Needle Sharing and Participation in the Amsterdam Syringe Exchange Program Among HIV-Seronegative Injecting Drug Users

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Synopsis

To enhance the prevention of human immunodeficiency virus infection, factors related to regular participation in the Amsterdam Syringe Exchange and the borrowing of syringes were studied in 131 HIV-seronegative injecting drug users in a 1989-90 survey. A total of 29 percent of the users reported borrowing syringes, that is injecting drugs at least once in the past 4-6 months with a needle or syringe previously used by someone else.

Users at increased risk of borrowing are previous borrowers, long term moderate-to-heavy alcohol users, current cocaine injectors, and drug users without permanent housing. Regular clients of the syringe exchange, when compared with other injecting drug users, were found more often to be frequent, long term injectors. They borrowed slightly less often than other users, but this was not statistically significant, even after controlling for frequency of injecting or other potential confounders.

The results suggest that, 5 years after the start of the Amsterdam Syringe Exchange, drug use characteristics govern an individual injecting drug user's choice of exchanging or not exchanging syringes. The conclusion is that it seems more important to direct additional preventive measures at injecting drug users with an increased risk of borrowing rather than at users who do not participate in the syringe exchange or who do so irregularly.

A SYRINGE EXCHANGE (SE) was set up in Amsterdam in 1984 to reduce the risk of hepatitis B and human immunodeficiency virus (HIV) infection among injecting drug users (IDUs) (*1*). Since then, SEs have been installed in many countries (*2*). The aim of the Amsterdam SE was to promote the one-time use of needles and syringes by making them available without charge and thus increasing their accessibility and by disseminating information about HIV risk. The thinking was that through increased access, sharing of injection equipment (and reuse of one's own equipment) would not be necessary and would become less prevalent. Prior to 1984, IDUs could obtain new injection equipment by buying it. This is still possible at pharmacies, some shops, and on the street in the red light district of the city (*3,4*).

The sharing of needles and syringes for injecting drugs has been found to be related to multiple drug use (*5,6*), younger age (*7,8*), homelessness (*9,10*), cocaine use (including injecting) (*11*), injecting drug use by a regular partner (*9*) or by peers (*12*), drug craving (*13*), little experience with injecting (*13*), and frequency of injecting (*14*). Both in Amsterdam and elsewhere, drug users who take advantage of SEs report lower levels of sharing than users who do not avail themselves of the SEs (*2,8,14-16*). Can this difference in fact be attributed to the access to syringes provided by SEs? It also may be due to motivation for risk reduction or to other characteristics of those who attend the SEs.

Results from another Amsterdam study (*3,8*) suggest that users who regularly exchange needles and syringes for new ones, when compared with

Table 1. Number of years since first using a specific drug regularly (3 days a week or more) and since first injecting among 131 HIV-seronegative current IDUs interviewed in Amsterdam between March 1989 and January 1990

Drug	Mean	Median	Range	SD
Heroin or other opiates (excluding methadone)	11.0	10.0	0–25	5.6
Methadone	5.9	5.0	0–21	4.5
Cocaine	6.2	5.0	0–25	5.5
Amphetamines	5.4	0.0	0–23	7.7
Tranquillizers[1]	2.7	0.0	0–24	5.0
Moderate-to-heavy alcohol use[2]	4.2	0.0	0–27	6.6
Injecting	10.6	10.0	0–27	6.3

[1] Barbiturates, methaqualones, benzodiazepines.
[2] At least 5 or more glasses a day 3 days a week.
NOTE: SD = standard deviation.

other IDUs, inject more frequently, for a longer period, and are more often in contact with methadone programs. In the United Kingdom, SE clients were found to be especially older, longer term injectors (*2*). In the State of Washington in the United States, clients were found more often to be frequent, long-term injectors (*16*). These characteristics could act as confounders in the relation between SE participation and needle sharing.

Another important issue is the stability of behavior over time. In the United Kingdom, contrary to expectations, SE participation was found to be highly variable over time (*17*). To our knowledge, no studies have examined the stability of needle-sharing behavior. With good access to syringes, however, it can be expected that needle-sharing is less regular than it is for those with little or no access.

Our study focused on one aspect of needle sharing—borrowing needles or syringes, or both, that have been used by somebody else to inject drugs. Since only HIV-seronegative IDUs are at risk of becoming infected through this behavior, this study was conducted among HIV-seronegative IDUs only.

