Incidence of heroin use in Zurich, Switzerland: a treatment case register analysis

Carlos Nordt, Rudolf Stohler; Psychiatric University Hospital, Militärstrasse, Zurich, Switzerland

Correspondence to: cnordt@bli.unizh.ch

Summary

Background Switzerland has been criticised for its liberal drug policy, which could attract new users and lengthen periods of heroin addiction. We sought to estimate incidence trends and prevalence of problem heroin use in Switzerland.

Methods We obtained information about first year of regular heroin use from the case register of substitution treatments in the canton of Zurich for 7256 patients (76% of those treated between 1991 and March, 2005). We estimated the proportion of heroin users not yet in substitution treatment programmes using the conditional lag-time distribution. Cessation rate was the proportion of individuals leaving substitution treatment programmes and not re-entering within the subsequent 10 years. Overall prevalence of problematic heroin use was modelled as a function of incidence and cessation rate.

Findings Every second person began their first substitution treatment within 2 years of starting to use heroin regularly. Incidence of heroin use rose steeply, starting with about 80 people in 1975, culminating in 1990 with 850 new users, and declining substantially to about 150 users in 2002. Two-thirds of those who had left substitution treatment programmes re-entered within the next 10 years. The population of problematic heroin users declined by 4% a year. The cessation rate in Switzerland was low, and therefore, the prevalence rate declined slowly. Our prevalence model accords with data generated by different approaches.

Interpretation The harm reduction policy of Switzerland and its emphasis on the medicalisation of the heroin problem seems to have contributed to the image of heroin as unattractive for young people. Our model could enable the study of incidence trends across different countries and thus urgently needed assessments of the effect of different drug policies.

Introduction

Switzerland has been criticised for its liberal drug policy.[1,2] Specifically, the implementation of harm reduction measures, such as drug consumption rooms, needle-exchange services, low-threshold methadone programmes, and heroin-assisted treatments, have been thought to make potential users think that harm will not arise from use of illicit drugs.[3,4] According to this critique, such a policy would lead to a growing number of new users of street drugs and lengthen the period of heroin addiction. Contrary to this belief, stable prevalence of heroin use since 1994 has been reported in Switzerland.[5–7]

Prevalence rates are important for estimation of the proportion of drug users who are in treatment, but provide only indirect information about trends in incidence of heroin misuse. Unfortunately, data for incidence as a direct measure of the ongoing spread of drug use are rarely available.[8–11]

Zurich is the most populous canton of Switzerland, comprising about a fifth of the country's population with 1 200 000 inhabitants, about 350 000 of whom live in the city. Open drug scenes developed in the early 1980s in the city of Zurich, culminating in 1986–92 at the Platzspitz ("Needle Park") and in 1993–95 at the former railway station Letten. Drug mortality data indicate that about 25% of Switzerland's heroin users live and die in Zurich.[12,13]

Since 1991, in the canton of Zurich there have been no requirements to qualify for substitution treatment other than being heroin dependent. Mandatory health insurance covers the costs of treatment and patients may choose their physician among those who practise in the canton. After special instruction in addiction medicine, any physician, whether working in a private practice or in an institution, may provide substitution treatments with methadone or buprenorphine. Therefore, there are enough treatment slots for all those who apply, at least since 1992.

Since 1991, the Research Group on Substance Use Disorders of the Psychiatric University Hospital of Zurich has been entrusted by the government with the long-term monitoring of substitution treatments in the canton of Zurich. We were therefore able to directly assess whether and how incidence, prevalence, and duration of heroin dependence have changed during past decades.

Methods

Database

The Swiss law on narcotics requires registration and evaluation of substitution treatments for opioid dependence.[14] Since 1991, our research group has been mandated by the health authorities to operate an anonymised case register of substitution treatments with methadone or buprenorphine. Providers must make anonymised information available at the beginning and at the end of each treatment episode, or at least twice annually. By means of a personal code (initials of first name and last name and date of birth) patients are identified unequivocally, and complete reporting is ensured by different means (eg, control of prescriptions, admonishment of those who do not provide information). From 1991 to 1996, the proportion of missing entry forms increased from 12% to 30%. Since the introduction of a database in 1997, the proportion of missing data has dropped below 3%. This database software produces lists and letters for providers, and checks the appropriate range of data inputs. Further details of the register can be found elsewhere.[15,16]

Data are obtained with a standard reporting form. At the beginning of each treatment patients are asked about their first year of regular heroin use (defined as more than four times a week during a month). Moreover, data for drug and alcohol use (kind and quantity of substances, frequency, and type of application), psychosocial characteristics (housing, education, work, friends, and family), health, former treatments, methadone or buprenorphine dose, and performance (results of urinalyses, number of take-home doses) are obtained.

