GLOBAL AIDS SITUATION AND PROJECTIONS TO THE YEAR 2000.

I. The global AIDS situation

As of 1 June 1990, a cumulative total of 263,051 cases of AIDS were reported officially to the World Health Organization from 156 countries (Table 1). Of reported cases, 61.1 % are from 44 countries in the Americas; 24.6% from 51 African countries; 13.3% from 29 European countries; and the remaining 1 % from 32 countries throughout Asia and Oceania. However, reporting is incomplete; the actual cumulative global total of AIDS is estimated at over half a million, more than three times the number reported, (Global AIDS fact file June 1990).

Nevertheless, it is the epidemiology of HIV infection which provides a more complete and current view of the Pandemic. At the beginning of this decade, about l00,(XX) persons worldwide were infected with HIV .During the n1980s, between 8 and 10 million people became infected.

Beyond absolute numbers there is an important contemporary development -the global epidemic of HIV infection remains dynamic and is continuing to expand, in three ways. First, HIV infection is generally and sometimes dramatically increasing in already affected areas. For example, in Thailand, HIV sero-prevalence among intravenous drug users in Bangkok was about 1% in late 1987; it was 20 a year ago; it is now over 40% Before1987, HIV seroprevalence among female prostitutes was less than 1/1(xx); now it is about 1/400 and in some focal areas exceeds 1% . Recently, infection was geographically limited HIV infection has been reported in 70 of the country's 73 provinces in 1bailand.

Second, the epidemic has recently expanded its geographical scope, reaching countries and regions previously unaffected or only slightly affected by HIV .For example, several surveys among female prostitutes in South-Eastern India have documented HIV seroprevalence of between 3% and 7% ; prostitutes are also infected in Calcutta and Bombay. In the capital city of Cote d 'Ivoire, HIV -1 seroprevalence among adults increased from less than 1% to at least 4% within two years. This pattern is being observed increasingly throughout West Africa, where a widespread HIV -1 epidemic is underway and gaining momentum in many large cities.

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Mann I.M. Global AIDS into the 1990&. An address presented 4 June 1989 at the International Conference on AIDS, Montreal, Canada; Chin I., Sato P.A. and Mann I.M. Projections of HIV infections and AIDS cases to the year 2000. Bulletin of the World Health Organization, 68(1): I-II (1990) Permission for reproduction was granted by the author and by the editor of the Bulletin of WHO.

Third, the pandemic has become extraordinarily complex and increasingly diverse at the national, provincial and community level, reflecting the great variety of social, economic and cultural circumstances which create, enlarge and maintain the potential for exposure to HIV .One stunning example has occurred in the USSR in Elista, a city between the Black and Caspian Seas. An HIV-infected man infected his wife; their infant was infected and on becoming ill was admitted to a

childrens, hospital. The reuse of unsterile needles and other invasive equipment led to transmission of HIV to pediatric patients; in all, over 50 children in several cities have been infected. In Brazil, the proportion of AIDS cases linked with drug infection increased from 3% to 13% in one year, reflecting a new urban epidemic of cocaine injecting; seroprevalence among drug injectors in Rio de Janeiro and Sao Paulo is 16%; and HIV infection and AIDS have now been documented in Rio de Janeiro's large population of street children. In Europe, the proportion of AIDS cases attributed to drug injection increased from 6% in 1984 to 34% in 1988; in Italy and Spain, drug injectors now account for over 60% of AIDS cases.

II. The major patterns of HIV infection

With available information, we can distinguish three broad but distinct patterns of infection. Everywhere, the modes of HIV transmission are fundamentally the same sexual, blood contact, and perinatal -but details of personal and social risk behaviours in different areas influence the relative frequency and expression of these three moves of spread.

In Pattern I areas, HIV likely began to spread extensively during the mid-to-late 1970's. In Pattern I, sexual transmission of HIV occurs predominantly among homosexual and bisexual men; over 50 percent of homosexual men in some urban areas have 1?een infected. Hetero-sexual transmission also occurs in these areas, and is increasing. Transmission through blood contact in pattern I areas of the world now principally involves persons with drug- injecting behaviour, as blood for transfusion and blood products have been made essentially safe. Perinatal transmission is uncommon because relatively few women have thus far been infected, but will increase as heterosexual transmission increases. Areas where this pattern is presently found include: North America, Western Europe, Australia, New Zealand, and many urban areas in Latin America.

