# THE AIDS VIRUS

## forecasting its impact

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# Introduction

In purely quantitative terms, acquired immune deficiency syndrome (AIDS) might not appear to have warranted the remarkable amount of attention it has attracted since 1982. By the end of October 1986 a total of just 548 cases of AIDS in the UK had been reported to the Communicable Disease Surveillance Centre. This sum pales in comparison with the contemporary incidence of respiratory tuberculosis – equally a scourge of mankind that is now, and for some time has been, 'under control'. Over the period from the beginning of 1982 to the end of the third quarter of 1986, it may be estimated that officially notified cases of respiratory tuberculosis exceeded 20,000. Furthermore, at a superficial level, AIDS might appear to be of only limited relevance to most of the population – almost 90 per cent of cases in the UK have occurred among homosexual or bisexual males. AIDS is also geographically highly concentrated – nearly 80 per cent of cases to date have been reported by clinics in the four Thames Regions of the National Health Service (CDSC 1986).

Yet aside from the extensive and sometimes sensational reporting of the problem in the general media, AIDS is viewed by health professionals and others as a significant threat to the well being of the community. Parallels have even been drawn with the syphilis epidemic that swept through Europe towards the end of the 15th century. It has also been referred to as the 20th century equivalent of the Black Death. More prosaically, but with no less concern, the Chief Medical Officer of the Department of Health and Social Security has warned that 'controlling the spread of infection must be regarded as an issue of prime importance to the future of the nation' (Acheson 1986).

Reconciliation of the two seemingly conflicting perspectives outlined above is, however, straightforward. AIDS is a new disease in man that is invariably lethal. Effective vaccines and treatments do not exist and the number of cases has increased alarmingly since AIDS emerged at the start of the 1980s. In the UK the total number of cases reported by the end of 1985 (273) has doubled during the first 10 months of 1986. In the United States 26,566 cases had accumulated by 20th October 1986 – an increase of 10,000 over the total recorded at the start of the year.

Furthermore, to focus on AIDS alone is to paint an incomplete picture. The causative agent, now known as human immunodeficiency virus (HIV), is responsible for a spectrum of illnesses. Indeed, current estimates suggest that in the UK probably 60 times more people are infected with the virus than have AIDS. Until recently, evidence from epidemiological studies broadly indicated that only about 10 per cent of those infected progressed to AIDS as

officially defined by the onset of certain opportunistic infections and other clinical markers (Smithies 1986). A further 26 per cent developed AIDS related symptoms but the majority generally appeared to remain well, experiencing only transient, if any, overt illness. However, new information about the virus and its consequences is emerging continuously and indicates that an increasing proportion of those infected are showing signs of serious illness. In addition, it is becoming evident that HIV may be associated with a wider spectrum of outcomes than initially suspected. It is now recognised, for example, that the virus may cause neurological impairment irrespective of the damage to the immune defence system that underlies AIDS.

The potential spread of HIV is a source of considerable alarm. To date the virus has been predominantly seen in a limited number of high risk groups – homosexual males, intravenous drug abusers and haemophiliacs.[1] The overall prevalence of infection among these groups is not accurately known. Information is nevertheless available from the testing of specimens referred from sexually transmitted disease clinics, from treatment centres for haemophilia and from some physicians treating intravenous drug abusers. In the UK, Jesson and his colleagues (1986) found antibodies to HIV among 21 per cent of identified homosexual clinic attenders in their 1984/85 sample. The figures for intravenous drug abusers and haemophiliacs were 10 per cent and 31 per cent respectively. Subsequent investigations have suggested that for some groups these proportions may now be significantly higher.

At the same time, there is growing concern that HIV could spread into the general population. It has become increasingly evident that HIV is in essence a sexually transmitted infection (Pinching 1986a) and it is feared that the sexual activities of certain groups such as bisexual males and intravenous drug abusers could pave the way for a broader dissemination of the virus. Heterosexual transmission is widely regarded as the explanation for the similar prevalence among males and females in Africa. In the United States between three and four per cent of the current AIDS case load may already be due to this means of spread (Pinching 1986). Against this background, there have been a series of alarming predictions about the magnitude of the future burden of HIV on the community in general and the health services in particular. The objective of this paper is to assess the validity of these forecasts and to explore the potential for containing the spread of the virus.

1 The statement applies to Europe and the United States and it is experience with the virus in these geographical areas that is the focus of this paper. In Africa, the epidemiological picture is markedly different with males and females affected in similar proportions. The question has been raised whether the African pattern reflects the involvement of different viral strains (*Lancet* 1986a). This is an area of uncertainty at the present time and alternative explanations for the geographical disparities will emerge in the course of the present paper.

# The nature and origins of HIV

The infectious agent responsible for AIDS was isolated in 1983, just two years after the first cases of AIDS were reported by the Centres for Disease Control in the United States.[2] The initial discovery was made by scientists at the Institute Pasteur in Paris (Barre-Sinoussi *et al* 1983) who called their isolate lymphadenopathy-associated virus, or LAV. The following year workers at the National Institutes of Health at Bethesda in the United States (Gallo *et al* 1984) reported finding an agent they designated human T cell lymphotropic virus Type III – or HTLV III – in patients with AIDS. The choice of this descriptor reflected the American investigators' belief that the virus was a new addition to a group which specifically attacks the T cells of the immune defence system in man.[3] Notwithstanding the differences in terminology, it soon became clear that the two separately discovered isolates were virtually identical morphologically and antigenically and, outside France and the United States, HTLV III/LAV entered frequent use in referring to the cause of AIDS. Subsequently the International Committee on the Taxonomy of Viruses (Coffin *et al* 1986) has recommended that the causative agent should be officially designated human immunodeficiency virus (HIV) but the issue remains a source of controversy (Palca 1986).

HIV is a retrovirus with an affinity for the T4 antigen site. It thus targets this site on lymphocytes and other bloodborne cells, including monocytes and macrophages. The virus replicates within living cells by using its enzyme, reverse transcriptase, to convert its own RNA into DNA (pro-viral DNA) which is then integrated into the DNA of the host cells. The pro-viral DNA thus becomes a part of the genetic material of cells which, upon activation, programs the further manufacture of viral components and their assembly into the whole virus. The new viruses leave the cells by budding out through the cell membrane and are capable of infecting other cells within the same host. Infection, once acquired, probably persists for life and infected subjects remain infectious to others (Curran *et al* 1985). It is not possible at the present time, however, to distinguish between infections destined to remain latent and those that will give rise to illness.

The origins of HIV are not yet clear. It has been suggested that the virus might have been man-made in laboratories in the United States or Soviet Union, perhaps during attempts to engineer new

2 With the benefit of hindsight, it is now believed that the virus entered the United States in 1976 and the first clinical cases have been retrospectively diagnosed back to 1978 (Coolfont Report 1986).

3 HTLV I is associated with adult T cell leukaemia and HTLV II, originally isolated from a patient with hairy cell leukaemia, has yet to be linked to a particular disease (Melbye 1986).

weapons of biological warfare (Medvedev 1986; Seale 1986). Alternatively, there is more support for the theory that HIV first emerged among geographically remote peoples in Africa and subsequently spread to other parts of the continent via population movement (Pinching 1986). The timing of this potential sequence of events is, however, contentious: sero epidemiological evidence has been presented to support the conflicting views that, on the one hand, HIV is a recent phenomenon and, on the other, that it has been present in Africa for some decades.

More specifically, research has been directed at the possibility that HIV in humans may have originated from the animal kingdom.[4] Interest has been generated by the discovery of an agent – designated STLV III MAC – that causes immunodeficiency in the Asian macaque monkey. Attention has additionally focused on the African green monkey. A virus related to HTLV III has been isolated from healthy animals of this species. Antibodies to the virus – known as STLV III AGM – have been found to cross-react with HTLV III. However, Barin and his colleagues (1985) have reported that antibodies to the AIDS virus found in a number of healthy subjects and surgical inpatients in Senegal were more closely related to the African green monkey virus than to reference strains of HTLV III.

In a more recently published paper, Kanki and co-workers (1986) have termed the virus HTLV IV. Contemporaneously, French scientists reported the discovery of a new virus in two patients suffering from AIDS (*Nature* 1986). This agent varies at least 30 per cent in sequence from the original LAV and has been designated LAV II. At the time of the initial communications there appeared to be clear differences between the clinical outcomes associated with the two new virus forms. It remains to be seen whether this distinction is maintained over longer-term follow-up. It is also unclear how these discoveries and any further related viruses that might emerge in the future will be incorporated into the proposed new nomenclature for the virus.

The origins of HIV are thus shrouded in uncertainty. It has even been concluded by the authors of a recently published sero-epidemiological survey of HIV (Wendler *et al* 1986) that their findings did not support the hypothesis that AIDS originated in Africa. Theories concerning the source and evolution of the virus can therefore only be regarded as provisional at present and there is a need for further research. Success in this respect would not only serve to satisfy historical interest but might also prove valuable to the search for a vaccine against the virus (Biggar 1986).

4 Morphologically – and in other respects – HIV resembles the lentivirus subfamily of retroviruses which include the maedivisna virus of sheep and infectious anaemia virus of horses (Weiss 1985).

# The consequences of HIV infection

Following infection with HIV, antibodies to viral proteins usually appear within a period of about eight weeks. This process, called seroconversion, may however be delayed for considerably longer periods of time in some cases (Bradbeer 1986). The antibodies possess little or no capacity to neutralise the virus – instead they serve most usefully as markers of infection. Furthermore, positive antibody status does not provide any guide to the size of the viral challenge that has been encountered nor does it indicate what the prognosis might be for the infected individual.

Focusing on clinical outcomes, the fact that HIV has emerged only relatively recently implies that the spectrum of ill health to which it gives rise has yet to be elucidated in full. Indeed, it is quite possible that currently observed patterns could alter radically in the future. Nevertheless, present understanding is that acute infection with HIV is sometimes accompanied by a transient non-specific illness similar to glandular fever, malaise, myalgia, lymphadenopathy pharyngitis and a rash. In most instances, however, acute HIV infection is subclinical.

The acute stage of infection, during which antibody development takes place, is then followed by a chronic phase. The latter may be asymptomatic or it may be accompanied by illness of varying degrees of seriousness. A large number of names have been devised for the various clinical expressions observed during this phase and the confusion thereby generated has been compounded by an inconsistent use of these terms by some commentators. However, Pinching (1986a) identifies persistent generalised lymphadenopathy (PGL) and AIDS-related complex (ARC) as the two principle groupings. Follow up data, so far covering a period of three years, indicate that between 35 and 45 per cent of persons becoming infected with HIV develop PGL or ARC although it is important to distinguish between the two conditions. Many patients experiencing PGL remain well, and on present evidence, relatively few go on to more severe disease. In contrast, ARC patients suffer

*Table 1* **AIDS-related complex.**

| *Signs and symptoms* | *Laboratory findings* |
|---|---|
| Pyrexia of unknown origin for 2 months | HTLV III antibodies or virus isolation |
| Chronic diarrhoea | Lymphopenia |
| Weight loss of 10% body weight | Leucopenia |
| Malaise and lethargy | Anaemia |
| Persistent generalised lymphadenopathy | Thrombocytopenia |
| Hepatosplenomegaly | Raised ESR |
| Hairy leucoplakia | Raised serum cholesterol |
| Minor oral infections (eg. herpes zoster, oral candidosis) | Raised immunoglobulins<br>Immunological abnormalities |

*Source* Bradbeer 1986.

systemic symptoms such as weight loss, fevers, diarrhoea and/or mild but relatively unusual and specific infections that indicate a defect in immune defence. (There is no standard definition for ARC but diagnosis requires two of the symptoms or signs shown in Table 1 as well as two abnormal laboratory results.) Patients with ARC have a high risk of progressing to AIDS.

## AIDS

AIDS is the most severe consequence of HIV infection. It is officially diagnosed at the onset of certain opportunistic infections or tumours such as Pneumocystis carinii or Kaposi's sarcoma (Box 1). Susceptibility to these developments results from the depletion or rendering ineffective of T4 lymphocytes – the cells which orchestrate much of the immune response – consequent upon infection with HIV (Laurence 1985). In selectively destroying these cells, the virus leaves the host unable to oppose parasitic, fungal, viral and other infections. The organisms involved may have been encountered earlier in life and have subsequently been contained (although not eliminated). They are released as HIV inflicts damage on the immune system and begin to cause disease. Thereafter repeated episodes of infection give rise to ever increasing morbidity and eventually become life threatening.

Defined in this way, that is according to the appearance of selected clinical markers, AIDS has been estimated to affect 10–15 per cent of infected individuals three years after the acquisition of HIV. This proportion has recently been found by a three year prospective study of HIV infection in homosexual males (Weber *et al* 1986). Twelve per cent (4/33) of seropositive patients progressed to AIDS over the three year period. However, it should once again be emphasised that observation of the clinical consequences of HIV is inevitably only short-lived and that further experience could lead to a significant revision of the proportion of seropositives developing AIDS. Indeed, cohort studies reported to the recent Paris conference on AIDS suggest that the proportion of antibody positive subjects progressing to the full syndrome now lies between 20 and 30 per cent (*Lancet* 1986).

AIDS is almost invariably fatal. Data for Britain gathered by the Communicable Disease Surveillance Centre and the Communicable Disease (Scotland) Unit indicate that 92 per cent of patients who had developed AIDS in or before 1982 had died by October 1985 (Richards 1985). (Although overall mortality is virtually 100 per cent, the case fatality rate at any one point in time is about 50 per cent. This lower estimate stems of course from the fact that the figure for cases will include patients who have only recently been diagnosed. Thus a study including almost all (96 per cent) AIDS cases reported in the UK by the beginning of June 1985, found a

## *Box 1* Definition of AIDS.

The original case definition for AIDS established by the Centres for Disease Control in the United States and subsequently adopted by the World Health Organisation and national health authorities including those in the UK was:

(i) A reliably diagnosed disease that is at least moderately indicative of an underlying cellular immune deficiency. For example, Kaposi's sarcoma in a patient aged less than 60 years, or opportunistic infection.

