likely to be infected than exclusively homosexual men, and our data suggest that two distinct populations may exist. In general the prevalence of HIV infection in homosexual men clearly exaggerates the risk of heterosexual spread from this source.

The part played by the information campaign funded by the government in bringing about modifications in homosexual lifestyle seems to have been small. The most substantial changes had occurred before the campaign started, and the reduced trend towards safer practices in the most recent cohort may be attributable to the government's reluctance to target the homosexual community in its subsequent publicity. Although selection of partners and use of condoms may militate against transmission of HIV, at risk behaviour is clearly still taking place, and more effort is required to reduce it to the best attainable minimum.

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Changes in sexual behaviour and the fall in incidence of HIV infection among homosexual men

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Abstract

To investigate the epidemiology and normal course of infection with HIV the prevalence and incidence of the infection were studied among two cohorts of homosexual men in Amsterdam in 1980-7. The cumulative incidence of infection increased from a weighted 2·2% in 1980 to 39·0% in 1987. The estimated yearly incidence of HIV was 3·0% in 1981, rose to 8·8% in 1984, and fell gradually to 0% in 1987. During the study the sexual behaviour of the cohorts was examined. The number of men with whom anopenetrative intercourse was practised fell from a mean of 10·6 to 1·4 for those positive for HIV antibody, whereas the number with whom anoreceptive intercourse was practised fell from a mean of 3·7 to 0·5 for those negative for the antibody. In addition, there was a reduction in the number of cases of hepatitis B and syphilis among men in general.

The decline in infection with HIV was assumed to be linked to changes in sexual behaviour. Such changes practised early in the course of the epidemic probably had a strong effect on the number of cases of AIDS among homosexual men in Amsterdam.

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Introduction

In 1982 the first case of AIDS in The Netherlands was diagnosed in a homosexual man.[1] By April 1988, 487 cases had been reported, of which 413 were in homosexual men.[2] To investigate the epidemiology and the natural course of infection with HIV a cohort study was started in October 1984 among 746 homosexual men in Amsterdam. Earlier epidemiological, clinical, and immunological results of this study have been reported.[3-6] This paper reports the cumulative incidence of HIV infection in this cohort in relation to changes in sexual behaviour. In addition the probable course of the spread of HIV in this cohort was assessed by reconstructing the epidemiological curve over the past seven years. This reconstruction was based on the retrospectively determined prevalence and incidence of HIV infection in a cohort of homosexual men who participated in a trial of hepatitis B vaccine in 1980-2.[7,8]

Subjects and methods

STUDY POPULATION

Two cohorts were studied. The first comprised 746 homosexual men who were participating in a prospective study of HIV infection and AIDS that started in October 1984 (the AIDS cohort study).[4-6] The second comprised 685 men who participated in a placebo controlled trial of the efficacy of a heat inactivated hepatitis B vaccine from November 1980 to November 1982.[7,8] In both cohorts participants were healthy male homosexual volunteers, most of whom lived in and around Amsterdam. Participants in the hepatitis B vaccine trial were negative for markers of hepatitis B infection. The design of these studies, as well as demographic and other characteristics of the participants, have been described previously.[3-8]

CONDUCT OF THE STUDY

Participants in the AIDS cohort study were enrolled from October 1984 to May 1985 and were seen every three months at the Municipal Health Service of Amsterdam. This study covers data collected until October 1987. When they entered the study subjects were physically examined and their medical history was taken. Every three months blood samples were collected for virological and immunological tests. Presence of antibody to HIV was established with two enzyme linked immunosorbent assays (ELISA; Organon, Oss, The Netherlands, and Abbott, north Chicago, United States) and confirmed by immuno-

blotting.[6] All subjects were informed of their results two weeks after they entered the study. Among men negative for HIV antibody the procedure was repeated every three months. Every six months subjects completed a self administered questionnaire on their sexual behaviour in the preceding six months. During the study 97 men negative for HIV antibody failed to return for follow up. Most of them had said that they did not want to know the result of their test for HIV antibody. Comparison of demographic background data on these men with those on the men who remained in the study did not show any differences.