Analysis of these data has been approved by the ethics committee of the canton of Zurich.

Statistical analysis

Calculations were based on data from the case register for substitution treatments in the canton of Zurich. We included all patients in our catchment area who were enrolled in substitution treatment between 1991 and March, 2005 (n=9518).

To enhance the quality of analyses, patients with data that indicated that they had begun to use heroin regularly before their 12th year of age or after their first substitution treatment were excluded (n=421; 2·3% of all reports). If patients entered treatment more than once and provided different years for their start of regular heroin use, a mean value was calculated if the largest difference was 3 years. For the remaining patients we assumed that the missing data did not strongly deviate from those obtained for 7256 (76%) patients with a known year of first regular heroin use.

To estimate the lag period between first regular use and first substitution treatment, we applied the method proposed by Hickman and colleagues.[9] To avoid bias due to the restricted number of treatment slots before 1992, we included only individuals (n=2384) who had begun to use heroin regularly between 1992 and 2004 (table). We estimated the conditional lag distribution of this 13-year period with a general linear model using five parameters (a linear and a quadratic term of the lag time, and dummy variables for the three shortest lag time periods) to test for differences by sex, age-group, and route of administration.

We calculated the cessation rate per year as the percentage of patients leaving substitution treatment in a given year and not reappearing within the subsequent 10 years. Thus, the cessation rate included not only remission (abstinence from heroin use), but also other reasons for not reappearing in substitution treatment, such as mortality, inclusion in a long-lasting heroin maintenance treatment programme, or emigration. Finally, we modelled prevalence rates by cumulating data for all individuals who appeared at least once in our register, and subtracting a constant proportion by using the estimate of the cessation rate. Calculations were done with SAS version 8.02 and SPSS version 11.5 software.

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The funding source had no role in study design, data collection, data analysis, data interpretation, or writing of the report. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

Year of onset	Year of first treatment													Total
	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	
1992	26	98	102	90	35	29	32	26	16	12	18	11	13	508
1993	0	26	85	85	51	47	34	19	11	13	11	7	14	403
1994	0	0	26	50	54	41	32	24	16	12	17	7	7	286
1995	0	0	0	12	51	53	33	14	18	18	12	11	10	232
1996	0	0	0	0	20	72	45	25	21	17	14	8	11	233
1997	0	0	0	0	0	24	44	33	19	23	23	11	13	190
1998	0	0	0	0	0	0	14	30	33	15	19	14	6	131
1999	0	0	0	0	0	0	0	16	37	25	22	10	12	122
2000	0	0	0	0	0	0	0	0	12	37	24	18	12	103
2001	0	0	0	0	0	0	0	0	0	18	22	12	16	68
2002	0	0	0	0	0	0	0	0	0	0	15	23	17	55
2003	0	0	0	0	0	0	0	0	0	0	0	20	22	42
2004	0	0	0	0	0	0	0	0	0	0	0	0	11	11
Total	26	124	213	237	211	266	234	187	183	190	197	152	164	2384

Table: **Observed numbers of individuals with onset of regular heroin use in 1992–2004, by year of first visit to a treatment facility**

Results

Since the start of the case register in 1991 we have registered 9518 patients who underwent 24 163 treatment episodes up to March, 2005 (uninterrupted substitution treatments by the same provider). Of these, 2996 treatments—provided by 21 institutions and 309 doctors in private practice—were still ongoing in 2005. From 1998, the number of substitution treatments remained stable (between 3094 and 3345 per quarter), whereas the number of patients decreased slightly from 3788 in 1998, to 3698 in 2004. During the same period, admissions to, as well as cessations of, substitution treatments dropped from about 500 to 300 per quarter. The percentage of first admissions (16–29% per quarter), however, did not differ over time, as the duration of treatments did (retention rate for 1 year was between 33% and 41%). From 1991 to 1994, patients were between 28 years and 29 years old (SD 5·6–6·3). Since 1995, mean age increased by 9 months every year (2004: 36·3 years, SD 7·4). During the entire study period, the percentage of women (30%) did not change. Over the last 13 years, the proportion of injectors (lifetime) declined from 90% to 72%.