(ii) No known underlying cause of the cellular immune deficiency nor any other cause of reduced resistance reported to be associated with the disease.

In June 1985, this definition was revised following the discovery of the causative agent and in recognition of the wider range of clinical manifestations experience had shown to be associated with HIV (MMWR 1985).

The following table, compiled by Weller (1986), lists those diseases at least moderately indicative of underlying cellular immune deficiency:

| | |
|---|---|
| **Protozoal and helminthic** | |
| Cryptosporidiosis, Isosporiasis | Diarrhoea for > 1 month |
| *Pneumocystis carinii* pneumonia | |
| Strongyloidosis | Pneumonia, CNS, or disseminated |
| Toxoplasmosis | Pneumonia or CNS |
| **Fungal** | |
| Aspergillosis | CNS or disseminated |
| Candidiasis | Oesophageal or broncho-pulmonary |
| Cryptococosis | Pulmonary, CNS, or disseminated |
| Histoplasmosis | Disseminated |
| **Bacterial** | |
| 'Atypical' mycobacteriosis | (Species other than tuberculosis or lepra) disseminated |
| **Viral** | |
| Cytomegalovirus | Pulmonary, gut or CNS |
| Herpes simplex virus | Severe mucocutaneous disease > 1 month, pulmonary, gut or disseminated |
| Progressive multifocal leucoence-phalopathy | |
| **Cancer** | |
| Kaposi's Sarcoma | No age restriction |
| Cerebral lymphoma | |
| Non-Hodgkin's lymphoma | Diffuse, undifferentiated, and of B cell or unknown phenotype |
| Lymphoreticular malignancy | > 3 months after an opportunistic infection |
| **Other** | |
| Chronic lymphoid interstitial pneumonitis in child under 13 years | |

Patients suffering such illnesses but showing negative results on testing for antibodies to HIV, without a positive culture for the virus, or possessing normal numbers of T-helper lymphocytes are excluded as AIDS cases.

crude case fatality rate of 55 per cent (Marasca and McEvoy 1986).) The inevitability of death may, however, have caused some misconception of the 'shape' of AIDS as an illness (Pinching 1986b). Despite the progressive deterioration of immune function, many infections may be successfully treated, at least in the early stages. Patients may recover well from these episodes and show no outward signs of disease. It is not until later on, when therapy, if it is available, becomes ineffective in the absence of immune defence, that patients may decline rapidly towards death.

The presenting disease in AIDS appears to have an important influence on prognosis. The analysis of cases in the UK by Marasca and McEvoy (1986) found a median survival time of 21 months from presentation for subjects with Kaposi's sarcoma compared with 12.5 months for those with Pneumocystis carinii. Patients suffering a combination of the two diseases were found to have the worst prognosis, with a median survival time of just 6.6 months. The overall median survival time was calculated to be 13.5 months. Three-quarters of the patients had died within 28 months of presentation.

Data collected by the World Health Organisation shown in Table 2 suggest that, in Europe at least, the majority of AIDS patients (65 per cent) experience opportunistic infections and only 20 per cent suffer Kaposi's sarcoma. A combination of the two sequelae is seen in just 14 per cent of cases. A similar pattern prevails in the United Kingdom. By the end of October 1986, 548 cases of AIDS had been reported in the UK and of these, 70 per cent had presented with Pneumocystis carinii pneumonia or other opportunistic infections, 21 per cent with Kaposi's sarcoma alone and seven per cent with a combination of Kaposi's sarcoma and Pneumocystis carinii (CDR 1986a).

*Table 2* **AIDS cases by disease category and number of deaths for 21 European countries, *30 September 1985.**

| | *Cases* | |
|---|---|---|
| *Disease category* | *Number* | % |
| Opportunistic infection | 1,025 | 65.2 |
| Kaposi's sarcoma | 309 | 19.6 |
| Opportunistic infection and Kaposi's sarcoma | 212 | 13.5 |
| Other | 27 | 1.7 |
| Total | 1,573 | 100.0 |

*Austria, Belgium, Czechoslovakia, Denmark, Finland, France, Federal Republic of Germany, Greece, Hungary, Iceland, Italy, Luxembourg, Netherlands, Norway, Poland, Spain, Sweden, Switzerland, USSR, United Kingdom, Yugoslavia.

*Source* WHO 1986.

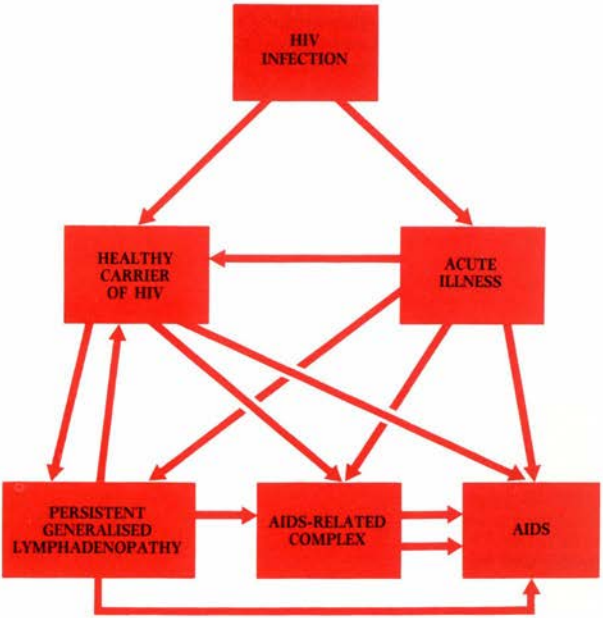
## Neurological involvement

The estimates of outcome following HIV infection discussed above contained, until recently, an element of optimism in that more than half of seropositives appeared to remain free of symptomatic illness. It is now clear, however, that the effects of the virus are not confined to the immune system but also extend directly to the brain. A deterioration of neurological function – involving, *inter alia*, headaches, depression, seizures, progressive dementia and peripheral neuropathy – is seen in between one quarter and one third of AIDS patients (Pinching 1986c). Initially, these developments were assumed by some to be a further consequence of the opportunistic infections which escape the impaired immune response. But recent investigations have revealed that HIV itself can attack the brain (Black 1985). The virus is therefore directly responsible for various acute, subacute and chronic neurological sequelae, the most frequently observed of which is a syndrome of subacute encephalitis (Carne and Adler 1986). Furthermore these neurological disorders do not just occur in AIDS patients – the abnormalities are also experienced by seropositive individuals who are immunocompetent and may never develop currently defined AIDS. Yet arguably the most significant issue raised by recent findings is the possibility that individuals who are antibody positive for HIV but without immune deficiency or discernible illness may in fact be undergoing processes of neurological damage, the impact of which may not emerge for a number of years. Against this background, Pinching (1985) has commented 'it may be that the neurological features will come to dominate the clinical perception of HTLV III related disease'.

Current understanding about the consequences of HIV infection is illustrated in Figure 1. It is possible that this epidemiological profile will have to be altered should new consequences of HIV infection emerge in the future. Indeed it is already 'dated' in the sense that specific reference is not made to the neurological effects of the virus. The diagram also disguises the many areas of uncertainty that have yet to be clarified. There are for example unresolved questions concerning the possible immunogenetic factors that may determine susceptibility to infection in the first instance.[5] It is also unclear whether the asymptomatic state seen in many patients may in some cases persist indefinitely, perhaps reflecting genuine containment of HIV by specific immune mechanisms. The co-factors that might determine the progression of disease are a further source of uncertainty. In this regard, atten-

5 It has been speculated that susceptibility to infection might be influenced by prior activation of T4 cells by sexually transmitted infections.

*Figure 1* **HIV-related disease**



tion has been given to subsequent sexually transmitted and other infections which might activate latently infected T4 cells and to causes of immunosuppression which could increase the biological damage caused directly by HIV (Pinching 1986a). Finally, explanations are sought for the apparent restoration of health among some subjects who had earlier seroconverted and then progressed to PGL. Progress towards clarifying these and other issues will be critical to the evolution of preventative and therapeutic interventions as well as to greater precision in gauging the magnitude of the health burden posed by HIV infection.

## Who is at risk?

HIV has been isolated from a wide range of body fluids including blood, semen, saliva, tears, breast milk and cervical and vaginal secretions (Acheson 1986). These discoveries have underpinned public concern at the possibility that everyday social and workplace interactions might be accompanied by the hazard of developing AIDS. In reality, this anxiety is unwarranted, not least because the virus is 'for the moment, a pathogenetic weakling' (Osborn 1986). HIV is a fragile virus that survives poorly outside the body. Consequently, very close contact is required for transmission to take place and all fully documented cases of AIDS or HIV seropositivity can be explained in terms of three routes of infection: sexual, blood to blood and maternofetal (Pinching 1986b).

Against this background, the Department of Health and Social Security in recently issued guidelines to health professionals (DHSS 1986) has emphasised that ordinary social contact with subjects who have antibodies to HIV appears to entail virtually zero risk of infection. The document points out that 'there is no evidence that the infection is transmissible by airborne droplets resulting from coughing or sneezing, nor by sharing washing, eating and drinking utensils, other articles in general use or the sharing of toilet facilities'. Research from the United States, based on detailed interviews, physical examinations and laboratory tests for serum antibody to HIV among 101 close but non-sexual contacts of 39 AIDS patients, supports this observation. Friedland and his colleagues (1986) found that only one of the contacts living in the same household as the index subject for at least three months (median: 22 months) during the period of presumed infectivity had evidence of infection with the virus (and in this isolated case infection appeared to have been acquired perinatally, not through horizontal transmission).

Even professionals engaged in the care of AIDS patients do not appear to be especially at risk of becoming infected. In April 1986, the UK Communicable Disease Surveillance Centre reported that

accidental transmission of HIV to a health worker had been substantiated in only one case although at least two other probable instances had also occurred (CDSC 1986). Given the infection control measures adopted in the hospital environment, it might perhaps be considered unsurprising that the number of misadventures in this context is so far very small. Yet even when precautions have lapsed, there does not appear to be a significant increase in the risk of accidental transmission. In the United States, 938 health-care workers with parenteral or mucous-membrane exposures to the blood or other body fluids of patients with AIDS or AIDS-related illnesses had been followed-up for a mean period of 15 months by the end of 1985 and none had acquired signs or symptoms of AIDS (McCray 1986). Almost half of the cohort (451 subjects) have been tested for antibodies to HIV and only two have been found to be seropositive. Furthermore, uncertainty surrounds the origin of infection in one of these cases so that the sample has in fact yielded only one documented instance of occupationally acquired HIV. Equally encouraging findings (to date at least) have emerged from studies conducted elsewhere in the US and in the UK (Geddes 1986).

The foregoing suggests that the limited amount of HIV found to be present in the quantities of blood generally involved in needlestick and related injuries is an important explanation for the small risks of accidental transmission in the hospital setting. Nevertheless, infection of health-care workers via this route can and does occur. Indeed it has very recently been reported from France that a female nurse has become HIV seropositive following a needlestick injury which occurred as she was taking blood from an AIDS patient (Neisson-Vernant *et al* 1986). The interests of health-care professionals and the non-HIV infected patients with whom they have contact therefore clearly demand that good standards of practice are employed at all times in order to avoid inadvertent infection (ACDP 1986).

## High risk groups

Although HIV has been isolated from many body fluids, transmission of the virus has been associated definitely only with semen, blood and blood products[6] (Acheson 1986). With few exceptions, infection in the UK has been effected via sexual (particularly but not exclusively homosexual) intercourse, the use of infected needles and syringes, the administration of Factors VIII

6 It may be speculated that the passage of time will require this statement to be modified. It has already been reported, for example, that an infected infant may have acquired HIV via breast milk (Ziegler *et al* 1985) and it has also been suggested that transmission in saliva via deep kissing might be the true route of infection in some cases attributed to genital contact (Voeller 1986).

*Table 3* **Cases of AIDS in the UK up to October 1986.**

| *Patient characteristic* | *Males* | *Females* | *Total* | *Deaths* |
|---|---|---|---|---|
| Homosexual/bisexual | 487 | — | 487 | 234 |
| Intravenous drug abuser | 6 | 2 | 8 | 2 |
| Homosexual and intravenous drug abuser | 3 | — | 3 | 2 |
| Haemophilia | 21 | — | 21 | 19 |
| Recipient of blood | 7 | 3 | 10 | 8 |
| Heterosexual contact: UK | 2 | 2 | 4 | 3 |
| Abroad* | 5 | 7 | 12 | 8 |
| Paediatric (intra-uterine or perinatal infection) | — | 2 | 2 | 1 |
| Other | — | 1 | 1 | 1 |
| Total | 531 | 17 | 548 | 278 |

*Includes 10 associated with sub-Saharan Africa.

*Source* CDR 1986a.

and IX for the treatment of haemophilia, the transfusion of blood and contact between infected mother and infant. (Cases of transmission during accidental occupational exposure, renal transplantation and artificial insemination have also been reported but these are exceptionally rare events and are extensions of the routes noted above.) Against this background, it has become clear that there are several sections of the community at high risk of acquiring HIV infection. These groups are clearly identifiable from the data on cases of AIDS reported to the Communicable Disease Surveillance Centre.

Table 3 provides an analysis by patient characteristic of all AIDS cases notified in the United Kingdom up to the end of October 1986. It shows that homosexual or bisexual males accounted for 89 per cent of all cases. The next largest group comprised haemophiliacs although these individuals only made up four per cent of the total. Intravenous drug abusers accounted for 1.5 per cent of the cases.

Information from other non-African countries reveals risk group profiles which are broadly similar to those observed in the UK. The one area of notable difference concerns the relative significance of intravenous drug abusers. In sharp contrast to the low UK figure, this group accounts for 17 per cent of AIDS cases in the US (Table 4). Similarly, the pooling of data for 21 European nations (including the UK) yields a proportion of AIDS cases attributable to intravenous drug abusers that is about six times the corresponding figure reported for the UK (Table 5).