The aim of the study was to determine, among both regular users of the needle exchange and others, specific groups at increased risk of borrowing, so that further prevention efforts could be directed at them. Three hypotheses that weredeemed relevant to this undertaking were examined.

1. Regular users of the SE, when compared with nonusers or irregular users, inject more frequently and over a longer period and are more inclined to use methadone daily.

2. Regular SE users borrow used needles and syringes less often than others.

3. Regular use of the SE constitutes stable behavior among current IDUs, while borrowing fluctuates over time. When comparing SE users with other IDUs, borrowing is expected to be least regular among SE users.

Methods

Sample. In 1985, an epidemiologic study of HIV infection was implemented among drug users in Amsterdam. This ongoing cohort study (*18–20*) involves voluntary and confidential HIV antibody testing and counselling, combined with an interview conducted by trained professionals using a standard demographic and behavioral questionnaire. Drug users can participate just once in the study or participate initially and then take part in the followup study as well (in which study-visits are scheduled every 4 months). For followup visits, participants receive 25 Dutch guilders (approximately $13). Participants enroll mainly through methadone programs or through a clinic on sexually transmitted diseases for addicted prostitutes, at which methadone is provided by methadone program staff members. The HIV seroprevalence among IDUs in the study cohort appears to be slightly higher than among Amsterdam IDUs recruited "on the street" (*21*) and in methadone programs (*22*). Enzyme-linked immunosorbent assays (ELISAs) are used for HIV testing. Confirmation of a positive specimen is performed by competitive ELISAs and by immunoblotting, following Centers for Disease Control criteria (*23*).

Our study concerned all 131 HIV-seronegative IDUs who were examined in the larger ongoing study between March 1989 and January 1990 (either at intake or at followup) and who reported having injected drugs in the 4–6 months preceding their visit. These visits are indicated as A and consist of an intake visit for 47 IDUs (36 percent) and a followup visit (2nd–12th visit) for 84 IDUs (64 percent), with a mean of 4.4 months (standard deviation [SD] 1.3) between visit A and their previous visit. The consecutive return visit for 113 (86 percent) of these 131 IDUs between June 1989 and December 1990, with a mean of 4.8 months since visit A (SD 2.2), is referred to as visit B.

Variables and analysis. For our purposes, current behavior was defined as behavior in the 6 months preceding an intake visit or, for followup visits, in the months since the previous visit.

Hypotheses 1 and 2 were studied cross-sectionally at visit A. To study hypothesis 1, it was necessary

to determine whether "regular exchange use," that is, currently obtaining 90 percent or more of new needles and syringes at the SE, was associated with current frequency of injecting, duration of injecting, or current daily methadone use.

The 90-percent criterion was chosen because it gave a more clear-cut division between the two subgroups (75 exchangers, mean 99 percent, median 100 percent versus 55 nonexchangers, mean 20 percent, median 0 percent) than the 100-percent criterion (65 exchangers, mean and median 100 percent versus 65 nonexchangers, mean 31 percent, median 10 percent).

To study hypothesis 2, we first examined the relation between regular exchange use and "borrowing," that is, currently having injected at least once with a needle or syringe, or both, previously used by someone else. Second, we studied social and drug use indicators of borrowing drawn from previous research on determinants of needle sharing. Third, we studied the effect of regular exchange use on borrowing, while controlling for independent and significant indicators of borrowing and other potential confounders, including five demographic variables: sex, age, nationality, number of years living in Amsterdam,—previously found as an independent predictor of HIV serostatus (*18*)—and kind of visit (intake versus followup) in the larger cohort study, because less injecting risk behavior was found to be associated with followup visits compared with intake visits (*19*).

To study hypothesis 3, a longitudinal analysis was conducted by comparing behavior at visits A and B among persons who currently injected at both visits.

Statistics include the Chi-square test of independence, the two-sample *t*-test, the Mann-Whitney (M-W) test for two independent samples, the Pearson correlation coefficient, and the Spearman rank order correlation coefficient; *P* values less than 0.05 were considered significant. In multivariate analyses, logistic regression modelling was used to determine the independent and significant (with $P<0.05$) contribution of variables in indicating regular exchange use (hypothesis 1) and borrowing (hypothesis 2). The contribution of these variables in indicating outcome is expressed in odds ratios (ORs) and 95 percent confidence intervals (CIs).