66% (1987) of the patients who left substitution treatment in 1991, 1992, or 1993 re-entered at least once during the next 10 years. Only 16 (1%) people returned after more than 10 years and 1000 (33%) never reappeared in the case register, which equals a cessation rate of 0·04 per year. After 2 years of regular heroin use, every second woman (47%) and every second man (47%, p=0·722) entered substitution treatment (figure 1), if they ever did so within 13 years. Half the individuals who started regularly using heroin at 18 years of age or older began substitution treatment within 2 years. On the other hand, it took 3 years until every second person entered substitution treatment if onset of regular heroin use was at 17 years of age or younger (p<0·0001). Within 2 years after onset of regular heroin use more non-injectors (52%) than injectors (42%, p=0·0002) began substitution treatments.
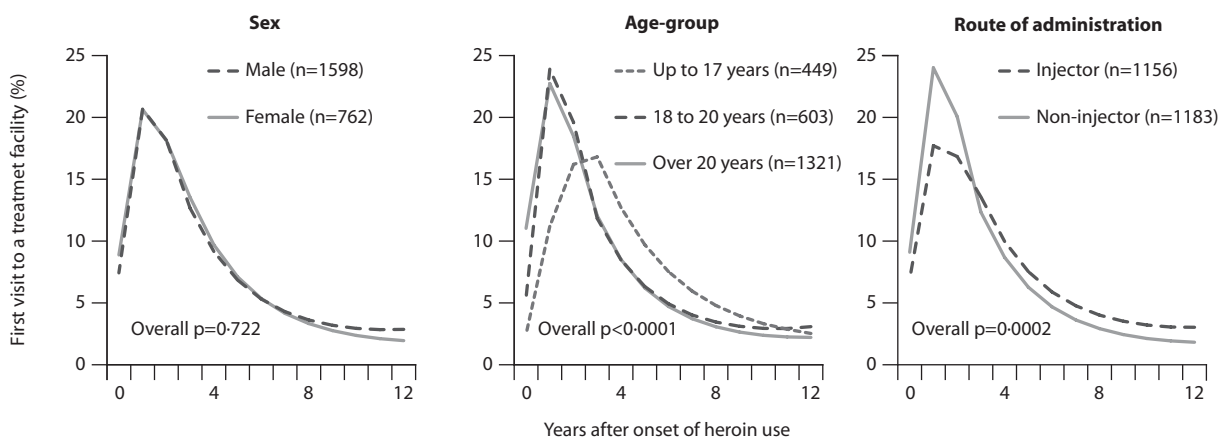

Figure 1: **Lag-time distribution between onset of regular heroin use and first visit to a treatment facility**

Adjustment of the observed incidence numbers by lag-time distribution only affected the overall shape of the heroin incidence curve to a small extent (figure 2). There was a steep rise, starting with about 80 individuals in 1975 and culminating in 1990 with 850 new users, and also a steep decline to about 150 users in 2002. After 1980, the shape of the incidence curves did not differ according to sex or place of first treatment (urban or rural). The mean age of first regular heroin use of men rose from 19 years of age in 1980 to 25 years of age in 2000, whereas for women the mean age of onset was constantly one year lower. More than 500 people from each birth cohort between 1966 and 1971 were in substitution treatment at least once in the canton of Zurich, which equals a rate of 25 per 1000 people of this age-group (ie, 35 per 1000 men and 15 per 1000 women).
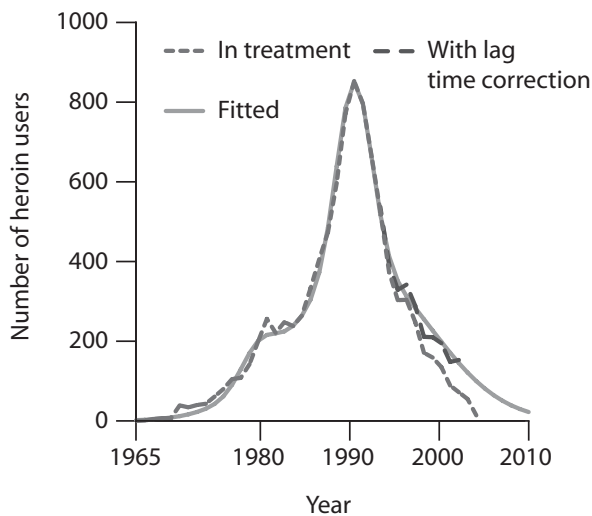
Figure 2: **Incidence of regular heroin use in the methadone case register of the canton of Zurich, March 2005**