These differences notwithstanding, it is clear that, at the present time at least, the vast majority of cases of AIDS in Western Europe and North America occur in homosexual men. The high risk status of this group is also indicated by the findings of serological surveys. In the United Kingdom, data from sexually transmitted disease (STD) clinics indicate that during the period October 1984 –

*Table 4* **Distribution of AIDS cases in the United States to 14 July 1986 by patient group.***

| | *Males* | *Females* | *Total* |
|---|---|---|---|
| *Adult cases* | | | |
| Homosexual/bisexual men[1] | 16,392 | — | 16,392 |
| Intravenous drug abuser | 3,045 | 779 | 3,824 |
| Haemophilia/coagulation disorder | 172 | 4 | 176 |
| Heterosexual contact[2] | 61 | 302 | 363 |
| Transfusion recipient | 241 | 134 | 375 |
| None apparent/unknown[3] | 921 | 268 | 1,189 |
| *Paediatric cases*[4] | | | |
| Haemophilia/coagulation disorder | 12 | — | 12 |
| Parent at risk | 123 | 122 | 245 |
| Transfusion recipient | 29 | 18 | 47 |
| None apparent/unknown | 6 | 6 | 12 |
| | 21,002 | 1,633 | 22,635 |

*Groups listed are ordered hierarchically; cases with multiple characteristics are tabulated only in the group listed first.

1 1,781 (11%) of homosexual men also reported having used IV drugs.

2 With a person with AIDS or at risk for AIDS.

3 Includes 482 persons born in countries in which most AIDS cases have not been associated with known risk factors; these persons are counted above heterosexual contacts in the hierarchy.

4 Patients under 13 years of age at time of diagnosis.

*Source* Centres for Disease Control, United States.

*Table 5* **AIDS cases by patient risk group and geographic origin for 21 European countries, *30 September 1985.**

| | *Origin* | | | | *Total* | |
|---|---|---|---|---|---|---|
| *Patient risk group* | *Europe* | *Caribbean Islands* | *Africa* | *Other* | *Number* | *%* |
| Male homosexuals or bisexuals | 1,031 | 4 | 11 | 39 | 1,085 | 69 |
| Intravenous drug abusers | 90 | — | — | — | 90 | 6 |
| Haemophiliacs | 52 | — | — | 1 | 53 | 3 |
| Transfusion recipients (without other risk factors) | 30 | — | 5 | — | 35 | 2 |
| Both homosexuals/bisexuals and intravenous drug abusers | 21 | — | 1 | 2 | 24 | 2 |
| No known risk factor males | 59 | 24 | 81 | 3 | 167 | 11 |
| No known risk factor females | 31 | 10 | 43 | — | 84 | 5 |
| No information | 16 | 1 | 16 | 2 | 35 | 2 |
| Total | 1,330 (85%) | 39 (2%) | 157 (10%) | 47 (3%) | 1,573 | 100 |

*Austria, Belgium, Czechoslovakia, Denmark, Finland, France, Federal Republic of Germany, Greece, Hungary, Iceland, Italy, Luxembourg, Netherlands, Norway, Poland, Spain, Sweden, Switzerland, USSR, United Kingdom, Yugoslavia.

*Source* WHO 1986.

*Table 6* **HTLV III seroprevalence by risk group and geographical distribution.**

| *Country* | *Year of collection* | *Total No studied* | *% HTLV III seropositive* |
|---|---|---|---|
| | *Homosexual men* | | |
| USA: | | | |
| New York | 1985 | 85 | 65 |
| Washington | 1985 | 160 | 44 |
| San Francisco | 1984 | 435 | 67 |
| Boston | 1982–3 | 160 | 21 |
| Canada: | | | |
| Montreal | 1984 | 209 | 18 |
| Vancouver | 1984 | 318 | 25 |
| Denmark | 1984 | 131 | 26 |
| England (London) | 1984 | 308 | 17 |
| France (Paris) | NS | 44 | 18 |
| Italy | NS | 70 | 9 |
| Holland | 1982 | 697 | 4 |
| Sweden | NS | 78 | 8 |
| Norway | 1984 | 47 | 6 |
| Germany (Berlin) | 1984 | 496 | 27 |
| Switzerland | NS | 40 | 10 |
| Finland | 1983–4 | 175 | 15 |
| Australia | 1984 | 49 | 20 |
| Panama | NS | 66 | 2.6 |
| Dominican Republic | NS | — | 10 |
| | *Intravenous drug users* | | |
| USA: | | | |
| New York City | 1984 | 272 | 60 |
| Newark New Jersey | 1984 | NS | 50 |
| Boston | 1982–83 | 69 | 42 |
| Italy: | 1985 | 209 | 29 |
| Rome | NS | 128 | 20 |
| Milan | NS | 71 | 23 |
| Cagliasi | NS | 30 | 17 |
| Catanzaro | NS | 20 | 0 |
| Vitebo | NS | 10 | 0 |
| Switzerland | 1985 | 37 | 32 |
| England | 1985 | 236 | 6 |
| Spain | 1985 | 75 | 48 |
| Germany (Berlin) | 1982 | 496 | 22 |
| Australia | 1984 | 126 | 33 |
| | *Haemophiliacs* | | |
| USA: | | | |
| Pennsylvania | 1985 | 121 | 59 |
| Los Angeles | 1984 | 42 | 50 |
| Georgia | NS | 25 | 72 |
| Massachusetts | NS | 47 | 64 |
| Denmark | 1984 | 22 | 64 |
| Germany | 1984 | 40 | 53 |
| England | 1982–84 | 184 | 34 |
| Scotland | 1984 | 77 | 16 |
| Canada | NS | 54 | 56 |
| | *Blood donors* | | |
| USA | 1985 | 1,027,786 | 0.2 |
| | 1985 | 593,831 | 0.25 |
| Spain | 1985 | 2,142 | 0.23 |
| England | 1983–84 | 1,042 | 0 |
| Germany: | | | |
| Hesse | 1984 | 4,445 | 0.47 |
| Six cities | 1984 | 6,720 | 0.52 |
| Switzerland | NS | 83 | 0 |
| Sweden | NS | 300 | 0 |
| Denmark | 1982 | 69 | 0 |
| Finland | 1985 | 20,000 | 0.005 |
| Brazil | 1985 | 1,469 | 0.13 |

*Source* Melbye 1986. NS = Not stated.

September 1985 the prevalence of HIV antibody among identified homosexuals attending these clinics was 21 per cent (Jesson *et al* 1986). This figure is an overall average and disguised the fact that seropositivity ranged from approximately 11 per cent in male homosexual attendees at provincial STD clinics to 35 per cent in one of the central London clinics. Yet even this latter figure appears relatively modest when compared with some of the rates reported from San Francisco and New York (Table 6).

The average figure of 21 per cent for the UK reported by Jesson and colleagues also camouflages the increases in prevalence that occurred over the twelve month period of analysis, thereby maintaining trends reported by other commentators. For example, Carne and his co-workers (1985) found that the prevalence of antibody to HIV among unselected British homosexual men attending a London STD clinic increased from 3.7 per cent during one week in March 1982 to 21 per cent during a similar period in July 1984.

The elevated risk for this group of acquiring HIV infection may be linked to a combination of factors. Of major importance among the latter is a large number of sexual partners which increases the likelihood of contact with an infected subject. In addition, the relatively high prevalence of other sexually transmitted infections found among some homosexual males may have significance in influencing susceptibility to HIV as well as prognosis following infection (Weber *et al* 1986).

Haemophiliacs dependent on injections of clotting factor prepared from human plasma and recipients of blood transfusions together currently constitute the second largest group of AIDS patients in the UK – 5.7 per cent of cases reported by the end of October 1986 (Table 3). In 1984/85, Jesson and colleagues (1986) found that 31 per cent of haemophiliacs, who account for 68 per cent of this sub-group, had antibodies to HIV. Among severely affected haemophiliacs seropositivity has been reported to be considerably higher: Jones and his co-workers (1985) found sera from 76 out of 99 patients with severe haemophilia A to be positive for HIV. These high rates may be attributed to the use of infected blood products during the early history of the emergence of HIV. Contamination arose because of the presence of infected subjects in the blood donor population – especially in the United States[7] which was supplying more than half of the United Kingdom's demand for factor VIII – and the absence of procedures to test and treat the blood products obtained from these individuals. Haemophiliacs are at especially high risk of coming into contact with infected factor

7 This may be linked to the fact that payment is made for giving blood in the United States. Richard Titmuss, in his book *The Gift Relationship*, published in 1970, showed that paid-for blood was more likely to be contaminated by hepatitis B virus than supplies donated voluntarily. HIV may be a contemporary exemplar of this phenomenon (Mclean 1986).

VIII because several thousand donations are required to manufacture one batch of concentrate.

Since 1984, however, modifications in the manufacture of factors VIII and IX, which have included heat treatment, have been generally introduced and to date there does not seem to have been a significant increase in the overall prevalence of HIV among haemophiliacs (Jones 1986a). This development, in conjunction with the introduction of universal donor screening (from October 1985) and requests to members of high risk groups not to donate their blood, should now mean that individuals requiring blood transfusion or factor VIII run practically no risk of HIV infection as a result of undergoing treatment.

A sharply contrasting picture is provided by intravenous drug abusers whose risk of acquiring HIV is presumed to be linked principally to the sharing of contaminated equipment, although sexual activity may also be of some relevance (Melbye 1986). Data covering the period from the beginning of the surveillance scheme to monitor AIDS (1982) until the end of October 1986 show that intravenous drug abusers have accounted for only eight of the 548 recorded cases. Yet it seems inevitable that this figure will increase substantially in the next few years. Underpinning this forecast is the rapid increase in the proportion of drug abusers found to have antibodies to HIV. In 1983 and 1984 seropositivity was observed in 1.5 per cent of a sample of intravenous drug abusers undergoing screening for hepatitis B (Cheingsong-Popov *et al* 1984). In 1984/85, 10 per cent of a sample of drug abusers receiving treatment from physicians were found to be anti-HIV positive (Jesson *et al* 1986). At this level prevalence in the UK is still apparently only half that reported for Italy where seropositivity among drug abusers is rising rapidly (Aiuti *et al* 1985; Gradilone *et al* 1986) and less than one quarter of the figures for Austria (Fuchs *et al* 1985) and Spain (Rodrigo *et al* 1985).

However, towards the end of 1985 Peutherer and his colleagues (1985) found a prevalence of HIV infection in a sample of drug addicts attending a large general hospital in Edinburgh of 38 per cent. In the same city, a more recent study found 51 per cent of a sample of intravenous drug abusers attending a general practice to have antibodies to HIV (Robertson *et al* 1986). This figure is approaching the prevalence rates observed in the north-eastern part of the United States (Table 6). In this specific location, the proportion of AIDS cases associated with intravenous drug abuse markedly exceeds the overall United States figure of 17 per cent.

## Current numbers and forecasts

The figures contained in Table 7 show that the total number of cases of AIDS notified to the UK Communicable Disease Surveillance Centre had risen to 273 by the end of 1985. New cases recorded during the first 10 months of 1986 have raised the total to 548. This new sum yields a cumulative incidence of approximately 9.8 per million population. In contrast this measure of occurrence stands substantially higher in the United States: AIDS notifications had reached 26,566 by 20th October 1986, implying a cumulative incidence of 112.5 cases per million population.[8]

The United Kingdom also appears – to date at least – to have been less severely affected by the 'AIDS epidemic' than many other European nations. Table 8 is based on the number of cases that had accumulated by the end of June 1986. Such comparisons have of course to be treated with caution, not least because of reporting vagaries and the rapid dating of the figures. Nevertheless the information contained in the table suggests that Belgium, Denmark, West Germany, France, Switzerland and Luxembourg all have a higher number of AIDS cases per unit of population than the UK.

In reality, these international comparisons are a source of little comfort given the magnitude of the burden HIV could potentially place upon the UK's health and related services in the future. Focusing on AIDS alone, McEvoy and Tillett (1985) have forecast the number of new cases presenting each year by extrapolating from past trends. Their initial analysis showed that new cases (measured by date of first medical consultation) will increase 30 times from the 1984 level to reach 1,837 in 1988 (Table 9).

A similar order of magnitude has been predicted by Mortimer (1985) on the basis of experience in the United States. The methodology assumes that the proportions of both the US and UK populations in the main risk groups are the same and consequently

*Table 7* **AIDS cases in the UK 1982–86.**

| | *Annual number* | *Cumulative total* |
|---|---|---|
| 1982 | 3 | 3 |
| 1983 | 28 | 31 |
| 1984 | 77 | 108 |
| 1985 | 165 | 273 |
| 1986* | 275 | 548 |

* To October. *Source* Acheson 1986; CDR 1986a.

8 The size of the difference between the two countries is considerably magnified when more specific denominators than the entire population are employed. Thus Acheson (1986) has estimated that the annual incidence of AIDS among single men aged 15 years and over was 1 per 100,000 in the UK in 1984 compared with 14 in the US and that in Greater London it was 5 per 100,000 contrasting with between 260 and 340 per 100,000 in New York and San Francisco.

