

# HIV outbreak among injecting drug users in the Helsinki region: social and geographical pockets

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**Background:** Incidence of newly diagnosed HIV infections among injecting drug users (IDUs) in Helsinki rose from 0 per 100 000 inhabitants in 1997 to 2.9 in 1998 and to 11.1 in 1999. Thereafter incidence declined to 2.1 in 2003. **Methods:** Data were collected from interviews with HIV-positive IDUs who attended the University Hospital in Helsinki from 1998 until 2003. We studied the sociodemographic profile and spatial distribution of IDUs who were diagnosed in the beginning of the outbreak and those diagnosed later. The indicator for the spatial differentiation within the metropolitan area is % employed males aged 25–64. **Results:** The outbreak occurred among a marginalized population of IDUs characterized by a long history of injecting drug use (10.7 years), mean age 32 years, homelessness (66.3%), history of imprisonment (74.7%) and psychiatric hospital care (40.6%). Compared with 98 early cases diagnosed during the first 2 years until 2000, 47 recent cases diagnosed after 2001 were 4 years older, and as marginalized. Except for the city centre, both early and recent cases had been living or using drugs in the same deprived neighbourhoods with the highest unemployment rates. Up to 40% of cases in the two big geographical clusters did not have contact with the city centre, where the needle exchange services were available. **Conclusions:** The Finnish HIV outbreak is restricted socially to a very marginalized IDU population, and spatially to local pockets of poverty. In low prevalence countries, prevention programs should be targeted early at high-risk areas and populations.

**Keywords:** demography, HIV, IDU, poverty, prevention.

An outbreak of HIV among injecting drug users (IDUs) in the Helsinki region in Finland occurred in 1998. The number of new HIV infections among Finnish IDUs increased rapidly until the year 2000, when it started to decline (National Register of Infectious Diseases, National Public Health Institute, Helsinki, Finland). By October 2003, 247 newly diagnosed HIV infections among IDUs had been identified. Nearly all IDUs were infected with a recombinant subtype AE (CRF01-AE) of HIV-1.<sup>1</sup> Before 1998, only single cases of new HIV-positive IDU cases were found annually, most of them known to be imported infections.<sup>2</sup>

The first HIV outbreaks among IDUs in the industrialized world were recognized in the 1980's. The Finnish outbreak represents the second wave of HIV outbreaks among IDUs, which started in the late 1990's.<sup>3</sup> Concurrent outbreaks, although larger, have occurred in the neighboring countries Estonia, Latvia, and areas of the Russian federation.<sup>3–6</sup> Even though geographically and temporarily close, these epidemics are shown to be independent, caused by different subtypes of HIV-1 virus.

The shape of the Finnish incidence curve is similar to many other IDU epidemics in 1990's, but the HIV prevalence among IDUs remained low (Figure 1). Between years 1999 and 2003 more than 7000 samples from needle exchange programs (NEPs) and prisons were tested with a rapid HIV-test (Determine HIV-1/2, Abbott, USA).<sup>7</sup> During the testing period the HIV-antibody prevalence decreased from 6.7 to 0.4% in NEPs and from 2.4 to 0.3% among prison inmates with an unknown serostatus.

The risk of HIV infection for IDUs is associated with injecting behaviour and sexual risk behaviour.<sup>8</sup> In addition, there are sociodemographic factors, which are associated with higher risk for HIV infection among IDUs; low education level, young age, divorce or separation and homelessness.<sup>9,10</sup> These risk factors are known to be different in low and high prevalence cities.<sup>11</sup> Furthermore, poverty is an independent risk factor for HIV infection.<sup>12</sup>

Sociodemographic characteristics of newly infected IDUs not only describes the epidemic, but can also be used for estimating future trends of this epidemic. The possible spread of HIV among younger age groups with a short history of injecting or casual illicit drug use may create a risk for the faster spread of the epidemic among IDUs and secondly sexually via partners of the HIV-infected IDUs. Here we studied whether there was a difference in the sociodemographic profile and geographical distribution of those HIV-positive IDUs, who were diagnosed in the beginning of the outbreak and those who were diagnosed later, i.e. during the last two years of the outbreak.