Results

Characteristics of the sample. Because of missing data, the effective sample size at visit A per variable ranges from 123 to 131 persons. Percentages for variables were calculated based on the number of persons for whom data were available. The sample consisted of 80 men (61 percent) and 51 women (39 percent) HIV-seronegative IDUs, who have lived in Amsterdam for a mean of 12.4 years (SD 12.5). Their mean age was 31.4 years (SD 5.9, range 19–47). Of the 131, 86 (66 percent) were Dutch, 22 (17 percent) German, and 23 (17 percent) were of another nationality. Of the total, 114 (87 percent) study participants had permanent housing, that is, they were not homeless and did not live in a squatter house. Of the total, 58 (44 percent) had a steady sexual partner, 30 of whom were current drug injectors. Currently working as a prostitute (for money) was reported by 41 IDUs (32 percent).

Table 1 shows duration of drug use by all 131 IDUs. Of the total, 128 (98 percent) reported

Table 2. Variables considered as indicators of borrowing and their bivariate association with borrowing, among 125 HIV-seronegative current injecting drug users in Amsterdam, 1989–90

Variable	Nonborrowers (N = 89)	Borrowers (N = 36)	P
Sex:			
Percent male	60	61	[1] ns
Nationality (percent):			
Dutch	65	64	[2] ns
German	14	25	[2] ns
Other	21	11	[2] ns
Age:			
Mean years	31.5	31.0	[3] ns
Percent at intake visit as opposed to followup	30	50	[1] 0.04
Mean (**median**) number of years:			
Living in Amsterdam	12.6 **7**	12.3 **6.5**	[4] ns
Regularly injecting	7.9 **7**	7.7 **6.5**	[4] ns
Regularly using:			
Cocaine	4.1 **3**	5.5 **4**	[4] ns
Tranquillizers	1.7 **0**	2.8 **1**	[4] 0.02
Alcohol, moderate-to-heavy	2.0 **0**	5.7 **2**	[4] 0.004
Current frequency of injecting (percent):			[2] ns
More than once daily	45	58	
Once daily	29	22	
Less than once daily	26	19	
Current daily injecting (percent):			
Cocaine	11	25	[1] ns
Heroin and cocaine	32	39	[1] ns
Permanent housing (percent)	92	78	[1] 0.03
Having a currently injecting steady sexual partner (percent)	23	25	[1] ns
Current use of tranquillizers (percent)	39	50	[1] ns
Current daily use of methadone (percent)	73	72	[1] ns

[1] χ^2 with df = 1. [2] χ^2 with df = 2. [3] Student's *T*-test. [4] Mann-Whitney test.
NOTE: ns = not significant.

current use of heroin or morphine or both. Current daily methadone use was reported by 96 IDUs (73 percent), with a mean daily dose of 47 milligrams (SD 17.6). A history of borrowing needles or syringes was reported by 92 (74 percent) participants, and a history of being "clean" for at least 1 month, that is, not being opiate dependent outside an institution after becoming dependent, by 78 (60 percent), with the longest continuous period of nondependence 12.6 months on average.

With regard to current daily use of noninjected drugs, those used most often were methadone (73 percent), benzodiazepines (23 percent), five or more glasses of alcohol daily (22 percent), and heroin (11 percent). On current use of injected drugs, 36 (27 percent) reported injecting heroin daily, 21 (16 percent) injected cocaine daily, 44 (34 percent) used heroin plus cocaine ("speedball") daily, and 7 (5 percent) used amphetamines daily. Frequent injecting, defined as more than once daily on average, was reported by 66 (50 percent); 35 (27 percent) reported injecting once daily on average, and 30 (23 percent) less than once daily. A total of 67 (51 percent) reported regular injecting, that is, every week. Regular injecting was positively related with frequent injecting ($\chi^2 = 23.55$, df = 2, $P = 0.0001$).

The 117 IDUs (89 percent) who injected in the previous month reported a mean of 3.7 injections on injecting days in that previous month (SD 2.9, median 3, range 1–15), with the same needle used a mean of 1.8 times in general (SD 1.3, median 1, range 1–8).

Hypothesis 1: determinants of regular exchange use. Among 130 respondents, 75 (58 percent) were regular users of the syringe exchange. The number of years since first injection was not significantly different for regular exchange users (mean 10.8, SD 6.2) and other IDUs (mean 10.5, SD 6.5). The number of years injecting regularly was slightly different, however. Regular users of the exchange reported a mean of 8.8 years of injecting regularly (SD 6.2) versus 6.9 years (SD 5.6) among other IDUs (M-W test, $P = 0.10$). Frequent injecting was reported by 48 (64 percent) of the regular exchange users, compared with 18 (33 percent) among the other IDUs ($\chi^2 = 19.5$, df = 2, $P < 0.0001$). Daily methadone use was reported by 54 (72 percent) of the regular exchangers, versus 41 (75 percent) among the other IDUs (not significant).