In Pattern n areas, HIV also likely began to spread extensively during the mid-to-late 1970s. In Pattern n, sexual transmission is predominantly heterosexual. Up to 25 percent of the 20-40 year old age group in some urban areas are already infected, along with up to 90 percent of female prostitutes in some areas. Transmission through HIV-contaminated blood transfusions continues where HIV screening of blood is not yet routine. While drug-injecting behaviour is rare in Pattern II, the use of unsterile needles or other skin-piercing instruments can contribute to HIV spread. Perinatal transmission is a major problem in those areas where 5 to 15 percent or more of pregnant women are HIV infected. Areas where this pattern is presently found include: Sub-Saharan Africa and increasingly in Latin America, especially in the Caribbean.

In Pattern III areas, HIV appears to have been introduced later, during the early-to-mid 19808. Thus far, only one percent of AIDS cases are reported from Pattern III countries. Early AIDS cases were generally associated with contact with Pattern I and II areas or imported blood or blood products. While HIV infection has not yet penetrated into the general population of Pattern m countries, indigenous transmission is occurring and HIV infections are being increasingly recognized among persons with risk behaviours, such as prostitutes and persons with drug-injecting behaviour. Areas where this pattern is presently found include: Eastern Europe, the Middle East, North Africa, and most countries in Asia and the Pacific.

Of course, these three patterns over simplify , for different patterns may co-exist within a single country, or even within a large city. Also, the patterns are not immutable. While certain clear limits are set by the HIV's limited modes of transmission, the range, pattern, timing and extent of transmission depend upon an extraordinary blend of individual behaviour, social practices and possible biological co-factors. Therefore, as in the life of a single person, risk behaviour may well vary over time, so social evolution, political unrest, economic disruption or success will also influence, over time, the social context within which risk behaviours flourish or recede.

III. Projections of HIV infections and AIDS

cases to the year 2000 Accurate data on the occurrences of human immunodeficiency virus (HIV) infection and AIDS cases are generally not available, and the routine collection of such data is difficult. Thus, the development of models to estimate the current extent of the HIV/AIDS pandemic and to make projections about its future course has received considerable attention since its recognition in the early 19808. HIV/AIDS models are simplified representations or simulations of the actual situation, and most can be broadly classified into two types.

Short-term projection on AIDS cases using the WHO projection model

In many areas, reporting of AIDS cases is either markedly incomplete or has been started only since 1986-87. In addition, detailed data to quantify HIV transmission variables are frequently scant or absent. In such situations, neither the extrapolation nor deterministic projection models can be used. For these areas WHO has developed an AIDS projection model which relies on available HIV serological survey data and on progression of HIV infection to AIDS.

Table 1. Reported and estimated AIDS cases, 1 June 1990

Area	Cumulative number reported	Number of countries	Estimated
Africa	66,745	51	375,000
Americas	160,619	44	250,000
Asia	647	25	1,200
Europe	35,021	29	45,000
Oceania	2,019	7	2,500
Total	263,051	156	650,000

Epidemiological observations and available HIV seroprevalance data were used in this model to formulate estimates of total AIDS cases up through 1988, and cumulative case totals at the end of 1991: the results are presented for each continent and major area in the world in Table 2. Over one million AIDS cases are projected worldwide by the end of 1991, and for Africa and the Americas a threefold increase in cumulative cases during this period. Asia may expect a tenfold increase in AIDS cases by the end of 1991 because the AIDS epidemic in most Asian countries is still at a very early stage when the doubling time for AIDS cases is much shorter than it will be later in the epidemic -a phenomenon already observed in Africa and the Americas.

Table 2. WHO/GPA estimates and projections of cumulative HIV/AIDS

	HIV/1988	AIDS/1988	AIDS/1991
Africa	2.5 million	200,000	575,000
America	2.0 million	150,000	425,000

Asia	0.05million	500	5,000
Europe	0.5 million	25,000	100,000
Oceania	0.03million	1,500	6,000
Total	> 5 million	377,000	11,111,000

Modeling adult rather than pediatric AIDS requires the use of different estimates of progression from infection to AIDS. Figure 1 presents the annual number of pediatric and adult AIDS cases which the WHO model projects for sub-Saharan Africa through 1991. This model estimates that up to 1986 the cumulative number of pediatric AIDS cases in Africa exceeded that for adults but from 1985 onward, the number of adult AIDS cases has been increasing at a greater rate than pediatric cases. A total of over 200,000 new AIDS cases (pediatric and adult) is projected for Africa during the year 1991 alone.