## Methods

### Study population

The Helsinki metropolitan area comprises the capital Helsinki and the surrounding cities Vantaa and Espoo, together having

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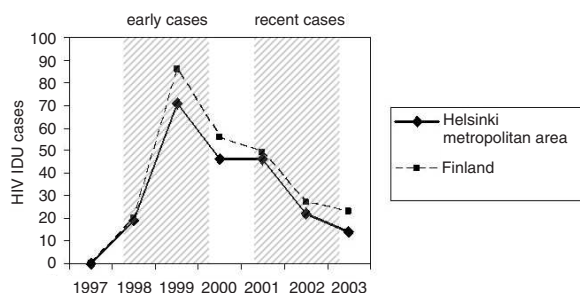
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**Figure 1** HIV cases among IDUs in Helsinki metropolitan area (HUS: Helsinki University Central Hospital area) and total number of HIV IDU cases notified in the National Register of Communicable Diseases. Data provided by KTL (National Public Health Institute, Helsinki, Finland). Early cases: first HIV-positive test between 1st of April 1998 and 31st of March 2000. Recent cases: first HIV-positive test between 1st of April 2001 and 31st of March 2003.

1.2 million inhabitants. Based on four different registers, the number of injecting problem users of amphetamine and opiates in the area is estimated at 4500–6500 in 2002.<sup>13</sup> Even though there are IDUs also outside the Helsinki region, 83.5% of all HIV cases among IDUs between 1998 and 2003 have been detected in the metropolitan area (National Register of Infectious Diseases, National Public Health Institute, Helsinki, Finland).

By October 2003, 213 HIV-infected IDUs had visited the Infectious Disease Clinic at the Helsinki University Hospital at least once. Since 1998, the HIV-laboratory of the National Public Health Institute has subtyped nearly all new HIV cases in Finland as a part of research projects. Subtyping was available for 141 (80.6%), and all cases but one were found to be CRF01-AE.

### Data collection

All newly diagnosed HIV-positive cases from the Helsinki region are referred to the Infectious Disease Clinic at the University Hospital for treatment and clinical follow-up. Since the three first cases of the outbreak were detected, HIV-positive patients were interviewed regarding their history of injecting drug use, income, housing, education, work, history of addiction care and imprisonment. Because many of the first cases were noticed to be in clusters, they were also asked in which areas they had been living or using drugs around the time of the first HIV-positive test result or at the time of infection. The participants could mention up to four different geographical areas.

At the first clinic visits of HIV-positive IDUs at the Infectious Disease Clinic, data was first collected by a social worker through semi-structured interviews for sociomedical purposes. After September 2002 the same data has been obtained from the baseline interviews of the cohort study among HIV-positive IDUs. Of 213 HIV-positive IDUs, who visited the University Hospital at least once, 37 IDUs had interrupted their follow-up without meeting the social worker or without being interviewed for the study. Of the remaining 176, 25 IDUs were interviewed by a social worker only, for 151 persons the data was collected or complemented structurally using standardised cohort questionnaires.

The CD4+ cell counts were collected from the hospital data system. As indicator for the stage of HIV infection, the CD4+ cell measurements within 100 days after the first HIV-positive test results were included, and were available for 129 (72.7%) persons.<sup>14</sup>

The socioeconomic data describing the spatial structures of the city in the Helsinki metropolitan area were obtained from

the city of Helsinki Statistics Unit. The indicator used is the percentage employed males aged 25–64. This age standardization is used to exclude students and the elderly. The geographical distribution of the areas, where the HIV-positive IDUs had been living or using drugs was projected on the maps, which show the spatial differences in male employment. Areas reported by more than two HIV-positive IDUs were defined as clusters.

The study was conducted in accordance with the ethical principles set out in the Declaration of Helsinki, and the informed consent was obtained for the cohort interviews. The retrospective part of the study was approved by the Ethics Committee, Department of Medicine, Hospital District of Helsinki and Uusimaa.