The population incidence of heroin use is shown in figure 3. There was a peak in 1990 with 0·73 per 1000 inhabitants. However, incidence dropped substantially by a factor of four from 1990 onward. Cumulation of incidence values and adjustment for losses by the cessation rate resulted in a prevalence curve (figure 4) that accords very well with estimates from a multiple-indicator approach,[6] a dynamic model for open populations,[7] surveys,[5] or rough estimates.[17,18] Taking the modelled prevalence curve as reference for all problematic heroin users in the canton Zurich suggests that since 1994 more than every second problematic heroin user was in substitution treatment. This model forecasts a prevalence of 64% of users in treatment by the year 2010.
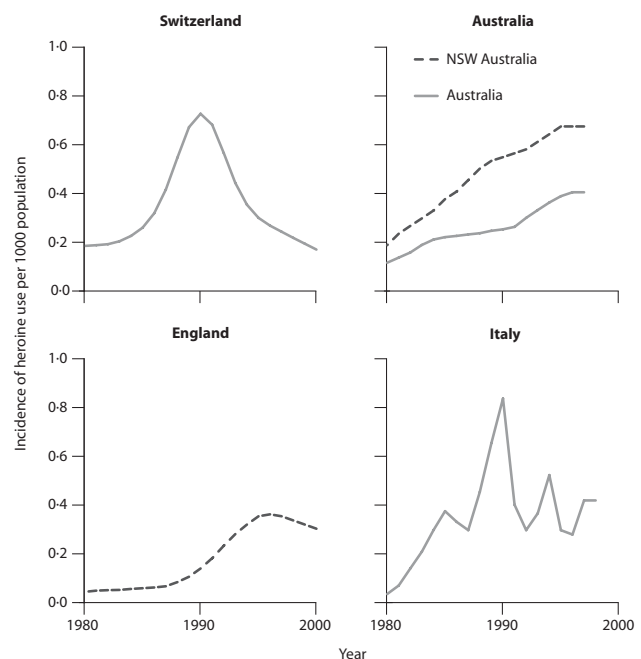
Discussion

The incidence of regular heroin use in the canton of Zurich started with about 80 new users in 1975, increased to 850 in 1990, and declined to 150 in 2002, and was thus reduced by 82%. Incidence peaked in 1990 at a similar high level to that ever reported in New South Wales, Australia, or in Italy. But only in Zurich has a decline by a factor of four in the number of new users of heroin been observed within a decade. This decline in incidence probably pertains to the whole of Switzerland because the number of patients in substitution treatment is stable,[19] the age of the substituted population is rising,[19] the mortality caused by drugs is declining,[13] and confiscation of heroin is falling.[13] Furthermore, incidence trends did not differ between urban and rural regions of Zurich. This finding is suggestive of a more similar spatial dynamic of heroin use for Switzerland than for other countries.[10,20,21]

As intended by the Swiss drug policy, we identified a rather short duration of untreated heroin misuse. Whereas every second heroin user entered substitution treatment within 2 years, it took about 4 years in Italy.[10] Because the respective data from Hickman and colleagues[9] cover only 8 years, their results cannot be directly

Figure 3: **Estimated incidence of heroin use in countries where trends over more than a decade have been published[8,10,11]**
England: De Angelis (2004),[8] figure 3, model 4;
Italy: Ravà (2001),[10] figure 18, model 1;
Australia: Law (2001),[11] figure 4 and figure 6.
Data have been converted to incidence rates per 1000 population.

compared, but a full lag-time distribution is probably the same as that for Italy. Like Hickman and colleagues,[9] we noted a longer lag time for individuals with an early onset of heroin use. Although we did not find a difference between the sexes we did observe a shorter lag time for non-injectors than for injectors.
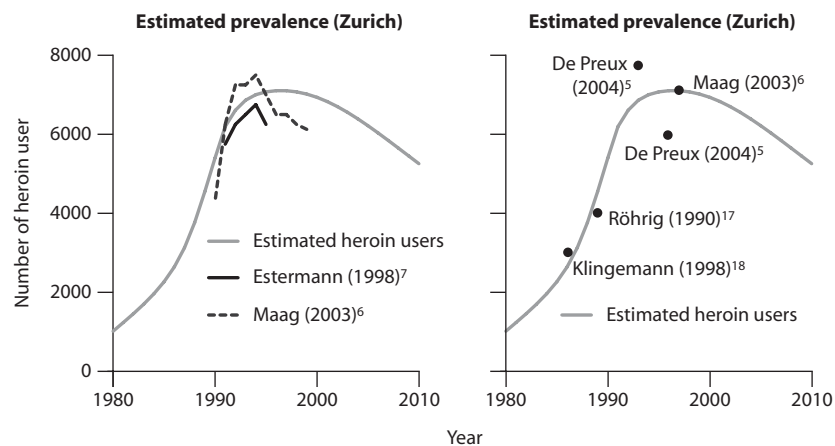

Figure 4: **Estimates of prevalence of problematic heroin use in Zurich, Switzerland[5–7, 17,18]**
Data estimated for Switzerland[5–7] were divided by a factor of four (see introduction).