Subjects in the trial of hepatitis B vaccine entered the study from November 1980 to December 1981. Follow up continued until December 1982. At entry participants were questioned about their medical history and sexual lifestyle. Blood samples were taken during each of the first five months of the study and every three months thereafter. The first and last blood samples were retrospectively investigated for the presence of HIV antibodies as described above. If antibodies were found in the last sample all intervening samples were tested to determine the date on which antibodies were first evident. This retrospective analysis of stored blood samples was incomplete for 112 susceptible men: 30 subjects were lost because of lack of motivation or because they moved and no last blood sample was collected from 82 subjects because the trial was finished.

STATISTICAL METHODS

The incidence of seroconversion for each six month interval—that is, for each interval the number of subjects who became positive for HIV antibody divided by (the number of subjects entering interval minus 0·5× number of subjects withdrawing during the interval)—was calculated with life tables according to the actuarial method[9] and expressed as a percentage. The reconstruction of the epidemiological curve in the AIDS cohort was based on data from HIV serological testing in both cohorts and on the estimation of the cumulative incidence of HIV infection in 1982-4. The prevalence of HIV antibody among men negative for hepatitis B virus markers in the AIDS cohort was 11·7% (14/120) at entry. In the total study population (excluding those vaccinated against hepatitis B) the prevalence was 35·3% (220/624). From these figures we concluded that men negative for hepatitis B virus antibody were at lower risk of becoming infected with HIV. Data on the prevalence and incidence of HIV infection in the cohort were therefore weighted for this difference. The weight factor was taken as the ratio of the proportion of men positive for HIV antibody among all the men entering the AIDS cohort study to the proportion of the men positive for HIV antibody among those negative for hepatitis B virus antibody on entering the study. This ratio was 35·3/11·7=3·01. A polynomial was fitted in the weighted values for 1980-2 and the observed values for 1984-7.[10] The regression equation was used to estimate the cumulative incidence for 1982-4, for which no actual data existed. A cubic polynomial produced an excellent fit (R^2=0·973). Because there were no data to validate the estimated curve this procedure was rather speculative, and no measures of statistical uncertainty are therefore presented.

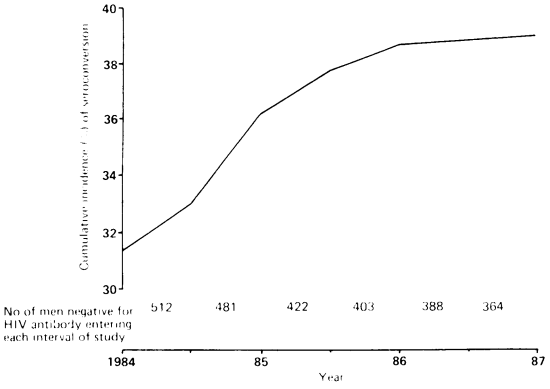

FIG 1—*Cumulative incidence of HIV infection among 746 homosexual men participating in AIDS cohort study in Amsterdam, October 1984 to October 1987*

Results

CHARACTERISTICS OF THE TWO COHORTS

At entry the men in the AIDS cohort were older, had been homosexually active longer, and had had a higher level of risky sexual activity than the men participating in the vaccine trial (table). These differences were to be expected because participants in the vaccine trial were negative for hepatitis B virus markers.

Characteristics of two cohorts of homosexual men in Amsterdam at entry into study, between November 1980 and December 1981 and October 1984 and May 1985 respectively

	Hepatitis B vaccine trial cohort (n=685)	AIDS cohort (n=746)
Mean (SD) age (years)	31 (7)	35 (7)
Mean (SD) No of years of homosexual activity	11 (7)	17 (8)
No (%) who had had >10 sexual partners in past six months	240 (35)	389 (52)
No (%) who practised anal sex	507 (74)	643 (86)
No (%) who had hepatitis B virus markers		501 (67)*

*Excluding men vaccinated against hepatitis B.