In multivariate analysis, frequency of injection was the strongest indicator of regular exchange use, while duration of regular injecting contributed at a marginal level and daily methadone use not at all. With the first two variables in the model, the odds ratio of currently injecting more than once daily compared with less than once daily was 8.65 (95 percent CI = 3.05–24.54) and of injecting once daily compared with less than once 4.47 (95 percent CI = 1.46–13.69). The odds ratio for number of years of regularly injecting (per year) was 1.07 (95 percent CI = 1.00–1.14). Daily methadone use was not a confounder.

Hypothesis 2: the effect on borrowing of regular exchange use. Of 125 respondents, 36 (29 percent) reported borrowing previously used needles or syringes or both. Of 30 borrowers about whom more data were available, 5 had borrowed exclusively from their steady sexual partner. Only one of these IDUs reported that this steady partner recently tested HIV-negative.

Of the 75 regular exchange users, 18 (24 percent) reported borrowing, while 18 (33 percent) of the other 55 IDUs did so (OR = 0.63, 95 percent CI = 0.29–1.38). This difference is not statistically significant ($\chi^2 = 1.35$, df = 1, $P = 0.24$). The chart shows this difference between regular exchange users and other IDUs corrected for frequency of injecting. There is no confounding or interaction. For 30 borrowers (15 regular exchange users, 15 other IDUs) more data on borrowing were known. Regular exchange users reported a median of 2 times borrowed (range 1–180), as compared with a median of 1 (range 1–10) among other IDUs (M-W test, $P = 0.52$). Four regular exchange users (27 percent) reported disinfecting borrowed equipment (either with bleach or by boiling), as compared with five other IDUs (33 percent) (Fisher's exact test, $P = 1.0$). Thus, with regard to borrowing and disinfecting, no significant differences between regular exchange users and other IDUs were found.

Reuse of one's own needle and syringe was different: 48 (66 percent) of the regular exchange users reported using the same needle only once, compared with 21 (38 percent) of the other IDUs ($\chi^2 = 9.6$, df = 1, $P = 0.002$).

Table 2 lists (below five demographic variables) the social and drug use variables examined and their bivariate associations with borrowing. In multivariate analysis, the following three variables were independent and significant indicators of borrowing: (*a*) number of years with moderate-to-heavy alcohol use, (*b*) permanent housing, and (*c*) frequency of cocaine injecting.

The model that resulted when regular exchange use was entered is shown in table 3. As can be seen, the adjusted OR for regular exchanging is

0.60, which is not statistically significant, and not different from the bivariate relation. Duration of injecting, daily methadone use, and demographic variables were not confounders for the effect of regular exchange use on borrowing. Frequency of injecting was found to be a slight confounder. When entered into the model in table 3, the adjusted OR for regular exchange use became 0.49 (95 percent CI = 0.18–1.31). The interaction term of frequency of injecting and regular exchange use did not improve the model.

Hypothesis 3: is regular exchange use a stable habit and borrowing not? Among the 113 IDUs seen at visit B, 5 had seroconverted since visit A. This corresponds to a seroconversion rate of 11.0 per 100 person-years (95 percent CI = 0.62–19.18). Among the 113 IDUs, 101 reported current injecting. Borrowing since visit A was reported by 22 of these 101 current injectors (22 percent), and regular exchange use by 69 (68 percent). In a longitudinal analysis, among the 101 who were current injectors at both visits A and B, regular exchange use at A was related to regular exchange use at B (Pearson's $R = +0.45$, $P<0.001$, $N=100$): of regular exchange users at A, 84 percent are again regular exchange users at B.

Borrowing at A is related to borrowing at B ($R = +0.32$, $P<0.01$, $N=93$): of borrowers at A, 42 percent report borrowing at B, while among nonborrowers at A only 13 percent report borrowing at B. The relation between borrowing at A and at B was different for regular exchange users and other IDUs, although contrary to our hypothesis. Among regular exchange users at A, a strong relation between borrowing at A and B was found ($R = +0.63$, $P<0.001$): of the IDUs who reported borrowing at A, 62 percent also reported borrowing at B, compared with 4 percent among those not reporting borrowing at A. No significant relation was found among the IDUs who did not regularly exchange: $R = -0.11$ (23 percent of borrowers at A and 33 percent of nonborrowers at A reported borrowing at B). The strong positive relation between borrowing at A and B among regular exchange users, and the absence of such a relation among other IDUs, was also found after controlling for frequency of injecting.

