be more difficult owing to the application of the new Belgian law on privacy which forbids the identification of people when personal information is recorded in databases.

Acknowledgments

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parable national estimates of problem drug use prevalence for all EU Member states" granted by the European Monitoring Centre for Drugs and Drug Addiction.

Résumé

Objectif: Estimer le nombre of d'injecteurs de drogues (IDs) âgés de 15 à 54 ans en Belgique en 1995.

Méthode: Le nombre d'IDs a été obtenu à partir du nombre de patients HIV en vie, de la prévalence des IDs au sein de la population des patients HIV, et du taux de prévalence de séropositivité HIV dans la population des IDs. Les données utilisées proviennent du registre national HIV/SIDA et de la base de données relative aux demandes de traitement enregistrées par le système de surveillance de la Communauté française. Les limites de confiances à 95% (LC 95%) du nombre estimé d'IDs ont été calculées par la méthode du bootstrap (bias-corrected and accelerated – BCa – confidence limits).

Resultats: Il a été estimé, en 1995, que le nombre d'IDs, dans le groupe d'âge 15-54 ans, s'élevait à 20,000 (LC 95%: 10,300 – 46,300) soit un taux de prévalence de 0.36% (LC 95%: 0.18-0.83%).

Discussion: Le registre belge HIV/SIDA recense, de manière exhaustive, les cas confirmés de séropositivité HIV et de SIDA. La prévalence des IDs au sein de la population HIV séropositive peut donc être directement estimée à partir de cette base de données. La prévalence de la séropositivité HIV parmi les IDs a, quant à elle, été estimée à partir d'un échantillon de consommateurs de drogues ayant demandé un traitement en Communauté française. Cette estimation a pu être utilisée au niveau national: en effet, une enquête réalisée ultérieurement a montré que la fréquence de séropositivité HIV déclarée par des IDs en Flandre était semblable à celle de la Communauté française. En outre, la séropositivité HIV déclarée dans cette enquête s'est révélée être un bon indicateur du statut HIV défini sur base de résultats d'analyse de salive et de sang. L'intervalle de confiance de la prévalence d'ID dépend principalement de la fidélité de l'estimation de la prévalence de séropositivité HIV dans la population des IDs.

Samenvatting

Doelstelling: Een prevalentieschatting realiseren van het aantal intraveneuze druggebruikers (IDGs) tussen 15 en 54 jaar oud in 1995 in België.

Methode: De schatting van het aantal IDGs werd gebaseerd op het aantal levende HIV patiënten, de prevalentie van IDG bij HIV patiënten, en de prevalentie van HIV-seropositiviteit bij IDGs. Gegevens zijn afkomstig van het nationaal HIV/AIDS register en de databank rond vragen naar behandeling van druggebruikers ingeschreven in het registratiesysteem van de Franse Gemeenschap. Het 95% betrouwbaarheidsinterval (95% BI) van de schatting werd berekend met de „bias-corrected and accelerated bootstrap" methode.

Resultaten: In 1995 was het aantal IDGs, tussen 15 en 54 jaar oud, geschat op 20,000 (95% CL: 10,300 – 46,300), wat overeenkomt met een prevalentie van 0,36% (95% BI: 0,18-0.83%).

Bespreking: Het Belgisch HIV/AIDS register bevat op een exhaustieve wijze alle bevestigde HIV-seropositieve en AIDS gevallen. De prevalentie van IDG bij HIV patiënten kan dus rechtstreeks geschat worden op basis van dit register. De schatting van de prevalentie van zelf-gerapporteerde HIV-seropositiviteit in de populatie van IDGs in België werd gebaseerd op de gegevens van een staal van druggebruikers die vroegen naar een behandeling in de Franse Gemeenschap. Omdat de resultaten bekomen in een latere studie in Vlaanderen vergelijkbaar waren met deze bekomen in de Franse Gemeenschap, mocht deze schatting gebruikt worden op nationaal niveau. Bovendien bleek zelf-gerapporteerde HIV-seropositiviteit een goede indicator te zijn van de HIV status gebaseerd op het testen van speeksel en bloed. Het betrouwbaarheidsinterval van de schatting van IDG was voornamelijk afhankelijk van de betrouwbaarheid van de geschatte prevalentie van HIV-seropositiviteit bij IDGs.

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