### Data analysis

To detect possible differences in the sociodemographic characteristics of the 176 HIV-positive persons, the early HIV-positive IDU cases ( $n = 98$ ) newly diagnosed between 1 April, 1998 and 31 March, 2000 were compared with the recent cases ( $n = 47$ ), who were diagnosed between 1 April, 2001 and 31 March, 2003 (figure 1). To achieve maximum contrast, we excluded 31 cases between the groups. The analyses were repeated without exclusion of cases and the data divided in two by 30 September 2000, which resulted in two 2.5 year intervals.

To describe the geographical dynamics of the HIV outbreak in the Helsinki area, the reported areas where the IDUs lived or used drugs were converted into zip codes.

Simple descriptive statistics were used to describe the basic characteristics of the study sample. Differences between early and recent cases were tested using the  $\chi^2$  test, student's  $t$ -test or Mann–Whitney  $U$ -test, as appropriate. Because of the possible easier access to health and social services after the HIV diagnosis, the analyses were repeated including only those interviews done within one year after the first HIV-positive test.

Statistical analyses were carried out using SPSS version 10.0 (Norusis; SPSS Inc., Chicago Illinois, USA). The geographic distribution of the HIV cases has been analyzed by the use of MapInfo Professional version 7.0 (MapInfo Corp., Troy, New York, USA).

## Results

### General characteristics

Of all 176 HIV-positive IDUs, the mean age was 33 (16–63 years), of these 86.4% were living in Helsinki city, and 72.2% was male. Only 1.9% was employed at the time of the first interview, 22.4% had been working within the past 5 years, and of 43% the main source of income was social security. The number of homeless (no official address) was 65.3%, and 82% had less than 10 years of education. 43.5% had been admitted to a psychiatric hospital care at least once.

Sociodemographic characteristics of the 98 early and the 47 recent cases are presented in table 1. The recent cases were slightly (4 years) older and had used injecting drugs for a longer period compared with the early cases (14.3 versus 10.7 years). Among the early cases, the proportion of the young drug users (age <25 years at the first visit) was 14.3%, and among the recent cases 6.4%, respectively. The proportion of IDUs, who had started injecting <5 years before the first visit was 26.7% and 14.6% among the early and recent cases of the outbreak, respectively.

Additional analyses either by excluding cases who had been interviewed later than 1 year after HIV diagnosis or by including cases between April 2000 and March 2001 yielded similar results.

**Table 1** Sociodemographic characteristics of the early and the recent HIV-positive IDU cases of the outbreak in Helsinki metropolitan area (Early cases: first HIV-positive test between 1st of April 1998 and 31st of March 2000, recent cases: first HIV-positive test between 1st of April 2001 and 31st of March 2003)

	Early cases n = 98	Recent cases n = 47	P
Age (years, mean, range) <sup>a</sup>	32 (16–56)	36 (20–62)	0.026
Male (%)	70.4%	78.3%	0.323
Main drug amphetamine	74.1%	77.8%	0.670
Duration of injecting (years, mean, range) <sup>a</sup>	10.7 (0–32)	14.3 (1–37)	0.035
Homeless	66.3%	66.0%	0.966
In employment	2.2%	2.4%	
History of imprisonment	74.7%	72.3%	0.762
Lack of further education (≤9 years)	83.8%	84.4%	0.919
History of addiction rehabilitation and/or detoxification	61.7%	70.5%	0.109
First CD4 count (10 <sup>6</sup> /l, mean)	579	431	0.004

a: At the time of the first HIV-positive test

The CD4+ count at HIV diagnoses was  $148 \times 10^6$  cells/l lower for the recent cases compared with the early cases ( $P = 0.004$ ). For estimation of the time of infection, the last HIV-negative test result was available for 39 (39.8%) early cases and 24 (51.0%) recent cases.

### Sociogeographical distribution of HIV-positive IDUs

The reported geographical areas where the IDUs lived or used drugs during the time of HIV diagnosis are presented in figure 2. Among recent cases, only one additional area (suburb of Myyrmäki) is mentioned. When the distribution of unemployed males is compared with the distribution of areas mentioned by IDUs, there is a clear correlation (figure 2). All IDU clusters outside the city centre are located in the areas with highest unemployment rates (over 30% of males unemployed).