Discussion

One of the main findings of our study was that regular exchange use may be attributable to differences in drug use. Similar to earlier findings (*8*), the Amsterdam SE seems most attractive to frequent, long-term injectors. In our sample, no indications were found that daily methadone users were regular SE clients more often than other IDUs.

Table 3. Logistic regression model of indicators of borrowing among 124 HIV-seronegative current injecting drug users, Amsterdam, 1989–90

Indicators	Adjusted odds ratio	95 percent confidence interval
Regular exchanging:		
No	1	...
Yes	0.60	0.25– 1.44
Number of years with moderate-to-heavy alcohol use[1]	1.11	1.04– 1.20
Permanent housing:		
Yes	1	...
No	4.17	1.28–13.62
Frequency of current cocaine injecting:		
Monthly or less	1	...
Weekly	2.10	0.75– 5.84
Daily	3.76	1.31–11.79

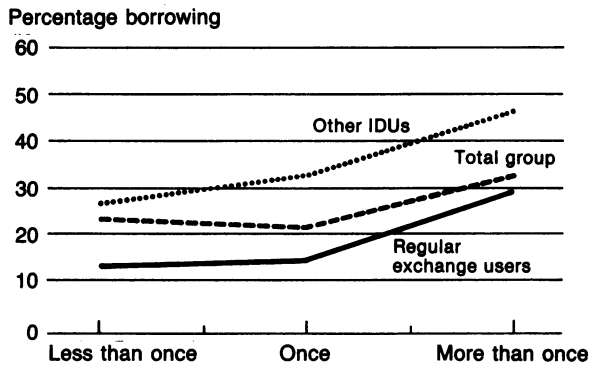
[1] The adjusted odds ratio corresponds to each increase of 1 year (for example, 5 years is associated with a risk of borrowing that is 1.11 times higher than 4 years).

Before further discussion of our findings, we would like to reiterate that the sample consisted of HIV-seronegative IDUs only, that is, IDUs at risk of HIV infection. Many studies of determinants of needle sharing concern IDUs with unknown HIV-serostatus (*5–12*). Comparisons of results, therefore, need to be made cautiously. The self-reported data may be biased by memory loss or a tendency to give socially desirable answers. Also, the sample consisted of volunteers for an HIV test that was combined with an epidemiologic study of HIV. Therefore, one should be careful in generalizing findings to the population of HIV-negative IDUs in Amsterdam.

Although 74 percent of the IDUs in the sample had a history of borrowing, they remain seronegative so far. Nevertheless, it is not a "safe" group, as indicated by the seroconversion rate found at followup.

Groups at increased risk of borrowing were long-term moderate-to-heavy alcohol users, current cocaine injectors, and persons without permanent housing. When examining the interrelations between the long-term drug-use variables, the number of years of alcohol use is most strongly related to years of tranquilizer use (Spearman's $R = 0.48$). The alcohol variable thus reflects a history of alcoholism or polydrug use, or both, in addition to the primary opiate addiction. Polydrug use has been found related to needle sharing (*5,6*), as have

Borrowing among 72 regular exchange users and among 52 other injecting drug users (IDUs) by average daily frequency of injecting



homelessness (*9,10*) and cocaine use (including cocaine injecting) (*7,11,24,25*). Regular exchange users were found to borrow less often than other IDUs for each category of frequency of injecting. This relation was not statistically significant, however, even after controlling for other potential confounders.

Regular exchange use was a rather consistent behavioral characteristic over an average period of 5 months. This suggests that client turnover is a smaller problem than in the United Kingdom (*17*). It is difficult to compare findings, however, because of differences in study design and measures. Contrary to our hypothesis, borrowing seems to be especially regular among the group of regular exchange users, while it varies over time among other IDUs. This finding could not be explained by differences in frequency of injecting. Thus, another group at increased risk of borrowing are previous borrowers, especially among regular exchange users.