*Table 8* **Cumulative totals of AIDS cases reported to the World Health Organisation.**

| *Country* | *1982* | *1983* | *1984* | *1985* | *1986 to June* | *Approx Rate/ 100,000 of cumulative totals* |
|---|---|---|---|---|---|---|
| Austria | — | — | 13 | 28 | 36 | 0.480 |
| Belgium | — | 38 | 65 | 139 | 171 | 1.730 |
| Canada | 31 | 84 | 222 | 522 | 699 | 2.800 |
| Denmark | 7 | 19 | 37 | 68 | 93 | 1.820 |
| France | — | 79 | 224 | 573 | 859 | 1.560 |
| Germany, Federal Republic of | 11 | 48 | 203 | 377 | 538 | 0.880 |
| Greece | — | 1 | 6 | 13 | 22 | 0.220 |
| Iceland | — | — | — | — | 2 | 1.000 |
| Ireland | — | — | — | 8 | 10 | 0.280 |
| Italy | 1 | 6 | 39 | 140 | 300 | 0.520 |
| Japan | — | — | — | 11 | 15 | 0.010 |
| Luxembourg | — | — | — | 3 | 3 | 0.750 |
| Netherlands | 3 | 18 | 48 | 98 | 146 | 1.010 |
| Norway | — | — | 5 | 17 | 24 | 0.570 |
| Portugal | — | 1 | 2 | 18 | 28 | 0.270 |
| Spain | 3 | 13 | 37 | 83 | 177 | 0.460 |
| Sweden | — | 4 | 16 | 42 | 57 | 0.690 |
| Switzerland | 9 | 20 | 44 | 100 | 138 | 2.120 |
| Turkey | — | — | — | 2 | 2 | 0.004 |
| United Kingdom | 3 | 28 | 77 | 287 | 389 | 0.690 |
| United States of America | 1,329 | 4,091 | 9,605 | 18,947 | 24,491 | 10.500 |

*Source* *Hansard*, 3 November 1986, col 355.

*Table 9* **Annual new patients with AIDS by date of first medical consultation.**

| *Year* | *Cases* |
|---|---|
| 1979 | 1 |
| 1980 | 0 |
| 1981 | 4 |
| 1982 | 9 |
| 1983 | 36 |
| 1984 | 58 |
| Total | 108 |

**Predicted numbers of new AIDS cases in UK for years 1985–88.**

| *Year* | *Predicted new cases** | *95% confidence limits** | |
|---|---|---|---|
| | | *Lower* | *Upper* |
| 1985 | 144 | 66 | 313 |
| 1986 | 336 | 127 | 889 |
| 1987 | 785 | 242 | 2,544 |
| 1988 | 1,837 | 462 | 7,307 |

*Using log-linear extrapolation, which does not allow for changing epidemiological patterns.

*Source* McEvoy and Tillett 1985.

adjustment has only to be made for the fourfold difference in the total number of people in each nation. Thus the third column of Table 10 shows the outcome of scaling down the actual annual number of AIDS cases in the United States (shown in the second column) to UK levels on the basis of overall population size. If account is then taken of the apparent three year time lag separating the two nations – the first cases of AIDS in the US were seen in 1978/79 and in the UK in 1981 – the 'adjusted' volume of new US AIDS cases in 1985 would be expected in the UK in 1988. Table 10 shows the figure estimated in this way to be remarkably similar to that predicted by the regression model of McEvoy and Tillett (1985).

Other predictions have painted an even more ominous picture. A leading article in the *British Medical Journal* has recently suggested that within five to six years the number of AIDS fatalities occurring each month in Britain could be equivalent to the crash of a fully laden jumbo jet – that is, an annual total of around 5,000 deaths (BMJ 1986). And Peto (1985) has estimated that at least 10,000 people in the United Kingdom will have developed AIDS by 1990.

Statistical predictions are, of course, subject to varying degrees of potential error. Focusing specifically on the findings of McEvoy and Tillett, the wide confidence intervals accompanying their forecast – the 95 per cent limits for the estimate of 1,837 cases in 1988 were 462 and 7,307 – reflect the uncertainties inherent in analyses based on just five data observations. In addition, as the authors emphasised, statistical projections employing extrapolation techniques fail to accommodate potential changes in the epidemiological pattern of disease. Thus the regression equation calculated by McEvoy and Tillett, if extrapolated further into the future than the authors' own analysis, suggests that the annual incidence of new AIDS cases will reach a magnitude equivalent to the entire

*Table 10* **New cases of AIDS reported/estimated: United States and United Kingdom.**

| *Year* | *USA** | *USA ÷ 4.06††* | *UK§* |
|---|---|---|---|
| 1981 | 241 | 59 | 58 |
| 1982 | 758 | 187 | 144 |
| 1983 | 2,518 | 620 | 336 |
| 1984 | 4,445 | 1,095 | 785 |
| 1985 | 7,500† | 1,847 | 1,837 |
| Total | 15,462 | 3,808 | 3,160 |

*From figure in MMWR (10 May 1985).
†Estimated from cumulative total to 20 September 1985, which is 5,451 (MMWR).
††Population adjustment: USA = 226.5 million, UK = 55.8 million.
§New cases 1985–88 predicted by McEvoy and Tillett.

*Source* Mortimer 1985.

population of the UK in 2001. In reality, however, as the experience of the United States indicates, extrapolated and actual rates of increase in incidence may begin to diverge soon after the final data point in the time series providing the basis for projection. Thus in the early stages of the AIDS outbreak in the US, the number of new cases doubled every five months but this interval had lengthened to 10 months in 1984/85 and to 11 months in 1985/86 (MMWR 1986).

A further problem in forecasting on the basis of the date of onset of AIDS stems from delays in the reporting of new cases. McEvoy and Tillet's (1985) original predictions were based on 108 cases known to have occurred between 1979 and the end of 1984. Subsequently, it has emerged that a further 81 cases had onset during this period. Consequently, a new analysis has been undertaken (Tillett and McEvoy 1986) and it is now predicted that 3,000 new cases of AIDS will present in 1988 instead of the 1,837 forecast in the authors' earlier communication.

The impact on the health and social services of the steady increase in the annual number of new AIDS cases will of course be compounded by the survival of patients beyond the year of diagnosis of the illness. The first analysis undertaken by McEvoy and Tillett (1985) did in fact attempt to take account of this element of the overall burden. On the basis of available survival data, it was calculated that 700 AIDS patients requiring treatment would be alive at the beginning of 1988. In combination with the predicted number of newly diagnosed cases arising in the latter year, this estimate yielded an overall caseload of 2,537. However, the authors calculated possible lower and upper limits either side of this figure of 692 and 9,478 respectively. The estimates are now clearly out of date and need revising in the light of the additional cases that have been reported for the 1979–84 period. Nevertheless, they might be considered to reflect quite appropriately the uncertainty that surrounds the annual flow of new cases as well as the potential for modifying survival times in the foreseeable future.

Straightforward statistical predictions based on extrapolations from past trends can therefore provide only very imprecise guides to the future size of the AIDS caseload. Greater precision in this respect requires accurate estimates of the prevalence of HIV in the population and the likelihood of AIDS developing in those who are infected but such information is not available at the present time. Furthermore, such forecasts, even if the necessary data became available, would still substantially understate the true resource impact of HIV since illness caused by the virus is far from confined to currently defined AIDS. Yet here, too, prediction is difficult.

It is not clear, for example, what might happen to those individuals who are seropositive for HIV but currently show no signs of

ill health. Whilst some may remain in this state others may develop persistent generalised lymphadenopathy (PGL), AIDS related complex (ARC) or AIDS itself. Equally, it can only be speculated whether the virus in some asymptomatic subjects is having a directly deleterious impact on the central nervous system (or predisposing to such a development) that might eventually manifest in some form of neurological dysfunction, irrespective of immune system effects. Accurate predictive tests have yet to be devised although 'several longitudinal studies are in progress with the aim of identifying the very earliest signs that mark inevitable progression towards any of the protean manifestations of the syndrome' (*Lancet* 1986a).

Yet further uncertainty arises in connection with the distribution of the various sequelae of HIV infection over time. In particular, the natural history of infection experienced by the earliest high risk groups may not be representative of that facing subsequent cohorts (Pinching 1986a). At present, HIV related disease may be seen as a moving target in the sense that observed clinical outcomes are changing with time (Adler 1986a). It is possible that the future will see changes in the nature of the observed impacts of HIV as well as alterations in their relative significance.

## Forecasting the spread of HIV

The foregoing has made clear that in attempting to forecast the economic and social burdens associated with HIV it would be inappropriate to focus solely on the potential number of AIDS cases. Instead attention should be directed towards the possible spread of the virus within the population. Yet even within the clearly defined high risk groups accurate prediction is inhibited by the limited availability of information about the potential numbers at risk and the uncertainties concerning the risks of acquiring HIV.

With regard to the former, the number of homosexual and bisexual males in the UK, for example, is unknown. It has been estimated that these individuals comprise four per cent of the adult male population in the United States (Cameron 1986). Application of this proportion to the UK male population aged 18 years and over in 1984 would yield a total of 818,000 currently belonging to this group. If it is assumed, admittedly rather arbitrarily, that those in the age range 18–44 years are at greatest risk and that the overall US prevalence figure of four per cent applies equally to this specific age group, this total falls to 440,000. It is however impossible to judge how accurate this estimate might be.

Similar uncertainty surrounds the data on the extent of intravenous drug abuse in the UK. In a recent parliamentary discussion it was stated that more than 60,000 people regularly misuse drugs and that the substance most frequently involved is heroin (Braine

1986). Alternatively, extrapolations based on information from drug dependency clinics in Liverpool and Bootle suggest a figure for the total number of addicts in the UK of 150,000. It has to be recognised that this particular part of the country may not be nationally representative and that projections based on the experience of the area could overstate the global size of the problem (Marks 1986). Despite the uncertainty implied by such wide-ranging estimates, it is however clear that contemporary trends in drug abuse have disturbing implications for the spread of HIV. Table 11 shows the number of new narcotic drug addicts notified to the Home Office in recent years. Clearly, these figures illustrate only the tip of the iceberg of the drug abuse problem. Nevertheless the data indicate that between 1982 and 1984 the annual number of new notifications in the UK increased by more than 90 per cent for both males and females. The largest increases over the two years have occurred at the younger end of the age spectrum shown in the table: notifications among persons under the age of 24 years rose by 119 per cent over the period and accounted for one case in every two in 1984.

## The risks of infection

It is therefore extremely difficult to gauge with any accuracy the sizes of the various populations at high risk of HIV but even greater problems confront attempts to estimate the likelihood of individuals within these groups acquiring infection. The latter risk is frequently especially linked to certain patterns of behaviour but the extent to which these are followed within a specific community

*Table 11* **Narcotic drugs – new addicts notified to the Home Office, 1973–84, by age and sex, United Kingdom.**

| | *AGE* | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | *Under 20* | *20–24* | *25–29* | *30–34* | *35–49* | *50 or over* | *Not known* | *Total* |
| Males | | | | | | | | |
| 1973 | 149 | 334 | 89 | 23 | 20 | 24 | 5 | 644 |
| 1976 | 61 | 315 | 251 | 55 | 35 | 20 | 8 | 745 |
| 1981 | 141 | 544 | 511 | 269 | 78 | 15 | 49 | 1,607 |
| 1982 | 197 | 676 | 593 | 323 | 118 | 16 | 53 | 1,976 |
| 1983 | 402 | 1,011 | 766 | 440 | 192 | 38 | 130 | 2,979 |
| 1984 | 584 | 1,334 | 958 | 570 | 257 | 22 | 115 | 3,840 |
| Females | | | | | | | | |
| 1973 | 41 | 79 | 20 | 7 | 8 | 8 | 0 | 163 |
| 1976 | 40 | 100 | 55 | 15 | 10 | 12 | 7 | 239 |
| 1981 | 91 | 225 | 186 | 84 | 18 | 14 | 23 | 641 |
| 1982 | 113 | 271 | 233 | 113 | 41 | 12 | 34 | 817 |
| 1983 | 170 | 446 | 315 | 150 | 59 | 18 | 49 | 1,207 |
| 1984 | 214 | 618 | 405 | 205 | 63 | 19 | 51 | 1,575 |

*Source* *Social Trends*, 1986 edition.

is unclear. Among homosexual males, for example, sexual contact with large numbers of partners is associated with a high risk for HIV but the extent to which this type of lifestyle is followed is not known. In addition, some forms of sexual intercourse may carry a greater risk of infection than others but again the prevalence of such activities is unknown. Furthermore, there are no direct means of monitoring behavioural change that may occur over time as a response to concern about the virus. Against this background of uncertainty, there can at least be no doubt that with the indicated rise in seropositivity rates – thereby increasing the chances of coming into contact with an infected subject – and estimates that regular sexual contact with an infected individual carries a more than 50 per cent risk of acquiring infection, the hazards facing some homosexual males have increased substantially.

With regard to intravenous drug abuse, recent trends reported from Edinburgh suggest that individuals engaging in this activity face a rapidly increasing risk of acquiring HIV. The virus is believed to have arrived in the Scottish capital during the second half of 1983 and studies published so far this year suggest HIV seropositivity rates for this group may be in excess of 50 per cent. Investigations carried out elsewhere – for example in Glasgow and London – have reported considerably lower HIV seropositivity figures. This has raised questions about whether the experience of Edinburgh serves as a useful guide to potential developments in the United Kingdom as a whole.

Scientific exploration of this issue is inevitably beset by many difficulties. Prominent among the latter is the problem of obtaining information about comparable and representative groups of drug users in different locations. Nevertheless available evidence suggests that the rapid spread of HIV infection in Edinburgh may be attributed to the high frequency of needle and equipment sharing found in the city compared with other centres of drug abuse (Robertson *et al* 1986, Brettle *et al* 1986). Initiatives aimed at arresting this practice on the 'shooting galleries' of Edinburgh and preventing its development elsewhere could therefore have an important impact on future rates of HIV seropositivity. In this context, increasing the availability of sterile needles and syringes (discussed later) has been put forward as a possible means of discouraging equipment sharing although for maximum effect such an approach would have to be tailored to the varying needs of different groups of drug abusers. The spread of HIV among drug abusers will also reflect the extent to which individuals are switching to 'safer' (as far as HIV risk is concerned) forms of drug abuse (for example, substituting the method of heroin administration known as 'chasing the dragon' for intravenous injection). But, once again, little is known about such trends at the present time.