When examining the two big geographical clusters outside the downtown separately, 39% (15/38) of the persons who lived or used drugs in the suburb of Maunula and 40% (8/20) of those in the suburb of Malmi did not mention the centre of Helsinki as one of the areas.

### Discussion

The outbreak of HIV in the Helsinki region from 1998 to 2003 occurred among a very marginalized population of IDUs characterized by a long history of injecting drug use, homelessness, little education, and history of imprisonment and psychiatric hospital care. Those diagnosed HIV-positive after 2001 were as marginalized as those diagnosed HIV-positive before 2000.

The recent cases had lower CD4+ counts at the HIV diagnosis than the earlier cases. They were also older, and had a longer history of injecting drug use. Furthermore, for 61.7% of the recent cases the time of infection was unknown. This

indicates, that they present at least partly the same clusters than the early cases, only diagnosed later. Thus, the spread of the epidemic at the end of 1990's may have been even more explosive and restricted faster, as shown in our earlier study with 93 IDUs with estimated times of HIV infection.<sup>15</sup> However, 38.3% of the recent cases had a last HIV-negative test result after April 2001, which shows ongoing HIV transmission among IDUs (results not shown).

Geographically, the outbreak occurred in socioeconomically defined areas, which—except the downtown—are characterized by high unemployment rates and low income, i.e. the most deprived neighborhoods in the Helsinki region. Even though there was a maximum time period of 5 years between the first and the most recent case included in this study, only one additional area was reported by recently diagnosed IDUs.

HIV infection is a mandatory notifiable disease in Finland, reported both by the diagnosing laboratories and physicians in each case since 1987. Our study population represents 70.8% of all HIV-positive IDU cases reported to the National Registry between 1998 and 2003.

After the outbreak was detected in 1998, there was an increase in HIV testing frequency especially in prisons and at the NEP stations. However, this cannot fully explain the increase in HIV infections, since the HIV subtype CRF01-AE was different from the earlier sporadic HIV subtype B infections found among IDUs. In addition, the relatively high CD4+ levels at HIV diagnosis found in this study indicate a recent outbreak.<sup>16</sup> The declining occurrence of HIV among NEP users and in prisons does not indicate the presence of a large hidden population.<sup>7</sup> Furthermore, those IDUs who were not interviewed and included in the study, were probably even more marginalized than our study population, because social instability is correlated to poor compliance and adherence.<sup>17,18</sup>

The Finnish outbreak differs from the other explosive HIV outbreaks among IDUs in the neighboring countries like Russia or Estonia, where the size of the outbreak was more than 20 times larger, the prevalence rose and remained high, and most of the HIV-positive IDUs belong to the age group 15–24 (reviewed in<sup>3</sup>). A contracted outbreak similar to ours has been described in Orel, Russia.<sup>19</sup>

In our study among HIV-positive IDUs, the proportion of young IDUs and those IDUs, who have recently started injecting, is small, especially among the recent cases. This can not be explained by the absence of young IDUs in the Helsinki region: in the RISKI cohort study among NEP users interviewed between years 2000 and 2004, the median age was 27.5 years, even after participants under 18 years were excluded.<sup>20</sup> The RISKI participants had also more often stable housing conditions (66.3 versus 44.7%), a shorter injecting career (8 versus 12 years), and were more often employed (10.7 versus 1.9%) than our HIV-positive study population (Airi Partanen, personal communication).<sup>20</sup> This suggests that the epidemic has had a limited spread to IDUs outside the core population with a long history of injecting drug use and strong social marginalization. Even though this study does not answer the questions about the reasons behind the positive development, some possible explanations can be discussed.

There were several interventions, which may have influenced the development of the HIV epidemic. In Helsinki, the first NEP, which offered clean needles and syringes, health counseling and testing for HIV and hepatitis, was started in 1997. Shortly after the first HIV cases were observed, there was public information about the possible outbreak in the media and specifically at the NEP-stations. In addition also pharmacies were encouraged to continue selling needles and syringes to IDUs. Since December 2000, the day-centre for HIV-positive IDUs offers a free low threshold methadone program, food, and social services. Also infectious disease specialist services and medication might have improved HAART adherence,



**Figure 2** Geographic areas in the Helsinki metropolitan area, where the HIV-positive IDUs lived or used drugs during the time of the HIV diagnosis, and male employment rate. Map A shows the areas reported by the early cases, map B the areas reported by the recent cases of the outbreak (1–4 observations/person).

which can reduce the risk of transmission.<sup>21</sup> Furthermore, separate services may have reduced the mixing of the HIV-positive IDUs with the HIV-negative IDUs. Indeed, a decline in HIV incidence among IDUs was seen concurrently at the end of 2000, when the service centre was opened.