What are the implications of our findings for further prevention efforts? The absence of "hard" indications for a lower level of borrowing among regular exchange users is in line with the results of other studies among IDUs participating in the cohort study (*19,20,26*). In our view, however, this does not necessarily lead to the conclusion that the Amsterdam SE has no preventive effect.

First, if IDUs with a relatively high risk level participate in the cohort study (*21,22*), this may obscure the differences between regular exchange users and other IDUs with regard to borrowing. Also, the difference in borrowing between regular exchange users and other IDUs may reflect a real difference in the population that may not have reached statistical significance in our study because of the small sample size.

Second, we found that regular exchange users reuse their own needles and syringes less often than other IDUs, which may indicate better access to syringes.

Third, we found that borrowing—as well as not borrowing—is particularly consistent among regular users of the exchange. At the outset, we assumed that regularity of borrowing is indicative of the degree of access to syringes. This finding would thus lead to the unlikely conclusion that regular exchange users have less access to syringes than other IDUs. A better explanation may be that borrowing (and not borrowing) among regular exchange users is dependent on certain individual characteristics, while for other IDUs—among whom borrowing behavior was not consistent over time—it is more situationally determined. Since regular exchange users more often are frequent, long-term injectors, they may possess other individual characteristics, such as psychopathology (*27*), presently not measured, that may confound the effect of regular exchanging on borrowing.

Fourth, there may be a time effect. A study in the United Kingdom (*28*) compared sharing behavior of users and nonusers of SEs from 1987 to 1990. Sharing declined in both groups, but it did so most strongly among nonusers. While nonusers had higher levels of sharing than users in 1987, this difference had almost disappeared in 1990. There are indications of a similar development in Amsterdam (*26*). Thus, in 1984–85, the SE may have attracted IDUs motivated by risk reduction, while, 5 years later, a motivation for risk reduction may be equally present among regular exchange users and other IDUs. Our findings suggest that IDUs with different injecting behavior find different ways to supply themselves with new syringes according to their needs. Financial motives, for example, may induce infrequent injectors to buy syringes and frequent injectors to exchange them. If the degree of access to syringes, according to one's needs, and the degree of motivation for risk reduction is similar among regular exchange users and others, then regular SE participation, compared with irregular participation or none at all, should not be expected to have a direct effect on borrowing.

Therefore, factors like degree of access to new syringes (in relation to the amount needed) and motivation for risk reduction should be taken into account in studies of SE users and nonusers and in studies of seroconversion rates among these groups. Furthermore, results from studies of SEs in countries where new syringes can be purchased relatively

easily (like the United Kingdom and the Netherlands) and access is relatively good cannot be generalized to countries (like the United States) where buying injection equipment is illegal and access is relatively bad.

With these caveats in mind, the question is which prevention efforts might help to reduce the risk behavior we have found. In our view, it seems more important to direct additional preventive measures at IDUs with an increased risk of borrowing than at IDUs participating in the SE irregularly or not at all. Three groups at increased risk of borrowing (cocaine injectors, long-term alcohol users, and IDUs without permanent housing) may have in common difficulties with advance planning and with keeping adequate supplies of new syringes. In that case, increased access to syringes, through extending opening hours at locations where syringes can be bought or exchanged, and through increasing the number of such locations, may be helpful. If the major obstacle is the carrying of new syringes, however, then provision of small bottles of bleach seems an adequate measure, provided that IDUs do not have the same objections against carrying bleach.