Delphi projections of HIV infection to the year 2000: The Delphi method was developed in an attempt to improve the quality of the judgments needed in relatively uncertain situations as well as to provide a means of quantifying such judgments. The method requires that a group of experts be identified and asked to respond to a standard questionnaire. The responses are analyzed, and the analysis is then distributed to all participants. A questionnaire together with mid-1988 baseline estimates and assumptions
about the four global epidemiological patterns of HIV/AIDS, as of mid-1988, was first pretested internally, and then sent to the Delphi survey participants (fable 3). In search of a consensus, participants are asked to complete a repeat questionnaire after being informed of the results of the first survey.

Table 3. Delphi projection of the HIVIAIDS pandemic: Estimated or assumed situation as of mid-1988

Epidemiological pattern	Estimated situation, mid-1988	Assuned HIV prevalences, mid-1988 (milions)	
Patterns I and III (Australia/New Zealand Canada/USA, most of, Western Europe, and most of Latin America	HIV prevalence, 2.5 million Cumulative adult AIDS cases, 150,000	Homosexuals and bisexual males: Intravenous drug users(IVDU): Blood/blood products transfusion: Other:	1.60 0.83 0.04 0.03
Pattern II (sub-saharan Africa, and parts of the carabbean basin)	HIV prevalence, 2.5 mil Cumulative adult AIDS cases, 150,000	Heterosexual transmission: Mother-to-infant transmission: Blood/blood products transfusion: Inadequately sterilized skin-piercing instruments (health sector and outside): Other:	2.00 0.27 0.15 0.04 0.04
Pattern III (easetrn Europe, the Far East, the Near and Middle East, North Africa, South-east Asia, and most of the pacific basin)	HIV prevalence, 100,000 Cumulative adult AIDSSD cases, < 1000	Homosexual and bisexual males Intravenous drug users: Hetrosexual transmission: Blood/blood products transfusion: Other:	0.03 0.03 0.022 0.015 0.003

Delphi participants were asked to make HN prevalence projections for mid-year 2000 for areas which exhibit each of the four global HN/AIDS epidemiological patterns. These projections were made in the context of two scenarios (fable 4). For brevity, scenario 1
will be referred to as "no coordination" and scenario 2 as "with coordination". Table 5 presents the Delphi results for the world and for each global epidemiological pattern. From the estimated mid-1988 global HN prevalence of about 5.1 million, Delphi participants projected mean prevalence of 18.3 million by mid-year 2000. Comparison of the projected mean HN prevalence in mid-2000 to the estimated mid-1988 HN prevalence indicates that those areas currently classified as epidemiological pattern II can anticipate the largest absolute increase of HN infection (8 million). ~ largest relative increase in HN prevalence (l3-fold) is expected in areas currently classified as pattern ill.

Figure 2 presents cumulative HIV infection estimates among adults in mid-2000 for the world and for each of the epidemiological patterns. Each bar is divided into three parts. The base represents the cumulative HIV infections in mid-l988; the middle segment represents the increase in HIV infection expected from mid-l988 to mid-2000 even if there is a coordinated prevention and control effort (not preventable); and the top segment represents those additional HIV infections which Delphi participants believe might occur in the absence of major coordinated global and regional coordinated effort (preventable). Delphi participants estimated that about 6 million HIV infections worldwide might be prevents with such a coordinated effort. The Delphi projections suggest that prevention efforts are more likely to be effective in pattern I and Im areas when compared with pattern ill areas.

Table 4. Delphi HIV/AIDS projection survey: Basic associations and projection scenarios for 1988-2000

Basic associations:
1. Intervention strategies for the prevention and control of HIV/AIDS fall within four major categories:
a) promotion of safer sexual practices, including condom use;
b) promotion of blood and blood products safety:
c) prevention of transmission through inadequately sterilized syringes and needles;
d) prevention of mother-to infant transmission.
2. No dramatically effective additional intervention (e.g. HIV vaccine or a curative drug) introduced between 1988 and the year 2000.
3. Global geographic distribution of patterns 1,1/11,11 and 111 remain constant up until the middle of the year 2000.
Delphi projection scenarios for 1988-2000:
Scenario 1. The prevention and control of HIV/AIDS is not globally or regionally coordinated, and is not given special emphasis and attention at the country level.
Scenario 2. The prevention and control of HIV/AIDS is globally and regionally coordinated. The epidemic receives special emphasis and attention in all countries worldwide.