A study of Jarlais *et al.*<sup>22</sup> described prevention activities and risk behavior in cities, where HIV was introduced to the IDU population, but the seroprevalence remained low (<5%). The three common prevention components were present in all five cities: Implementation of prevention activities when the HIV prevalence was still low, good access to sterile injection equipment, and community outreach to IDUs. As described, the two first components were present also in the Helsinki metropolitan area.

However, NEP started with limited resources in the downtown, and the other five NEP centres were opened after 1999. In the beginning, there were also limitations in syringe

numbers, and the NEP did not include any secondary exchange (exchanging for other IDUs). In the Helsinki metropolitan area, the number of needles and syringes exchanged at NEP stations increased from 74 000 in 1998 to 1 108 000 in 2003 (Airi Partanen, personal communication). Thus, even though it was started before the outbreak, NEP did not reach the geographical pockets of infection, in which our study showed, that up to 40% of the HIV-positive IDUs had no contact with the city centre of Helsinki. Also, in 1999, 50% of pharmacies sold needles and syringes, but the proportion did not grow during the study period (Katja Malin, personal communication).

In this study, the average number of reported areas where the IDUs lived or used drugs was two, which describes the mobility of IDUs: They may use drugs and live in several areas. Since 66% of them did not have any permanent address, this data is a surrogate for the spatial distribution of the HIV-positive IDUs.

The indicator used to describe the spatial structure of the Helsinki region is the percentage employed males aged 25–64. Male employment is one of the most commonly used spatial deprivation indicator in Nordic countries.<sup>23</sup> As the social security system minimizes income differences, indicators such as employment and income have restrictions in their use. However, areas with low average income and high proportion of poor (defined as having income below 50% of the average in the metropolitan area) show similar distribution, as well as housing conditions in social housing (data not shown).<sup>24,25</sup>

Long-term unemployment with cumulative social problems is creating new social and spatial profiles in the Helsinki metropolitan area. The result of this study shows that these emerging patterns are also reflected in the spatial distribution of HIV-positive IDUs. The local pockets of poverty thus carry elements of deprivation or social exclusion. In addition to social policies that target drug users, the metropolitan area needs also HIV prevention programs in the high-risk areas. Decentralization of services and early development and initiation of NEPs are also important in other cities in Finland, as well as in other low prevalence countries.

Friedman *et al.*<sup>11</sup> described in 1995, that in low prevalence cities, HIV may be concentrated in social pockets of infection. Our study shows, that these social pockets are located in the pockets of poverty within the region.

The development and continuation of the prevention activities is still important, in spite of the decreasing incidence of HIV among IDUs. According to the RISKI study, there is still continuing risk behavior among the HIV-negative IDUs.<sup>20</sup> In addition, among the Finnish drug users, 70% inject their drugs, in general amphetamine and buprenorphine.<sup>20</sup> Also, according to the surveys made in NEPs, the prevalence of hepatitis C has varied between 63% in 1998 to 54% in 2004 (Henrikki Brummer-Korvenkontio, personal communication) suggesting, that there is a large high-risk IDU population susceptible to HIV infection.

In conclusion, the Finnish HIV epidemic among IDUs is restricted socially in a very marginalized drug user population, and geographically to areas characterized by low income and high unemployment numbers. This suggests that in low prevalence countries like Finland, prevention programs should be targeted early at high-risk areas and populations.

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### Key points

- The social pockets of HIV infection are located in the regional pockets of poverty.
- Almost half of the cases in the geographical pockets of infection was not reached by the needle exchange program (NEP).
- In countries with a low HIV prevalence, prevention programs should be targeted early at high-risk areas and populations.

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