Our findings also suggest that virtually all people re-enter substitution treatment within 10 years, if they ever do so. Therefore, if one out of three patients does not need a further substitution treatment within the following 10 years, this equals a cessation rate of 0·04 per year for those dependent on opioids, which could be a result of mortality, abstinence, inclusion in a long-lasting heroin maintenance programme, or emigration. This estimated cessation rate is lower than that assumed by Law[11] (0·05) for Australia and the rates applied by De Angelis[8] for England (0·05, 0·09, and 0·12). Ditton and Frischer[20] assumed that all individuals dependent on heroin can be counted as addicts for exactly 10 years, neglecting any mortality for this time. However, these cessation rates (apart from 0·05) do not accord with our data for prevalence and proportion in substitution treatment.

The low cessation rate in the canton of Zurich could be attributed to the unrestricted access to opioid substitution extending the period of dependence. Despite marginal substitution treatment during a 33-year follow-up of narcotics addicts in California,[22] however, our cessation rate of 0·04 accords with their data. Besides, a higher cessation rate than that found in Switzerland might also be due to increased mortality.

Heroin misuse in Switzerland was characterised by a substantial decline in heroin incidence and by heroin users entering substitution treatment after a short time, but with a low cessation rate. There are different explanations for the sharp decline in incidence of problematic heroin use. According to Ditton and Frischer,[20] such a steep decline in incidence of heroin use is caused by the quick slow down of the number of non-using friends who are prepared to become users in friendship chains. Musto's[23] generational theory regards the decline in incidence more as a social learning effect whereby the next generation will not use heroin because they have seen the former generation go from pleasant early experiences to devastating circumstances for addicts, families, and communities later on.

In line with Musto's social learning approach, we think that an additional effect of the liberal Swiss drug policy is possible. Parallel with the decline of heroin incidence, Switzerland adopted its so-called four-pillar strategy to approach the heroin problem;[18] main components of this strategy have been an increased emphasis on treatment and harm-reduction measures. As the Swiss population supported this drug policy,[1,2] this medicalisation of opiate dependence changed the image of heroin use as a rebellious act to an illness that needs therapy. Finally,

heroin seems to have become a "loser drug", with its attractiveness fading for young people. Nevertheless, whether drug policy had a positive effect on the number of new heroin users or not, our data could not confirm an increase of heroin incidence as expected by the critics of the liberal Swiss drug policy. Furthermore, even if the prevalence of heroin dependence did not substantially decline the situation for those concerned and also for the whole population was improved by the measures of the Swiss drug policy, as can be seen from a reduction in criminal behaviour surrounding heroin use and falling drug mortality.[13]

Our analyses of incidence and prevalence strictly pertain to the number of problematic heroin users who have sought and entered treatment. We do not know how many people used heroin just a few times or who used heroin regularly for longer than 13 years without entering a substitution treatment. However, in view of the fact that our case register data led to prevalence estimates of heroin use closely similar to those of other approaches, most of these individuals probably entered a substitution treatment programme at least once. Nonetheless, it should be kept in mind that our results depend on the following conditions: heroin onset in people with missing data can be estimated from those with known years of onset without bias; the percentage of problematic heroin users entering treatment after more than 13 years since onset of regular use is negligible; and the lag-time distribution has been stable since 1992.

Up to now, there have been few data for trends in incidence and prevalence of problematic heroin use despite the importance of individual and societal problems caused by heroin epidemics. Knowledge of only prevalence rates is insufficient because "for some, heroin addiction has been a lifelong condition associated with severe health and social consequences".[22] As the presented data clearly show, a stable prevalence rate can mask a steep decrease in incidence. Based solely on data routinely obtained in substitution treatments, our straightforward model enables the study of incidence trends across different countries and might enable urgently needed assessments of the effect of different drug policies.

Contributors
CN was the main contributor to the design of the study and did the statistical analyses. Both authors participated in the execution of the study and the writing of the manuscript.

Conflict of interest statement
We declare that we have no conflict of interest.

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