The outlook for unaffected haemophiliacs is considerably brighter than it is for homosexual males and intravenous drug abusers. Although about one-third of the 7,600 haemophiliacs in the UK have antibodies to HIV, the heat treatment now being applied to the blood products required by this group coupled with the screening of donated blood should ensure that further instances of infection are exceptionally rare. The possibility of additional cases cannot, however, be ruled out entirely, at least in the immediate future. Until the UK Blood Products Laboratory comes fully on stream (estimated to be in 1987) demand for factor VIII will continue to be partly satisfied by supplies from the United States, where the incidence of infectivity is of course higher than in the UK, and therefore the risk of donation from infected sources greater (Jones 1986a). And heat treated blood products have been implicated in three recent reports of HIV infection (Van den Berg *et al* 1986; White *et al* 1986; Fletcher 1986). For these reasons the director of the Newcastle Haemophilia Centre has commented that 'it would be misleading to pretend that we could guarantee the safety of heat treated products to our patients' (Jones 1986). Against this background manufacturers are investigating new ways of ensuring the purity of blood products, including manufacture with solvents and detergents, longer periods of heat treatment and the use of recombinant DNA material (Jones 1986a).

Some concern for individuals dependent on volunteered blood supplies also arises from the continued presence of seropositive subjects within the donor population. Persons in high risk groups have been requested to cease making their blood available to the National Blood Transfusion Service. However, the screening of 1,926, 692 donations in the UK during the period October 1985 to June 1986 revealed 41 to be positive for antibodies to HIV. Thirty-six of these donors were subsequently interviewed and almost 90 per cent were found to belong to one or other of the currently recognised high risk groups (CDR 1986). The need to demand of the latter abstention from donating blood is plain: their lifestyles may entail an elevated risk of acquiring HIV and screening may fail to detect recently infected subjects because weeks or months may lapse before antibody is produced in response to the infection (Melbye 1986). Nevertheless, taking an overview, it would appear from the data quoted above that there is now very little risk to blood recipients of being infected by HIV from the supplies made available via the UK Blood Transfusion Services. Over the longer term, changes in the magnitude of this risk will continue to be determined by the responsibility of the behaviour of individuals at high risk of HIV, although perceptions of those for whom classification in this way is applicable could alter significantly over time.

## Infection outside high risk groups

Forecasting trends in the spread of HIV becomes yet more hazardous when attention is directed away from the currently recognised high risk groups towards the rest of the population. The latter may be regarded collectively as being at low risk, although within this substantial 'residual' population the likelihood of encountering or acquiring the infection will clearly show considerable variation. To the limited extent that individuals who choose to give blood may be regarded as representative of the community as a whole, donation screening data indicate that the prevalence of antibodies to HIV is extremely low among those not in high risk groups.[9] However, isolation of the virus from a wide range of human body fluids and the existence of bridges between individuals at high and low level risk, suggest that scope exists for a much broader dissemination of HIV than has been witnessed to date.

Information currently available indicates that significant increases in the community-wide prevalence of HIV are extremely unlikely to result from social contact. The fragile virus is present in such low titre in the majority of fluids that they pose no hazard for ordinary everyday life. Instead a number of other transmission routes are likely to be of greater importance. The virus may, for example, be passed from an infected mother to her child and he or she in turn may be infectious to others upon becoming sexually active. Transmission can be effected in utero, occurring as early as the 15th week of gestation (Sprecher *et al* 1986), but infection may also be acquired from maternal blood at parturition. (In at least one instance, HIV appears to have been transmitted through breast milk (Ziegler *et al* 1985).) The risk of transmission is not known precisely but available data indicate that infection in the neonate may occur in 50 per cent or more of pregnancies in anti-HIV positive mothers (Sande 1986; MMWR 1985a).

Concern has also been expressed at the potential risks of infection faced by health-care workers and dental practitioners. To date, as noted earlier in this paper, transmission of the virus via occupational exposure has been extremely rare. However, it might be speculated that the risks to those in the caring professions could become more appreciable if the number of asymptomatic (and thus without immediately obvious signs indicating potential risk) seropositives entering hospitals for other conditions increases in tandem with the infection becoming more widespread in the popu-

9 In the UK only 0.002 per cent of the two million blood donations screened between October 1985 and June 1986 were HIV antibody positive and, as noted in the text, the vast majority of these derived from high risk individuals. In the US, where the latter groups are similarly discouraged from volunteering their blood, HIV antibody prevalence in donated blood approaches 0.04 per cent (Schorr *et al* 1985). The much lower rate in the United Kingdom is likely to reflect, *inter alia*, the availability of testing facilities at other non-donor sites for persons wishing to ascertain their antibody status.

lation as a whole. It might be speculated that additional hazards may also arise in this general context if the growing burden of AIDS cases results in a shift of care away from centres of 'infection control excellence'.

Notwithstanding the real concerns generated by these possible developments, many commentators consider heterosexual activity to be the principal means whereby HIV could become significantly more prevalent than it is today. Support for this view is drawn from Africa where the sex distribution of AIDS is nearly equal and practically all cases occur in the sexually active age range (Biggar 1986; Melbye *et al* 1986). In particular, the risk for the disease appears to be strongly associated with having multiple heterosexual partners (Pinching 1986).

Evidence exists for the transmission of the virus from males to females during vaginal intercourse. Antibodies to HIV have been observed in the female sexual partners of male AIDS patients and haemophiliacs.[10] Further support for male to female transmission derives from the finding of antibodies to HIV in four out of eight recipients of artificial insemination with cryopreserved semen from a symptomless carrier of the virus (Stewart *et al* 1985).

Against this background, possibly quite extensive dissemination of the virus could result from the sexual activities of male intravenous drug abusers and bisexual males. Focusing on the latter group, Adler (1986) has estimated that between 10 and 15 per cent of homosexual men engage in heterosexual intercourse. The female sexual partners of these men therefore constitute another group at potentially high risk of infection, although in many instances they may be unaware of their vulnerability. Furthermore, the risk of infection may extend from these women to any children they may have and to any other subsequent sexual contacts (Calabrese and Gopalakrishna 1986).

The latter possibility – that is, infection passing from female to male – is, however, a source of some uncertainty at the present. Clearly, this transmission route could have significant implications for the spread of HIV from the high risk groups into the wider community. Prostitution and drug abuse, for example, might combine as an effective bridge in this context. In order to be able to purchase supplies of illicit drugs some females engage in prostitution. Thus while drug abuse increases the risks to the individual of acquiring HIV[11] the means of financing the habit could extend the hazard of

10 For example, Jones and his colleagues (1985) found anti-HIV in three out of 36 sexual partners of patients with severe haemophilia A. For two of these women no other possible risk factors could be identified.

11 Seropositivity has been reported in up to 40 per cent of prostitutes in some areas of Europe and the United States and many of these individuals are parenteral drug users (Handsfield *et al* 1985).

infection to other members of the population who are not currently identified as members of a high risk group. Of course, prostitution is not an essential aspect of this bridge: any sexual contact between infected female drug abusers and male non-users – irrespective of whether it occurs at the time the former are employing these substances or after they have stopped – might carry a risk of passing on the virus.

HIV has been isolated from the cervical and vaginal secretions of antibody positive females (Vogt *et al* 1986; Wofsy *et al* 1986) but, to date, evidence to support female to male transmission is argued by Wykoff (1986) to be based only on 'untested epidemiologic observations'. Redfield and co-workers (1985), for example, claimed to have established HIV transmission in this direction in a report on 10 married US servicemen with HIV associated diseases for whom contact with prostitutes was the only apparent risk factor. The study has, however, attracted criticisms concerning methodology and epidemiological reasoning (Schutz *et al* 1986) and these have cast doubts on the authors' central conclusion. More generally, the response to the study has highlighted the immense complexities of scientific investigation in this area.

Further uncertainty concerning the transmission of HIV from females to males derives from the relatively small number of AIDS cases to date among heterosexual males in New York despite certain evidence for the presence of HIV among the city's prostitutes (Acheson 1986). In addition, attention has been drawn to the possibilty that the equal sex distribution of AIDS cases in Africa need not necessarily invoke female to male infection. The observed pattern may instead be explained by other factors including, for example, higher rates of male homosexual and bisexual activity than have been revealed by case interviews (Padian and Pickering 1986). Alternatively, Wykoff (1986) has suggested that males believed to have become infected directly from prostitutes may in fact have acquired HIV from infective semen remaining in the vaginas of these women or as a result of treatment for sexually transmitted diseases, sought after prostitute contact, that might have involved the use of non-sterile needles.

The foregoing is clearly not a comprehensive analysis. Instead, the purpose of drawing attention to these points is to illustrate the considerable difficulties confronting investigations of the transmission of HIV from females to males. Nevertheless, Redfield and colleagues (1986) argue that it would be remarkable if HIV was the first example of a unidirectional sexually transmitted disease. And even critics of available epidemiological data such as Wykoff (1986) concede there is strong evidence to implicate female to male spread of HIV, although it may be that transmission in this direction is less efficient than from males to females. Against this back-

ground and in view of contemporary developments such as the rising prevalence of intravenous drug abuse Sande (1986) echoes the views of many commentators in claiming that 'the potential for the future spread of this disease in the heterosexual community remains a serious problem . . . '.

## Containing the spread of HIV

The foregoing suggests that projections of the imminent burden of HIV on the health and related services are, in the present state of understanding, unlikely to be accurate. This observation reflects the lack of information about the current numbers infected by HIV and the effects of the virus. There is also considerable uncertainty about the size and lifestyles of the different groups currently classified as being at high risk for the virus. A further unknown quantity is the degree of sexual interaction that occurs between high and low risk groups.

It is also clear that future caseloads will be a function of yet another elusive variable – the extent to which fears about the consequences of HIV generate changes in behaviour aimed at the reduction of the risk. In other words, it remains to be seen whether the almost inevitable mortality accompanying officially defined AIDS, the morbidity linked with AIDS related complex and the anxieties for the future experienced by individuals infected by HIV, but so far without apparent ill effect, are sufficient to slow down or halt the steady spread of the virus within the high risk groups and to prevent its dissemination to the rest of the population.

Indeed in the absence of effective vaccines or medication and assuming there is a desire to avoid measures that might involve, for example, curtailing the liberty of seropositive individuals, the only feasible means of currently containing the spread of HIV lies in an appropriate modification of lifestyles. With the objective of encouraging such change, the government has launched an information programme aimed not just at homosexual males and intravenous drug abusers but at the population as a whole. The campaign seeks to promote accurate understanding about the nature of AIDS, how it is spread and the high risk activities that should be avoided. It also stresses that normal social contacts with infected subjects should not be a source of concern.

At the same time educational and other materials are being made available by voluntary organisations such as the Terrence Higgins Trust. (The latter is named after the first homosexual male to die from AIDS in the UK.) Most of the Trust's work is focused on this particular high risk group although it has recently started to take a more direct interest in drug abusers to counteract a perceived neglect of these individuals by other agencies.

## Criticisms of government action

The government campaign was launched in the spring of this year and its initial thrust attracted much criticism. In the first instance, many commentators believe that the government delayed far too long before entering this particular area of health education. Advertisements in the national newspapers and in the gay and contact press first appeared in March and April 1986, four years after 'warning bells' had started ringing in the United States and by which time more than 300 cases of AIDS had already been reported in the United Kingdom. In retrospect, the dilatory reaction to the spread of the virus is difficult to justify and has led to the suggestion that had some other group more socially popular than homosexual males been the target of HIV, an official response might have been more rapidly forthcoming (Adler 1986).

A second major criticism concerned the scale of the campaign. The costs of advertising are such that the resources made available by the government were considered by many to be insufficient to mount a comprehensive campaign (*Guardian* 1986). In particular, Adler (1986) argued that newspaper advertisements alone were inadequate and should be complemented by the use of television and radio broadcasts and by the distribution of information leaflets direct to every home in the country.

The content of the campaign was also the target of adverse comment. A number of critics argued that the advertisements failed to convey the message that AIDS should be the concern of everyone: many misconceptions about the virus and its potential impact persist and in particular large sections of the population seem to believe that it affects only homosexual males (BMJ 1986). And running alongside this issue, some observers criticised the copy employed in the newspaper advertisements as being insufficiently explicit and too weak to have the desired impact on behaviour patterns.

In short the government's initial public education strategy, based on newspaper advertisements, was widely regarded within the medical profession as unimaginative and too limited in scale. Nevertheless, the government has recently expressed satisfaction at market research findings indicating that one quarter of a sample of 1,400 adults aged 18–64 years had been aware of its advertising campaign (DHSS 1986a). This proportion was claimed to be higher than might have been expected and most of the respondents indicated that they had gained useful new information about AIDS. An independent postal survey in Southampton undertaken to gauge the impact of the government's AIDS campaign found that an even higher proportion of respondents (31 per cent) claimed awareness of the advertisements (Mills *et al* 1986). However, the authors of the study also concluded that the campaign '. . . seems to have had

little effect on the public's knowledge of AIDS, and the increased publicity may have caused some confusion about the principal cause of AIDS . . . '. Other research suggests that information gains have been achieved by the campaign but these seem likely to have resulted from a filling-in of knowledge gaps rather than from an adjustment of misconceptions (Sherr *et al* 1986). In response to these criticisms the government has recently announced major revisions to its campaign and these are discussed in the conclusion.

## Complementary initiatives

The official campaign has not been the only cause of controversy in the present attempts to halt the further spread of HIV – the nature and wisdom of possible complementary initiatives have also generated heated debate. For example, Kurtz (1985) has suggested that 'education should aim to encourage widespread screening for HTLV III antibody in people in the high risk groups and their families and their sexual contacts'. In the absence of effective therapy against the virus, it is argued that screening would be beneficial in promoting appropriate behavioural change: discovery of seropositivity would lead individuals to alter their lifestyles to reduce the risk of transmission to others. However, the evidence on this matter is limited and equivocal (Acheson 1986) and there can be little doubt that there would in any event be considerable variation in the reactions of different individuals. Indeed, it is possible that for some people a negative test result might generate unwarranted complacency about sexual behaviour. Concern also stems from recent press reports suggesting that some individuals discovering themselves to be seropositive are now engaging in what has been termed 'revenge sex'.