PREVALENCE AND INCIDENCE OF HIV INFECTION IN THE AIDS COHORT STUDY

When the participants entered the AIDS cohort study (October 1984 to May 1985) 234 (31·4%) out of 746 had antibodies to HIV. During follow up until October 1987, 52 men became positive for antibody to HIV, resulting in an incidence of 11·2%. The slope of the curve of the cumulative incidence of HIV infection (fig 1) shows that most men became positive for antibody before the end of 1986, after which the curve started to level off. In October 1987 the cumulative incidence of HIV infection in the cohort was 39%.

CHANGE IN SEXUAL BEHAVIOUR AND DECLINE IN INCIDENCE OF HIV INFECTION IN AIDS COHORT STUDY

The relation between changes in sexual behaviour of the cohort and the decline in transmission of HIV was examined by evaluating the decrease in the number of partners with whom anopenetrative and anoreceptive intercourse occurred. To evaluate the risk of becoming infected with HIV the mean number of partners with whom men negative for HIV antibody practised anoreceptive intercourse was studied, and the risk of disseminating HIV was evaluated by studying the mean number of partners with whom men positive for HIV antibody practised penetrative intercourse. Both groups reported a decrease in these practices (fig 2), primarily during the first 12 months of the study, men positive for the antibody showing more change than those negative for it (a reduction from a mean of 10·6 partners during the past six months to 2·9 partners among those positive for the antibody versus reduction from 3·7 to 1·4). During the remaining 24 months a slow decrease was seen, which resulted in an average number of 1·4 partners among those positive for antibody and 0·5 partners among those negative at the end of the study. The absolute number of partners with whom condoms were used while the men practised these activities remained more or less stable during the total study: an average of 1·0 among those positive for antibody and 0·5 among those negative. A comparison of figure 2 and figure 1 shows that the levelling off of

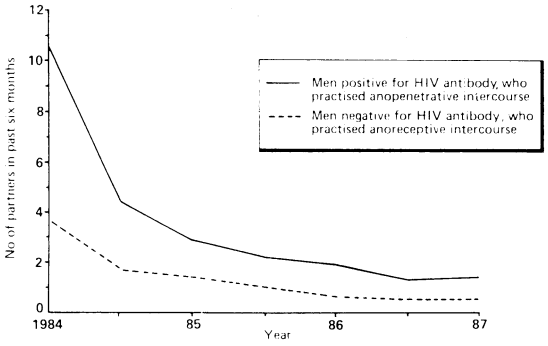

FIG 2—*Mean number of partners with whom anogenital intercourse practised among 746 homosexual men (512 negative for HIV antibody, 234 positive) participating in AIDS cohort study in Amsterdam, October 1984 to October 1987*

the rate of infection coincides with an approximate mean of zero partners with whom those negative for antibody perform anoreceptive intercourse without using condoms.

PREVALENCE AND INCIDENCE OF HIV INFECTION IN THE HEPATITIS B VACCINE COHORT

On entry into the trial of hepatitis B vaccine from November 1980 to December 1981, five (0·7%) out of 685 participants were positive for HIV antibody. During follow up 15 men became positive for antibody (three in 1981 and 12 in 1982), an incidence of 3%. The trend in the observed cumulative incidence (fig 3) shows that most of the men who became positive did so in the second half of the study. When the prevalence and incidence were weighted for the selection of men negative for hepatitis B antibody 2·2% of the participants were positive for HIV antibody at entry and 9·1% became positive during follow up. At the end of 1982 the weighted cumulative incidence was 11·1%.

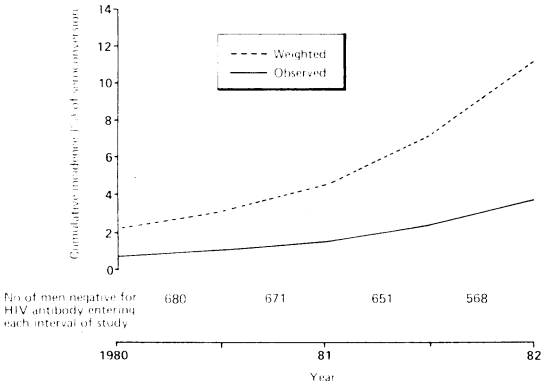

FIG 3—*Observed and weighted cumulative incidences of HIV infection among homosexual men participating in hepatitis B vaccine cohort study in Amsterdam, November 1980 to December 1982*