Delphi participants felt that efforts to prevent and control sexually transmitted HIV infections could potentially reduce such transmission by more than 50% in pattern I and II areas, but only by about 30% in pattern n areas. It was also apparent that prevention of HIV infection transmitted through intravenous drug use was considered a much more difficult goal to accomplish, and that a reduction of only about 20% was expected. Projecting adult AIDS cases to the year 2000: Adult AIDS case projections for each year up through the year 2000 was made by using the WHO model and the Delphi projections of HIV prevalence.

This was done initially with HIV prevalence estimates for scenario 1 (no coordination). An increase of about 12 million adult infections from mid-1988 to mid-2000 was predicted. These infections were distributed backwards linearly from 2000 to 1988 to derive estimates of the expected annual HIV -infected cohorts. The WHO model was then used to calculate the number of adult AIDS cases which might be expected annually through the year 2000.

The results are shown in Figure 3. This figure shows clearly that according to the Delphi participants, the second decade of the HIV I AIDS pandemic, during the 1990s, will be much worse than the first full decade -the 1980s. Fewer than one million cumulative adult AIDS cases are expected up to 1990; in contrast, during the 1990s, over 5 million adult AIDS cases are projected. In addition, Figure 3 also shows that the ratio of cumulative HIV infection to AIDS cases during the early 1980s was very high (from thousands to hundreds to one), whereas by the mid to late 1990s, this ratio is expected to fall substantially to less than ten to one.

The cumulative number of adult AIDS cases projected by the year 2000 under scenario 1 (no coordination) is about 6 million cases, and under scenario 2 (with coordination), about 5 million cases. However, the projected total by the year 2000 under either scenario includes AIDS

cases which will develop in persons who were infected prior to mid-1988 as well as those infected after mid- 1988. The number of AIDS cases that might be prevented in future years by a continued prevention and control effort coordinated globally and regionally is best appreciated if the projected AIDS resulting from persons
infected prior to mid-1988 are clearly separated from those projected to arise from those individuals infected after mid-1988. The results of such calculations are shown in Figure 4. Over 3 million adult AIDS cases (the lower portion to the bars in Figure 4) are expected to develop (mostly during the 1990s) from among the 5 million persons infected prior to mid-1988. Under scenario 1, approximately 3 million additional cumulative AIDS cases are projected to occur in the 1990s in those persons infected after mid-1988 (the upper two segments of the bars in Figure 4). However, with a coordinated effort (scenario 2) about 1.2 million of these cases could be prevented. Thus, according to the Delphi projections, a coordinated global and regional prevention and control effort with special emphasis at the country level might be capable of reducing adult AIDS cases that
result from HIV infections acquired after mid-1988 from just under 3 million to about 1.8 million -a difference of about 40% .

Table 5. Delphi -projected HIV prevalence by global epidemiological pattern

	Projected mid-2000(mean ± SD)		
	Estimated mid-1988 (million)	Scenario 1 (millions)	scenario 2 (millions)
Global	5.1	18.3±7.4	12.2±6.4
Pattern I	2.5	6.5±2.0	3.9±1.9
and I/II			
Pattern II	2.5	10.5±6.1	7.6±5.2
Pattern III	0.1	1.3±1.0	0.7±0.6

The potential impact of global prevention and control efforts on the number of annual AIDS cases can be seen in Figure 5. Marked increase is noted from 1985 when about 15,(XX) cases were estimated to about 8S0,(XX) adult AIDS cases projected for the year 2(XX) alone. As with the cumulative AIDS cases shown in Figure 4, the annual totals in Figure 5 are divided into three parts; those AIDS cases expected to develop in persons infected prior to mid- 1988 are shown in the lowest part. The middle and top portions include AIDS cases expected to develop in persons infected after mid-1988; the top part represents those AIDS cases which may be preventable through a coordinated global and regional prevention and control effort. Figure 5 demonstrates that the potential impact of global prevention efforts undertaken in the late 19808 will not be apparent until close to the mid-1990s. Even with a concerted global effort, Delphi participants expected less than half of the projected future AIDSs cases up to the year 2(XX) to be preventable.