The debate about screening has not of course been confined to this particular issue alone. Attention has been drawn to many purported advantages and disadvantages that might result from the introduction of antibody screening. On the 'benefit' side of the equation, it has been claimed that screening might be useful, for example, in promoting infection control in hospitals and elsewhere. It could also provide more accurate information about the prevalence of HIV infection. And screening could prove advantageous if therapies become available which require early administration for maximum benefit to be obtained. Alternatively, it has been argued that the potential consequences of screening could serve to 'drive HIV infection underground' and thereby add to the difficulties of containing the spread of infection. In addition a positive test finding can have devastating material, social and psychological consequences for the individual concerned.

Recently, the focus of the controversy surrounding the costs and

benefits of screening has shifted away from 'domestic' high risk groups to individuals coming into the UK from Africa. It has been suggested that because of the relatively high prevalence of HIV infection in countries such as Zambia, Uganda and Tanzania, visitors – especially students – from these nations should be screened for antibodies to the virus. In particular there is concern that travellers from Africa could, given the epidemiological pattern of infection in the continent's affected countries, promote the spread of the virus in the UK among sections of the community not considered at the moment to be at high risk. Consideration has been given to the economic, logistical and political viability of screening African visitors to the UK and arguments of varying degrees of persuasion have been advanced by both those favouring and those against the introduction of such a scheme. However, the proposal would appear to be flawed to some extent since screening based on antibody tests would fail to detect individuals who had only very recently become infected with the virus. Yet further complexities arise once it is recognised that a logical approach to screening might also need to embrace UK citizens returning from business and other trips to Africa as well as residents of the United States visiting this country.

Screening clearly raises many difficult issues. It may be effected in a number of different ways, each of which is associated with specific as well as more general problems. Operated on a voluntary basis, for example, screening may fail to obtain the participation of those it particularly seeks to attract.[12] Compulsory universal screening, as an alternative approach, has formidable implications for civil liberties in addition to generating difficulties of a purely logistical nature. Beyond these immediate issues, attention has also to be directed at the consequences for individuals found to have antibodies to HIV. At one extreme it is suggested that knowledge of seropositivity alone is sufficient to encourage appropriate behavioural change whilst the opposite view holds that isolation is the only solution for those found to be infected. Unfortunately, discussion of these and many other critically important issues raised by screening has, to date, tended to be confused, incomplete and based on arbitrary opinion rather than firm evidence.

Special initiatives to halt the spread of HIV among intravenous drug abusers have also been the subject of controversy. Apart from debate surrounding the value of the government's separately

12 In this context, recent research has suggested that, with appropriate counselling, screening may in fact be more widely acceptable than has previously been thought to be the case. Welch and her colleagues (1986) found that only five per cent of 270 homosexual and bisexual men attending a department of genito-urinary medicine did not wish to be tested for antibodies to HIV and that 70 per cent of those investigated wanted to be informed of the result.

launched campaign to stem the increasing number of addicts in this country, there are diametrically opposed views on the net benefits of making needles more readily available with the goal of discouraging equipment sharing and, in turn, preventing the spread of HIV. Some protagonists of this approach favour the type of strategy pursued by the authorities in Amsterdam where addicts receive a sterile syringe and needle free of charge when they return used equipment (Buning *et al* 1986). The impact on the prevalence of HIV of this aspect of the city's 'pragmatic, non-moralistic' approach to drugs will only become clear with the passage of time, although Veitch (1986) has written that 'unofficial reports from drug agency workers in Amsterdam suggest that the level of infection is still running at less than 5 per cent'.

In the UK, the government has expressed concern that a free exchange system might lead to an increase in the prevalence of drug abuse. At the same time, it has been argued by some commentators that increasing the supply of clean syringes and needles might not in fact significantly reduce equipment sharing since the latter may be 'associated with socialisation, communal feeling and protection in the drug culture, not merely with shortage of needles' (quoted in Prentice 1986). However, a recent publication from the Scottish Office expresses the belief that police action to limit the availability of intravenous drug abuse equipment has contributed to the extensive sharing of 'works' in Edinburgh and at the time of writing the UK government is re-considering its position on the issue (McKie 1986).

## The cost of HIV

Uncertainty about the spread of HIV in the foreseeable future and the clinical burden it will cause necessarily imply that the future resource costs of the virus cannot be predicted with anything approaching accuracy. Forecasting is made yet more difficult by the variations in current per capita treatment outlays and the likelihood of changes in the methods of care over time. It is nevertheless valuable to examine the costs generated by HIV at present as this highlights the extent to which they differ from those associated with other causes of ill health. It also makes clear that the impact of the virus is considerably more wide-ranging than is generally recognised.

Focusing first on the costs of treating AIDS patients, information from studies carried out in the United States reveals a wide range of estimates for hospital inpatient care. At one extreme, Hardy and her colleagues (1986) have calculated an average expenditure of

$147,000 per patient. At the other end of the spectrum, Scitovsky and colleagues (1985) have derived a figure of $24,000. The magnitude of this discrepancy reflects substantial differences in the average length of inpatient stay – 168 days in the former study compared with just 29 days in the latter.

In the UK, Johnson and her colleagues (1986) have calculated the average 'lifetime' cost of inpatient care for an AIDS patient at £6,308. This figure is based on a total of 50 inpatient days between diagnosis and death and the costs of providing treatment on a general medical ward in a London teaching hospital in 1984/85. Average lifetime outpatient expenditures amounted to £530 per case, yielding a total hospital care cost of £6,838 per AIDS patient.

These estimates have subsequently been corroborated by an extension of the study to include a larger number of patients receiving treatment at two hospitals (Adler 1986a). However, the authors acknowledged in their published paper that some understatement of cost might arise from the inclusion of early cases in the study as this will tend to select disproportionately patients with shorter survival times. On average, the cases comprising the study were followed up for 22.4 weeks. Patients surviving for longer periods of time may spend a greater total number of days as hospital inpatients and this would of course increase the cost per case. In addition, substantial extra expense will be incurred in cases requiring intensive care – treatment costs in this setting are approximately double those of general medical wards.

It is therefore possible that individual case costs might show a substantial degree of dispersion around the mean of £6,838 calculated by Johnson and her colleagues (1986). Nevertheless, this remains a considerable sum; to provide some perspective, the costs of caring for an AIDS patient are more than four times the resources needed to perform a hip replacement. Alternatively, the AIDS case costs may be compared with £4,732 for cardiac valve replacement, £5,915 for coronary artery graft and with £7,098 for the first year costs of a renal transplant.[13] It might be argued, however, that such comparisons are inappropriate since these other expenditures are expected to improve substantially the survival prospects and the quality of life for the patients concerned.

Yet in the context of global NHS spending, the provision of care for individuals with AIDS constitutes, at the present time, an insignificant drain on available resources. Applying the per capita care cost reported above to the 270 AIDS patients currently alive

13 These cost estimates are taken from Jennett (1984). In that publication they were quoted in November 1982 prices but here they have been re-adjusted to the level prevailing in August 1986. It should be emphasised that adjustments made only on the basis of changes in the retail price index may distort the accuracy of the costs in question.

yields a figure for expenditure on AIDS treatment in 1986 in the UK of about £2 million. This sum represents just 0.01 per cent of the resources consumed by the NHS. However, since AIDS cases to date have been concentrated in the London area, certain health districts have been subjected to much greater resource pressures by the disease than might be inferred from the cost data viewed in a global context. The financial implications of this geographical distribution – exacerbated by the resource consequences for London of the RAWP process – have in fact been recognised by the government and in the current financial year (1986/87) an extra £2.5 million is being supplied to the North West, North East and South East Thames Regional Health Authorities (DHSS 1986b).

In addition to the hospital inpatient and outpatient costs of AIDS, medical and related care expenditures are also generated by the other outcomes of HIV infection. In this regard, account should therefore be taken of the treatment provided for individuals with persistent generalised lymphadenopathy and the other conditions grouped together under the term AIDS related complex. More minor episodes of ill health linked to the infection coupled with the costs of antibody testing and of counselling seropositive individuals[14] are also clearly relevant to an overall assessment of the financial consequences of caring for those infected by the virus. Yet in all of these instances, insufficient data are available to allow even a crude guess at the total and per capita costs involved.

## Economic and social costs

In addition to the expense of medical care falling on the NHS, HIV also inevitably gives rise to wide ranging social and economic costs borne by individuals infected by the virus and the community as a whole. Focusing on the former, the patient with AIDS is confronted with the prospect of inevitable death within a relatively short period of time. Little that is useful can be said of the burden faced by these people since the capacity to adapt in such circumstances is infinitely variable. Among those who are antibody positive but without the clinical markers defining AIDS – embracing, that is, asymptomatic and apparently healthy individuals at one end of the spectrum to those suffering persistent illness at the other – reactions are equally varied. Confirmation of seropositivity is, however, frequently a cause of psychological and emotional morbidity and such distress is likely to extend to relatives and others close to the person concerned. Diagnosis may also lead to social isolation and,

14 In 1985/86, the government made £90,000 available to six health authority haemophilia reference centres to provide support and specialist counselling services and this sum will rise to £270,000 in 1986/87. In addition, £150,000 is being spent on the provision of counselling training courses for health-care personnel (DHSS 1986b).

coupled with anxiety about possible future deterioration, could result in severe depression and possibly even suicide in some cases.

The practical consequences of seropositivity may be equally disturbing. Some infected subjects have, for example, experienced difficulties in obtaining medical and dental treatment. Instances have been reported of hospital surgeons requiring suspected high risk patients to undergo antibody testing so that special precautions might be taken where a positive result is obtained. Others have refused to treat individuals found to be seropositive (Ferriman 1986). Infected persons are also encountering increasing barriers to securing life insurance cover and endowment mortgages (Green 1986). Focusing on the former, life companies operating in the UK are considering whether to include in their contract proposals a question that would seek to identify applicants who had 'received medical advice, treatment or a blood test in connection with AIDS or an AIDS related condition' (Short 1986)[15]. And in the context of employment, Miller and his colleagues (1986) have reported that following disclosure or discovery of seropositivity 'dismissal, premature retirement or redundancy have often followed swiftly'.

From the perspective of the community as a whole one of the major costs of HIV is, in theory at least, the loss of output due to the withdrawal of infected individuals from the labour force. Focusing on AIDS cases alone, Hardy and her colleagues (1986) have calculated that the first 10,000 patients in the United States lost earnings over the period between diagnosis and death of $189 million. The economic loss from future earnings foregone following premature death was estimated at $4.6 billion. In the United Kingdom the corresponding costs are of course considerably smaller. A total of 548 AIDS cases had been reported by the end of October this year. Assuming that each of these individuals had previously been in employment and subsequently missed one year of work due to ill health before death, it may be calculated that approaching £6 million has been, or will be, foregone in personal income or, from society's viewpoint, in lost production.[16] On the additional assumption that each of these patients, had they not developed AIDS, would have had a further 25 years of working life[17], the sum of

15 In the United States, some states have legislated to prevent life insurance companies employing HIV antibody tests to determine whether cover may be offered to an applicant. A solution to the problem of providing cover already adopted in some states in response to other high risk conditions such as diabetes and cystic fibrosis involves the use of special schemes administered by the authorities but funded by the insurance companies. The latter contribute to a high-risk pool in proportion to their turnover and individuals regarded as bad medical risks can obtain cover at premiums which are usually capped at 150 per cent of the standard charge (*Nature* 1986).

16 This sum is calculated employing earnings data for full-time males in all occupations in all industries and services for each year since 1982.

future production loss may crudely be estimated at nearly £150 million.

The foregoing calculations for the UK are open to significant methodological and conceptual criticisms. Adjustment has not been made for changing levels of real income over time. More fundamentally, continuing high levels of unemployment cast doubts upon the validity of this approach to assessing economic loss, since job vacancies created by ill health may be filled by individuals who might otherwise have been out of work. The use of averaged data is a further source of inaccuracy: survival time and working capability may vary considerably between AIDS patients. In addition, mean earnings figures may not be particularly relevant measures of productive worth for the individuals who currently account for 90 per cent of AIDS cases in the UK. Indeed, as Osborn (1986) has observed, many may be talented individuals and in their untimely deaths society may be foregoing the Tchaikovskys and Prousts of today.

While 'costs' of the type described above are financially unquantifiable, the fact remains that ill health caused by HIV is placing additional, albeit unknown, demands on the resources of the social security system. However, sickness and unemployment benefits along with other payments from these funds are transfer payments and are not therefore treated by economists as costs in the conventional sense. Nevertheless an opportunity cost is involved insofar as their allocation to any one use – social provision for HIV infected persons – precludes their use in other areas of public or private endeavour.

Alongside these economic costs, HIV has generated anxiety among the general public. For example, a Gallup poll conducted towards the beginning of March this year found that almost one adult in every three considered it unsafe to have contact with anyone suffering from AIDS (*Daily Telegraph* 1986). More than a quarter of the sample also indicated they would keep their children away from a school attended by a child with AIDS.[18] In the United States, public concern that donating blood may raise the risk of contracting AIDS – an opinion poll conducted in December 1985 found that 34 per cent of Americans believed AIDS could be acquired in this way – has led to a disturbing reduction in blood reserves (Rados 1986). At the same time, fears about the virus have

17 In their paper on the length of survival of patients with AIDS, Marasca and McEvoy's (1986) sample had an overall mean age of 38.3 years.

18 A recent study in France found that no children having close contact with anti-HIV positive haemophiliac children in a boarding school had seroconverted by the end of a three year study period (Berthier *et al* 1986).

contributed to an increasing reluctance on the part of patients to receive homologous (donated) blood and to a growing interest in 'directed' donations – those in need directly soliciting supplies from family or friends (Moore 1986). In the UK, press reports have raised the possibility that the number of donors has similarly begun to decline (McLean 1986). If true, this development could reflect self-exclusion by high risk groups and not just unfounded concern among other volunteers leading them to withdraw from the donor population. However, the reported trend has been neither verified nor refuted by official sources.