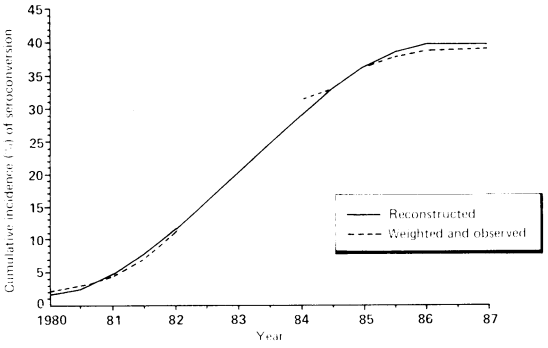

FIG 4—*Reconstructed cumulative incidence of HIV infection among two cohorts of homosexual men in Amsterdam, November 1980 to October 1987*

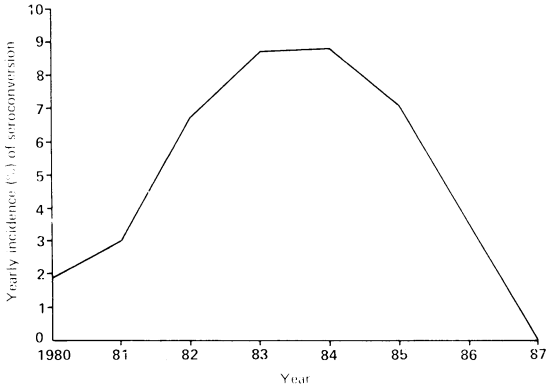

FIG 5—*Reconstructed yearly incidence of HIV infection among two cohorts of homosexual men in Amsterdam, November 1980 to October 1987*

RECONSTRUCTION OF THE SPREAD OF HIV, 1980-7

The estimates of the cumulative incidence of HIV infection in the unobserved period, 1982-4, were interpolated by a regression model. Figure 4 presents the reconstruction of the curve for the total period, 1980-7. According to this reconstruction, the cumulative incidence in the unobserved period rose from 15·8% in mid-1983 to 20·3% in the beginning of 1984 and to 24·8% in mid-1984. The curve shows a steady progressive increase in the incidence of HIV infection in 1980-5 and an inflection in 1986-7. The yearly incidence based on this reconstruction (fig 5) shows a sharp increase from 3% in 1981 to 8·7% in 1983, a plateau of 8·8% in 1983-4, and a decline to 7% in 1985, 3·5% in 1986, and 0% in 1987. Probably this is the course which the spread of HIV in the AIDS cohort ran.

Discussion

This report presents a reconstruction of the epidemiological curve of the spread of HIV among the homosexual men participating in the AIDS cohort study and its relation with changing patterns of sexual behaviour. The reconstructed rapid increase in the number of men positive for HIV antibody at the beginning of the epidemic is a classic example of the spread of a sexually transmitted disease. The rate at which such spread occurs depends on the number of partners, type of sexual contact, infectivity of the agent, and number of infectious people in the population. More than a third of the men who entered the AIDS cohort study from October 1984 to May 1985 were infected with HIV. These men reported a mean of more than 279 different sexual partners during the past five years and a mean of 24 partners during the past six months.[3] In addition, they reported a mean of more than 10 sexual partners with whom they had practised anoreceptive intercourse during the six months preceding entry.[3] This behaviour may account for the increase in the proportion of men positive for HIV antibody from the weighted 11% in 1982 to the observed 31% from October 1984 to May 1985. The decline in transmission of HIV in the AIDS cohort from 1985 onwards was probably a result of the decrease in sexual activity in the studied population and more specifically the decrease in the number of partners with whom anogenital intercourse was performed. The alternative explanation, that the decline in transmission of HIV is a result of a so called saturation effect, is unlikely given that 60% of the participants were still not infected.