References

1. Buning, E. C., et al.: Preventing AIDS in drug addicts in Amsterdam (letter). Lancet No. 8495: 1435, June 21, 1986.
2. Stimson, G. V.: Syringe-exchange programmes for injecting drug users. AIDS 3: 253–260 (1989).
3. Hartgers, C., et al.: Intraveneus druggebruik en het spiritenomruil programma in Amsterdam. T Soc Gezondheidsz 66: 207–210 (1988).
4. Van Santen, G. W.: Spuitverkoop aan druggebruikers in Amsterdamse apotheken. Gemeentelijke Geneeskundige en Gezondheidsdienst, Amsterdam, 1990.
5. Dolan, M. P., et al.: Characteristics of drug abusers that discriminate needle-sharers. Public Health Rep 102: 395–398 July-August 1987.
6. Klee, H., et al.: AIDS-related risk behaviour, polydrug use and temazepam. Br J Addict 85: 1125–1132 (1990).
7. Guydish, J. R., et al.: Changes in needle sharing behavior among intravenous drug users: San Francisco, 1986–88. Am J Public Health 80: 995–997 (1990).
8. Hartgers, C., et al.: The impact of the needle and syringe-exchange programme in Amsterdam on injecting risk behaviour. AIDS 3: 571–576 (1989).
9. Klee, H., et al.: Factors associated with risk behaviour among injecting drug users. AIDS Care 2: 133–145 (1990).
10. Popkin, S. J., et al.: Homelessness and risk behaviours among IVDUs in Chicago and New York. Presented at the VIIth International Conference on AIDS, Florence, Italy, June 16–21, 1991.
11. Woods, W. J., et al.: Treatment helps reduce needle sharing in San Francisco. Presented at the VIIth International Conference on AIDS, Florence, Italy, June 16–21, 1991.
12. Magura, S., et al.: Determinants of needle sharing among intravenous drug users. Am J Public Health 79: 459–462 (1989).
13. Grund, J. P. C., Kaplan C. D., and Adriaans, N. F. P.: Needle sharing in the Netherlands: an ethnographic analysis. Am J Public Health 81: 1602–1607 (1991).
14. Watters, J., Cheng, Y-T., and Prevention Point Research Group: Syringe exchange in San Francisco, preliminary findings. Presented at the VIIth International Conference on AIDS, Florence, Italy, June 16–21, 1991.
15. Brettle, R. P.: HIV and harm reduction for injection drug users. AIDS 5: 125–136 (1991).
16. Hagan, H. et al.: Lower HIV-seroprevalence, declining HBV incidence and safer injection in relation to the Tacoma syringe exchange. Presented at the VIIth International Conference on AIDS, Florence, Italy, June 16–21, 1991.
17. Stimson, G. V., Alldritt, L., Dolan, K. and Donoghoe, M.: Syringe exchange schemes for drug users in England and Scotland. BMJ 296: 1717–1719 (1988).
18. Van den Hoek, J. A. R., et al: Prevalence and risk factors of HIV infections among drug users and drug-using prostitutes in Amsterdam. AIDS 2: 55–60 (1988).
19. Van den Hoek, J. A. R., Van Haastrecht, H. J. A. and Coutinho, R. A.: Risk reduction among intravenous drug users in Amsterdam under the influence of AIDS. Am J Public Health 79: 1355–1357 (1989).
20. Van Haastrecht, H. J. A., et al.: The course of the HIV epidemic among intravenous drug users in Amsterdam, The Netherlands. Am J Public Health 81: 59–62 (1991).
21. Fennema, J. S. A., van Ameijden, E. J. C., van den Hoek, J. A. R., and Coutinho, R.A.: Incorrect prediction of HIV seroprevalence among intravenous drug users contacted on the street in Amsterdam. Presented at the VIIth International Conference on AIDS, Florence, Italy, June 16–21, 1991.
22. Hartgers, C., et al.: De HIV-prevalentie onder druggebruikers die methadon verstrekt krijgen bij de drugsafdeling van de Gemeentelijke Geneeskundige en Gezondheidsdienst te Amsterdam. T Soc Gezondheidsz 70: 275–279 (1992).
23. Interpretation and use of the Western blot assay for serodiagnosis of human immunodeficiency virus type I infections. MMWR 38 (suppl 7): 1–7 (1989).
24. Amsel, Z., Battjes, R. and Pickens, R.: Cocaine use and HIV risk among intravenous opiate addicts. Presented at the VIth International Conference on AIDS, San Francisco, CA, June 20–24, 1990.
25. Todts, S., Avonts, D., Vercauteren, G. and Piot, P.: HIV-seroprevalence and risk behaviour in IV drug users in a low HIV seroprevalence city in Belgium. Presented at the VIth International Conference on AIDS, San Francisco, CA, June 20–24, 1990.
26. Van Ameijden, E. J. C., van den Hoek, J. A. R., and Coutinho, R. A.: The harm reduction approach and risk factors for HIV seroconversion in injecting drug users, Amsterdam. Am J Epidemiol. In press.
27. Hartgers, C., van den Hoek, J. A. R., Coutinho, R. A., and van der Pligt, J.: Psychopathology, stress and HIV-risk injecting behaviour among drug users. Br J Addict 87: 857–865 (1992).
28. Donoghoe, M. C., Dolan, K., and Stimson, G. V.: Changes in injector's HIV risk behaviour and syringe supply in UK 1987–1990. Presented at the VIIth International Conference on AIDS, Florence, Italy, June 16–21, 1991.