The anxieties felt by some sections of the public have served to intensify prejudice against individuals who have developed AIDS and those at high risk of becoming infected by the virus. In the United States, some sections of the homosexual community have lost their jobs, others have been evicted from their homes and it has been reported that signs of similar intolerance are increasingly surfacing in the UK (Laurance 1986). A more specific example derives from the recent accusation by the Royal College of Nursing that the hospice movement is refusing to care for people suffering from AIDS (*Times* 1986). It is alleged that this apparent neglect derives from fears on the part of the hospices that by admitting AIDS patients they may lose financial and other support from their local communities. This development and the type of attitude reflected in the protests recently directed at an AIDS Charity's plans to develop a hospice on the site of old school premises in West London (Coen 1986), may be regarded as particularly unfortunate, not just because of the implied lack of sympathy for individuals who are dying, but in view of the possibility that hospices could become an increasingly important means of care if the forecasts of the future spread of HIV turn out to be correct.

## Research costs

In view of the potential costs associated with HIV there can be little doubt about the urgent need for effective means of preventative and curative treatment. Research aimed at these objectives is currently attracting substantial funds and besides leading to new interventions specific to HIV, these could promote understanding throughout immunology and related areas at a much faster pace than might otherwise have been achieved. In the United States, for example, public funds to support AIDS-related research reached $97 million in the 1985 financial year (Lee and Arno 1986) and are now put at $340 million (*Times* 1986b). And in the UK, the government-funded Medical Research Council, with additional financial support from the Health Departments, has awarded more than a dozen special project grants for AIDS research which in sum are valued at £1.5 million.

The funding of research undertaken by public authorities is complemented by private sector initiatives. For example, the newly launched American Foundation for AIDS Research is supporting 20 research projects, costing in total $1.1 million, most of which are investigating the biology of HIV (Palca 1986a). In the UK, a new organisation called the United Kingdom AIDS Foundation has been established with the objectives, *inter alia*, of promoting research and co-ordinating fund-raising efforts. At the same time, research funds are being made available by other charitable bodies and as a result of the generosity of individual philanthropists. Finally, the multinational pharmaceutical companies, which played a major role in the development of the antibody tests, are co-operating with academic centres in joint research ventures as well as pursuing projects in their own laboratories. It has been reported that 304 pharmaceutical manufacturers worldwide are currently undertaking research into AIDS and AIDS related infections (TMG 1986).

Despite the formidable obstacles to therapeutic progress, the research effort directed at HIV has already provided some grounds for guarded optimism. For example, studies have identified a number of compounds with potential for interfering with viral replication – suramin, ribavirin, azidothymidine, HPA–23 and phosphonoformate. At the conference on AIDS held in Paris in June this year, disappointment at the reported clinical experience with the first of this group of drugs was countered by promising results from trials of azidothymidine (AZT). The latter halts virus replication and may even allow some degree of regeneration of the immune system (Yarchoan *et al* 1986). The preparation has the further advantage of being able to penetrate the cerebrospinal fluid which is significant because of the ability of HIV to infect the nervous system.

Continuing clinical trials in the United States have subsequently indicated that AZT prolongs survival in AIDS patients suffering from Pneumocystis carinii pneumonia. Indeed placebo-controlled investigations of the drug's use in this indication have been halted on ethical grounds (Scrip 1986a). It is now planned to make AZT available to those US patients who fulfil the appropriate clinical criteria and the pharmaceutical company concerned is scaling up production to meet the expected new level of demand – perhaps 6,000 AIDS sufferers compared with the 145 patients receiving AZT in the now abandoned trial phase. In addition it is hoped to set up a multi-centre investigation of the drug in the UK and Europe involving an estimated 500 patients. It should however be emphasised that AZT – which has yet to be granted a product licence to permit commercial sale – is not a cure for AIDS and appears to offer only a relatively limited extension of survival.

Research aimed at developing effective therapy for AIDS is also

examining the possibility of reconstructing the damaged immune system. Interleukin – 2 and isoprinosine are examples of drugs that may be classified as immune system 'enhancers' although in both cases laboratory and clinical investigations to date have shown no consistent benefits (Hecht 1986). At the same time more effective means are being sought to combat the opportunistic infections and other clinical developments which currently define an AIDS case. For example, Koretz and his colleagues (1986) have recently reported that the drug, 9 – (1,3 – dihydroxy – 2 – propoxymethyl) – guanine, offers promise for the therapy of severe cytomegalovirus infections in some immunodeficient patients. Other investigators are assessing the efficacy of alpha-interferon, chemotherapy and radiotherapy in Kaposi's sarcoma. And many established medicines – notably antibiotics and anti-fungal agents – are also being tested for potential effectiveness in controlling the infections suffered by AIDS patients.

The development of an effective vaccine against HIV has attracted considerable attention from research workers. Yet the prospects for success in this have followed, according to media coverage, a cycle whereby they are viewed with optimism at one point in time, followed by profound pessimism which in turn is superseded by a revival of hope: the headline over an article in *New Scientist* recently suggested that 'Hopes for an AIDS vaccine are fading fast' (Connor 1986) yet two months later a report in *The Times* from the annual meeting of the British Association proclaimed 'Scientists hopeful of vaccines to beat cancer and AIDS' (Wright 1986).

There is little doubt that the design and manufacture of a vaccine poses considerable challenges that are both scientific and practical in nature (Francis and Petricciani 1985). With regard to the former, little is known of the specific host defence mechanisms, if any, against HIV. Further problems arise because many differences have been found in the composition of the protein coats of various isolates of the infectious agent (Dowdle 1986).

Even if it should prove possible to produce a suitable vaccine, the development would give rise to a range of difficult issues related to its testing and ultimate administration. Some of the most significant of these concerns may be summarised by quoting Osborn (1986): 'In order to establish protective efficacy one would need a group of willing, thoroughly informed research subjects at high risk, but as yet unexposed. The slowness of viral infection would make assessment of both efficacy and safety a tremendous challenge, and the liability problems would be vast. Who would want to manufacture such a vaccine? To whom would it be given? High-risk groups? The general public? If we can't cope with pertussis, how can we manage a vaccine for the AIDS virus?'

## Prevention costs

At the present time it is not therefore possible to intervene medically either to prevent or treat effectively the virus that is responsible for AIDS. Consequently, the key to halting the spread of the infection lies in ensuring the safety of blood products and blood transfusions and, more significantly, in health education and other measures aimed at helping people to avoid acquiring HIV. The expense generated by some of the preventive initiatives can be identified with a reasonable degree of accuracy but this is not the case with the numerous local responses to the current and potential problems associated with HIV. The construction, for example, of information packages and networks, guidelines for the protection of health-care staff and health education programmes by district health authorities and other organisations consumes financial and time resources about which little is known although in sum these costs may reach significant values.

The procedures adopted to eliminate the potential risks faced by those requiring supplies of factor VIII or transfusions of blood include the screening of between one and two million blood donations each year at a cost reportedly estimated by the DHSS at between £2 and £4 million (Parker 1986). In addition, the decontamination of blood by heat treatment generates costs of between £3 and £4 million. Substantial expenditure is also being incurred in the construction of a blood products facility on a scale sufficient to meet the entire needs of the NHS in this area. Whether or not it might be appropriate to attribute some of the final expenditure to HIV – around £50 million upon completion next year (DHSS 1986c) – is a matter for debate.

Other initiatives aimed at checking the spread of the infection may be divided into two categories: those aimed specifically at reducing the risks to professionals whose work may involve contact with infected patients or HIV itself and those directed at the population as a whole. Focusing on the former, the Advisory Committee on Dangerous Pathogens (1986) has recently published revised guidelines indicating that HIV should be categorised as a Hazard Group 3 pathogen. For individuals undertaking patient care, this recommendation does not imply a need for expensive preventative procedures. Instead, emphasising that some patients may not be recognised as being seropositive, the document highlights 'the importance of maintaining at *all* times a good standard of operational practice designed to avoid any inadvertent infection'. In the context of laboratory work, the ACDP document indicates that centres involved in the frequent and routine examination of HIV samples should establish a separate room for manual tests and the preparation of samples. At the present time it is unlikely that these recommendations are generating globally significant addi-

*Table 12* **College of Health's estimates of the resources required for health education in England and Wales in 1987/88.**

| | *£millions* |
|---|---|
| National publicity | 30.0 |
| Publicity by specialised agencies | 2.0 |
| NHS Regional Health Education £100,000 × 15 | 1.5 |
| District Health Education (including Health Boards in Wales) £50,000 × 200 | 10.0 |
| Regional and District Staff Training £250,000 × 15 | 3.75 |
| NHS Training Authority | 0.1 |
| Extra costs for London | 5.0 |
| Voluntary bodies | 10.0 |
| Total | 62.35 |

*Source* College of Health 1986.

tional costs although they may be creating more substantial financial pressures for individual centres.

The prevention costs arising from the government's public health education campaign so far principally derive from advertisements placed in national newspapers and other selected publications, a telephone information service provided by the College of Health and a leaflet prepared by the Health Education Council. In total, the cost of the programme to date has been £2.5 million (DHSS 1986b). However, the recently announced expansion of the government's campaign will increase this cost to £20 million over the next 12 months. This new figure is in much closer accord with the sums estimated by many authorities to be necessary to mount an effective campaign of health education.

The College of Health (1986), for example, had recommended spending on public health education should be increased to £30 million. Expenditure at this level was justified by reference to the sums of money large companies spend on advertising to create awareness of new products.

The College also envisaged that central spending on national campaigns should be supplemented by appropriate funding of regional and district health authorities to enable the latter to establish local prevention and education campaigns. Further resources were also urged for the Terrence Higgins Trust to facilitate an expansion of its much-praised information and counselling services for high-risk groups and for other voluntary bodies providing care for those already infected by the virus and working to contain the spread of HIV. In total, the College of Health estimated that the government should spend an extra £62 million in 1987/88 in order to mount an effective programme of prevention (Table 12).

# Conclusion

Forecasts of the future resource impact of HIV are open to error on a potentially considerable scale. From current information, it might for example be estimated that the treatment of AIDS patients in 1988 will cost between £20 and £30 million. Yet uncertainties about the future spread of the virus, the clinical consequences to which it will give rise and possible changes in methods of patient care combine to imply that this figure could substantially misrepresent the true size of the resource burden.

The choice of 'target' year for forecasting purposes is also of critical significance. The care costs generated by a cohort of individuals developing antibodies to HIV in a specified 12 month period will be distributed over many subsequent years. Furthermore, perceptions of these distribution patterns are having to be modified with more prolonged observation of the virus and its impact. Early epidemiological surveys suggested that only 10–15 per cent of seropositives progressed to AIDS within three years of infection. Evidence presented to the recent Paris conference on AIDS now suggests that the proportion lies between 20 and 30 per cent (*Lancet* 1986). Consequently, the care costs for a given cohort of seropositive subjects may continue at high levels for longer than might originally have been anticipated as individuals in whom HIV takes more time to progress to AIDS replace the 'early presenters' who survive to require care for only about a year after diagnosis.

In years yet further into the future, few if any additional cases of AIDS (as presently defined) may emerge from the original cohort of infected subjects although new demands may be imposed on the health services should some of the remaining group of seropositives start to develop other sequelae, involving, for example, the central nervous system.

The forecasting difficulties implied above inevitably become even greater when the analysis is extended to include all individuals developing antibodies to HIV and not just those seroconverting in one specified period of time. And this leads on to the major obstacle to predicting the size of the resource impact of HIV – the uncertainty concerning the future spread of the virus.

At the present time it is estimated that about 30,000 individuals in the UK may be seropositive (Trumpington 1986) and that the majority of these subjects belong to one or more of the following high risk groups: male homosexuals and bisexuals, intravenous drug abusers and haemophiliacs. The prevalence of infection in the future will reflect not only the spread within these groups but how far the virus penetrates into the rest of the population. One estimate suggests that up to 200,000 individuals in the UK could be infected by HIV by 1988 (McEvoy 1986). Yet the potential for error

in this forecast is clear: besides the uncertainties described in this paper, only 3,105 positive antibody tests had been reported by the middle of July 1986.

The latter figure is obtained from the surveillance system for positive antibody tests which was introduced in 1984. Serosurveillance of this type is useful for monitoring trends but does not define seroprevalence. A more accurate indication of the spread of the virus in the population might be gained from the introduction of a new blood testing procedure. Samples obtained from patients during the ordinary investigation of ill health might also be subjected to random selection for additional analysis to detect antibody to HIV. However, this approach to surveillance has attracted objections on ethical grounds: it has been argued that whilst it would be appropriate to inform those patients concerned of a positive result, it would at the same time be unethical to do so because of the lack of prior consent to the test (Newmark 1986). For other commentators the need for better data on the prevalence of HIV is more pressing and the way forward is seen to lie in a system in which it is impossible to trace positive test results to the individuals providing the samples.

These issues have yet to be resolved and contemporary forecasts of HIV are therefore largely based on extrapolations of AIDS caseload trends to date. In the UK, for example, Tillett and McEvoy (1986) have predicted that 3,000 new cases of AIDS will be reported in 1988. In the US, forecasts suggest that the cumulative total of 26,566 cases by 20th October 1986 could rise to 270,000 by the end of 1991 (Table 13). Yet these and other projections are acknowledged to be susceptible to potentially considerable error (Morgan and Curran 1986).

Unknowns in this regard are matched by uncertainties surrounding future treatment expenditures. At present, AIDS patients requiring hospitalisation are cared for in a variety of settings including general medical wards and infectious disease units. This observation coupled with the varying lengths of inpatient stay found in different centres, helps to explain the wide spectrum of hospital care costs reported in the literature. At the lower end of the range, Johnson and her colleagues (1986) have calculated that the 'lifetime' combined in-and out-patient expenditures per case currently amount to £6,800. Yet in the future, given the potential increase in the numbers of AIDS patients and the inevitability of continuing pressures on health budgets, even this comparatively modest sum may come to be regarded as unacceptably high and may force a reappraisal of care strategy.