Data from the United States show higher percentages of infected men in three comparable cohorts. In a cohort of homosexual men from New York city 6·6% were infected with HIV in 1978-9, and the proportion had risen to 43·7% in early 1984.[11] In the San Francisco men's health study a prevalence of HIV of 48·6% was found among the homosexual and bisexual members of a probability sample of single men in 1984.[12] In the San Francisco city clinic cohort study the prevalence of HIV among a cohort selected from those attending sexually transmitted diseases clinics rose from 4·5% in 1978 to 73·1% in 1985.[13] In 1980 more than 20% of the subjects in this last study were infected with HIV. At that time AIDS had not been diagnosed in any patient in The Netherlands and HIV had been introduced only recently in the male homosexual community in Amsterdam.[8] From 1984

onwards preventive activities were undertaken among homosexual men in The Netherlands to try to avoid the spread of AIDS such as that seen in the United States. There is little doubt that this influenced the sexual behaviour of homosexual men, which in turn reduced the transmission of HIV.

Additional evidence for this line of reasoning exists in the decrease in the number of men with acute hepatitis B and early syphilis. In 1984-7 these numbers decreased from 23 to 8 and from 92 to 31/100 000 men. Contact tracing showed that in many of these cases the diseases were acquired homosexually. These facts show that the sexual behaviour of homosexual men in Amsterdam started to change early in the epidemic in comparison with that in big cities in the United States.[14,15] A considerable percentage of homosexual men in the United States had already been infected with HIV by the time the AIDS epidemic was recognised and sexual behaviour could be changed. The differences in prevalence of HIV infection between the Amsterdam cohort and the San Francisco city clinic cohort show that early preventive activities may have a huge impact on the transmission of HIV. Amsterdam, as well as some large cities in the United States and Europe, has a strong homosexual community, in which preventive activities specifically directed at homosexual men can be carried out, often by homosexual organisations with the aid of private and government funding.

As a result of the earlier interventions in Europe a smaller proportion of homosexual men in this continent has become infected with HIV than in the United States. Additional evidence for this hypothesis is found in a study among homosexual men in London, in which the prevalence of HIV antibody remained fairly stable at about 25% in 1986 after a rise from 3·7% in 1982 to 18·1% in 1985.[16] Probably in the near future homosexual men will constitute a relatively smaller proportion of the total number of patients with AIDS in Europe than in the United States. This in turn has consequences for interpreting the relative growth and decline of other groups at risk of HIV infection in the Western world. Finally, we conclude that early preventive activities can be effective and that, at least in Amsterdam, they have considerably restricted the number of cases of AIDS among homosexual men.

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Problems of diabetics in prison

G V Gill, I A MacFarlane

Abstract

Providing care for diabetics is difficult in prison. Six diabetic prisoners or former prisoners were seen whose care was difficult or unsatisfactory. Three had multiple admissions to hospital during their sentences with diabetic ketoacidosis that they induced themselves by not taking insulin. The motive seemed to be removal from prison to the fairly pleasant surroundings of the local hospital. A fourth prisoner required admission in a hyperglycaemic, hyperosmolar state that had gone unnoticed as he was thought to be "acting up." The two others had imperfect long term management of diabetes during their sentences.

There is clearly room for improvement in diabetic services in British prisons, but manipulative behaviour on the part of some diabetic prisoners may remain a problem.

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Introduction

Recent reports have expressed concern over inadequacies in the present system of health care in British prisons.[1-3] The problems are complex and emotive, and audits of prison health care by outside bodies are rare. In this report we draw attention to difficulties in managing diabetes in a prison environment and give case reports from our diabetic clinics, located near one of Britain's largest prisons.

Case reports

SELF INDUCED KETOACIDOSIS (CASES 1-3)

A 44 year old man with insulin dependent diabetes of 13 years' duration (case 1) was serving a five year sentence. He was admitted to the local hospital six times with ketoacidosis. He was later found to have avoided taking insulin by squirting it into his clothes during supervised injections. He was also in contact with two other imprisoned men with type I diabetes (cases 2 and 3) and taught them this method of inducing ketosis, leading to a minor epidemic that caused severe disruption to both prison and hospital staff. One of these men (case 2) was admitted to hospital three times and the other twice with ketoacidosis induced by protest refusals of food and