It has been speculated, for example, that hospice care might therefore come to be seen as a more economically desirable means of care. Yet it is not clear that revenue costs in this setting would be

*Table 13* **Projected cases of AIDS in the United States.**

| *Category* | *1986* | *1991* | *1991 range* |
|---|---|---|---|
| **Cases diagnosed** | | | |
| Cumulative cases at start of year | 19,000 | 196,000 | 155,000 to 219,000 |
| Diagnosed during year | 16,000 | 74,000 | 46,000 to 92,000 |
| Cumulative cases at end of year | 35,000 | 270,000 | 201,000 to 311,000 |
| Alive at start of year | 10,000 | 71,000 | 50,000 to 83,000 |
| Alive at any time during year | 26,000 | 145,000 | 96,000 to 174,000 |
| **Deaths** | | | |
| Cumulative deaths at start of year | 9,000 | 125,000 | 105,000 to 137,000 |
| Deaths during year | 9,000 | 54,000 | 36,000 to 64,000 |
| Cumulative deaths at end of year | 18,000 | 179,000 | 141,000 to 201,000 |
| **Infections** | | | |
| Persons with HTLV III/LAV infection | 1 million–1.5 million (estimate) | | |

*Note* Case and mortality numbers refer only to those that meet the CDC definition for AIDS, and do not include other manifestations of infection, such as AIDS-related complex and lymphadenopathy syndrome.

*Source* Coolfont Report 1986.

significantly less than those generated by hospital treatment (Pinching 1986c). Further uncertainty exists with regard to capital expenditures. It might appear that a switch in care strategy need not involve substantial costs in the construction of new hospices if buildings previously employed in other ways became available for use. In this context, it might be considered relevant to the future that demographic trends have led the Secretary of State for Education to order the elimination of two million surplus school places which the Audit Commission estimates could involve the closure of up to 1,000 secondary schools (*Times* 1986a). Yet the potential savings generated by the avoidance of new construction expenditures would be offset to an unknown extent by conversion and other related costs.

Alternatively, therapeutic progress and other considerations could imply the retention of large acute hospitals as the most appropriate location for the supply of care. In centres dealing with significant caseloads, it may be necessary to establish dedicated units for AIDS cases. Elsewhere, special provision of this nature may not be required and occasional demands for additional isolation beds – for example, for patients who are incontinent or suffering uncontrolled bleeding (ACDP 1986) – might be economically met by the use of plastic bed isolators rather than the construction of permanent facilities (Long 1986).

Progress in research leading to new treatments for AIDS will itself be a direct determinant of the resource burden of HIV in the future. At one extreme, the development of an effective vaccine

could avoid the formidable treatment costs forecast for the end 1980s/beginning 1990s: £146 million in the UK according to figures compiled by the British Medical Association, the Royal College of Nursing and the Institute of Health Services Management[19] and between $8 and $16 billion per annum in the US from estimates computed by the Public Health Service (Coolfont Report 1986).

At the other end of the spectrum, the emergence of new treatments could lead to substantial increases in care expenditures. For example, the cost of a course of treatment for Kaposi's sarcoma with the recently licenced recombinant alpha-interferon product ranges from £7,500 to £16,000, depending on its duration (*Scrip* 1986). The former figure is greater than Johnson and co-workers' (1986) current estimate of the total hospital care costs incurred by an average AIDS case between diagnosis and death.

An accurate forecast of the future impact of HIV is clearly not feasible at the present time. The fact nevertheless remains that the virus poses a major public health hazard. It is a new and potentially substantial cause of morbidity and mortality, particularly affecting individuals who otherwise generally comprise one of the healthiest sections of the population. Even the most optimistic projections indicate that HIV will impose a significant additional burden on future health care budgets. Considerable efforts are therefore being channelled into the search for effective means of medical intervention but until the appropriate new medicines and vaccines become available 'prevention is the only cure' (College of Health 1986).

Prevention can, of course, be approached in different ways and some commentators have proposed quite radical methods for containing the spread of the virus. Seale (1986a), for example, is reported to have argued for the introduction of a system of compulsory universal blood screening. According to a recent opinion poll such a proposal would be supported by nearly two-thirds of the population (McKie 1986a). Voluntary testing programmes have also been advocated by some commentators (*Times* 1986c). Both approaches raise many complex issues – concerning especially their practical and ethical implications (Bayer *et al* 1986) and economic consequences (Lumsden 1986) – to which there are inevitably no unambiguous answers at the present time.

Further controversy surrounds the measures that might follow on the screening process. Rogers (1986), for example, has argued

19 This estimate may be compared with the figure quoted at the start of the conclusion of between £20 and £30 million based on the costings and forecasts of Johnson *et al* (1986) and Tillet and McEvoy (1986) respectively, thereby highlighting the substantial discrepancies that exist in current projections of the treatment costs of AIDS.

that disused isolation hospitals should be reopened and employed to quarantine AIDS sufferers and others who are antibody positive for HIV. Suggestions of this nature disregard the evidence indicating that the virus is not transmitted by casual contact. In addition, quarantine cannot be justified on the grounds that it would protect AIDS patients from the infections experienced by 'healthy' subjects. Many of these common infections are handled normally by AIDS patients (Pinching 1986b). Furthermore, it should be emphasised that isolation, ignoring doubts about whether identifying and 'containing' seropositive individuals would be logistically feasible, would mean depriving 30,000 people (at the present time) of their liberty even though a large majority would show no signs of ill health and may not in fact develop HIV related illness for many years, if indeed at all.

Instead, the widely favoured approach to preventing the spread of HIV lies in health education to encourage appropriate behavioural change. For some members of certain groups currently recognised as being at high risk this requires a substantial modification of lifestyle. For example, a dramatic reduction in the number of sexual partners is recommended for some homosexual men. Yet cutting the number of partners from, say, ten to three whilst the prevalence of HIV is rising from 10 to 33 per cent will not alter the chances of contact with an infected individual. Consequently, current information campaigns emphasise the need for individuals to adopt 'safe' sexual practices as well as to reduce the number of sexual partners. The extent to which the advised changes in behaviour are followed – for some individuals they represent a radical departure from established habits – will not become apparent for some time. Nevertheless, encouragement may be drawn from several sources. Recent falls in national clinic returns for acute gonorrhea in males aged 25 years or more (CDR 1986) may indicate that the desired alterations in lifestyle are now beginning to take place. Similarly hopeful signs have also been reported from the sexually transmitted diseases clinic at St Mary's Hospital in London (Gellan and Ison 1986). In addition a survey of more than 300 homosexual men in London found that information on safer sex practices had reached 95 per cent of those interviewed and that 75 per cent of the sample welcomed and were following the advice they had received (Burton *et al* 1986).

The need for behavioural change extends, however, far beyond the currently perceived high risk groups. Yet generating appropriate concern about HIV among people who clearly do not belong to these communities may not prove an easy task. To date, AIDS has been seen by many people to be a self-inflicted problem confined principally to homosexual males and drug addicts. Anxieties about HIV among the general population have therefore

tended to focus on the possibilities of becoming infected through direct and indirect contact with those who are seropositive.

In the latter context, the government has sought in its advertising campaign to stress the safety of ordinary social contact. People should not worry, for example, about shaking hands with seropositive persons or using the same swimming pools, toilets or cutlery. This assertion is founded upon scientific observation. Yet the fact remains that the risk of viral transmission via some forms of casual contact cannot in theory be ruled out entirely. As a result – that is, because it is not possible to state categorically that absolutely no risk attaches to a specified activity or situation – the task of dispelling public concern poses a considerable challenge and one that becomes even more formidable in the light of some of the press coverage given to the subject (de Jongh 1986). There is of course no straightforward solution to this problem but it might be useful to attempt to quantify the theoretical risks involved and to relate them to some of the familiar hazards that are readily accepted as part of normal everyday life.

At the same time as health education must strive to put the risks of acquiring infection through social contact into proper perspective, it has also to convey the message that sexual transmission is not confined to the male homosexual population. From the misunderstandings of the early 1980's it has emerged that HIV is essentially a sexually transmitted infection that does not discriminate between different sexual preferences. In the US, the Public Health Service estimates that heterosexual males and females[20] will account for 1,100 (7 per cent) of the newly diagnosed cases of AIDS in 1986 (Coolfont Report 1986).[21] By 1991, this figure is expected to have risen to nearly 7,000 (approaching 10 per cent of the total). In the UK, cases of heterosexually transmitted AIDS are considerably fewer but evidence provided by physicians working closely with the problem suggests that the infection is being increasingly spread in this way (Harris 1986).

This trend may initially reflect the sexual activities of the so-called 'bridging groups' – such as bisexual males or intravenous drug abusers of both sexes. Once the virus has become established in the heterosexual population, however, the presence of these

20 This group comprises individuals reporting heterosexual contact with infected persons or someone in a risk group as well as those for whom epidemiological studies suggest heterosexual transmission as the major risk factor.

21 Evidence of the heterosexual spread of HIV in the US has recently become available from a military study. Among 308,076 US military recruit applicants screened for HIV over a six month period from October 1985, serpositivity rates per 1,000 increased from 0.4 among 18 year olds, through 2.5 for those aged 21–25 years, to 4.4 among applicants aged 26 years and above. The overall rate was 1.49 per 1,000. Male prevalence (1.6 per 1,000) was only three times that for females, reflecting the exclusion of homosexuals and haemophiliacs (MMWR 1986a).

individuals will no longer be necessary to the further dissemination of HIV. The principal uncertainty then remaining will be the speed at which the infection spreads throughout the community. In this respect, the activities of a promiscuous minority could be a factor of key significance (Peto 1986). Against this background Acheson (1986) has stated that 'the sexually active population as a whole should be regarded as possibly at risk and should receive practical advice about how infection can be avoided'.

The message that has to be conveyed is straightforward. Sexual contact with an infected partner generates a risk of acquiring HIV infection. As the prevalence of infection in the population increases, so too does the likelihood of infection in a random partner (Peterman and Curran, 1986). Consequently, risk may be eliminated by confining sexual contact to one uninfected partner. In other circumstances, for example, where more than one partner is taken and infection status is unknown, risk may be reduced by the use of condoms.

Within the general population, as among the current high risk groups, there clearly exists a broad spectrum of hazard. Strictly monogomous couples face no danger of infection but individuals with multiple sexual partners are exposing themselves and others to risks that appear to be increasing rapidly. Consequently, young single people may be seen as particularly clear targets for education. Yet against a background of 20 years sexual liberation, the shift in responsibility for contraception with the availability of the pill and the reported dislike of using condoms among this group (Sherman and Dynes 1986), generating appropriate changes in attitudes towards sexual behaviour is likely to pose a considerable challenge. Indeed, a recent Gallup survey of 16–29 year olds found only one in seven had altered their sexual habits or contraception since learning about AIDS (Garner 1986). The apparent tendency for some people to believe that the risk of HIV confronts others but not themselves emphasises the need to shift attention away from the concept of high risk groups towards high risk activities especially casual unprotected sexual intercourse.

The central theme of this paper has been that immense uncertainty surrounds the future impact of the human immunodeficiency virus. Nevertheless, the possibility that it might spread to the extent suggested by many forecasts implies that effective preventive action must be taken now. The slow response to the rising prevalence of HIV among homosexual men has had considerable and wide-ranging costs and clearly such delay must not be repeated in 1986 as the virus begins to appear more frequently in the heterosexual population (Adler 1986b). Consequently, physicians and others closely involved with the problem have called for a significant injection of new resources into health

education – the only feasible approach to control at the present time.

The government has responded to this call by establishing a special Cabinet committee to expedite official action on the AIDS problem. At the first meeting of the group, it was decided that information leaflets – employing the slogan 'AIDS: Don't die of ignorance' – should be distributed to every household in the country. The committee also indicated that there would be further newspaper advertisements which would be supplemented by a poster campaign and advertising on television and radio.[22] Further details about the strategy and the timing of its implementation emerged during a House of Commons debate on AIDS held on 21 November. It was revealed that advertisements in national newspapers would commence immediately; a poster campaign at 1,500 street locations, special advertising in magazines for teenagers and radio commercials would begin during the first half of December; and a leaflet drop to 23 million households coupled with television advertisements would take place early in the New Year. In addition, cinema advertising will be used and information leaflets will be made freely available to the public through the nation's 11,000 pharmacies (*Hansard* 1986a).[23]

The newly announced measures would appear to meet many of the criticisms directed at the government's first round of information initiatives. It now remains to be seen whether the combination of this revised strategy and the willingness of the public to respond both to these measures and the warnings contained in the extensive media coverage of the AIDS crisis will be sufficient to stem the spread of the virus. Lack of success in this respect may force the introduction of compulsory screening, isolation and other undesirable procedures. Failure will also exact a considerable toll of morbidity and mortality. The *British Medical Journal*, for example, has warned that in five or six years time deaths from AIDS in the UK could be equivalent to the crash of a fully laden jumbo jet each month. Should events follow this course, the explanation will prob-

22 Subsequent meetings of the Cabinet committee will consider, according to press reports, such issues as making clean needles available to drug addicts, supplying condoms free of charge to certain groups and the possibility of using a prominent public figure to lead a public education campaign. Indeed, at the time of writing government announcements are awaited with regard to increasing the availability of needles and condoms. Focusing on the latter, easier access in terms of a greater number of points of distribution and zero cost might encourage a wider use of condoms if these factors are more important to potential consumers than the reported dislike of this method of contraception.

23 It was also revealed during the debate that there is to be a new health education authority within the National Health Service to promote public understanding about the prevention of AIDS. It will be reconstituted from the current Health Education Council whose existing responsibilities it will also assume. The new body will be directly accountable to Parliament.

ably be seen to lie in a widespread blinkered refusal to recognise the possibility of such a catastrophe. Retrospective judgement might then suggest that an annual loss of life equivalent to four *Titanic* disasters would have been a more appropriate analogy.

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