The first decade of the HIV / AIDS pandemic is coming to a close. The world is still in the early stages of a pandemic whose ultimate dimensions remain difficult to predict. Nevertheless, enough is known about the epidemiology and natural history of HIV infection to make reasonable short-term predictions. It can be estimated with some confidence that the number of AIDS cases which have occurred up to now throughout the worltt will increase by at least fivefold over the next 5 years.

Virtually all statistical extrapolation models applied to pattern I countries have projected several-fold increases in AIDS cases by the early 1990s. Where the reporting of AIDS cases is relatively

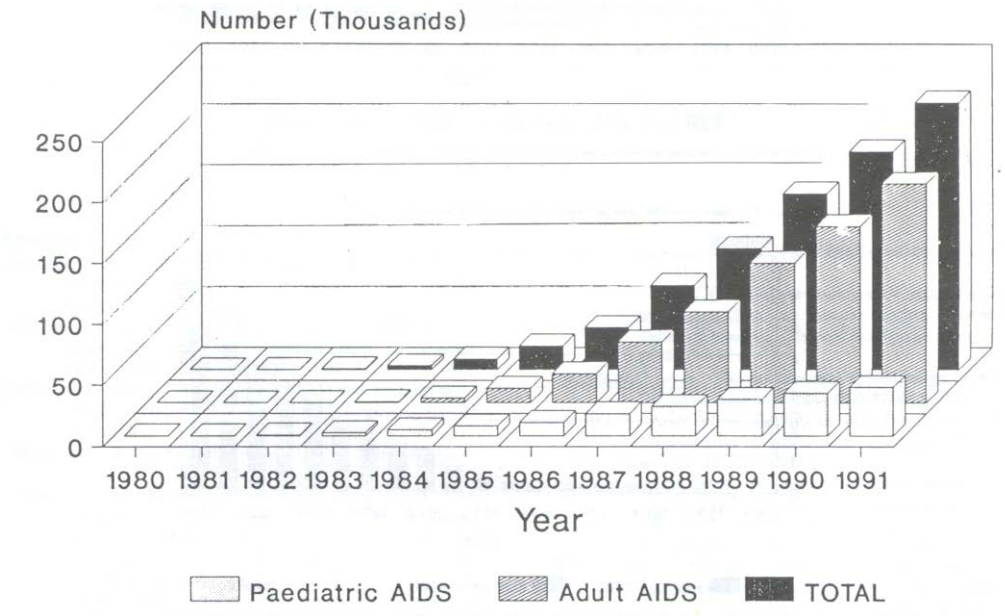
reliable and complete, these projections are considered fairly reliable for a period of about 2 to 3 years. The WHO projection should also be relatively reliable over the short term, provided that estimates of HIV seroprevalence are reasonably accurate. The WHO model's short-term projections of AIDS cases are virtually independent of future trends in HIV incidence. The vast majority (>90%) of AIDS cases expected over the next 4-5 years would occur even if all HIV transmission had ceased after 1989. This is so because the estimated median interval between infection and the development of AIDS is very long (about 10 years). Thus, the majority of new AIDS areas which become manifest over the next 4-5 years will be derived from the pool of persons who were infected with HIV before 1989. The WHO model projections of large increases in AIDS cases over the next 5 years are similar to most of the projections obtained by statistical extrapolation models.

WHO has estimated that from 5 to 10 million persons worldwide were infected with HIV as of 1988, but has consistently used the lower estimate of 5 million for projection purposes. The Delphi participants were asked to assume that the global prevalence of HIV in mid-1988 was about 5.1 million and asked to project HIV infection to mid-2000 on this basis. Thus, projections based on the Delphi responses may be conservative.

The Delphi projections of HIV infection made possible use of the WHO model to project AIDS cases annually up through the year 2000. According to the WHO projections the ratio of cumulative HIV infections to cumulative AIDS cases will steadily decrease with time. The ratio falls from thousands or many hundreds to one in the first few years of extensive HIV spread in a population to less than ten to one after the first decade. It is important to understand that the ratio of HIV infection to AIDS cases changes considerably over time, especially if such ratios are used to derive HIV prevalence from the reported prevalence of AIDS. During the early stages of the HIV /AIDS epidemic in sub-Saharan Africa countries, the WHO model indicated that pediatric AIDS cases were more numerous than adult AIDS cases. This finding is related to the observation that progression from HIV infection to AIDS is much more rapid in infants than adults. However, because of the much larger number of adult infections, adult AIDS cases will gradually surpass AIDS in childhood as the epidemic continues.

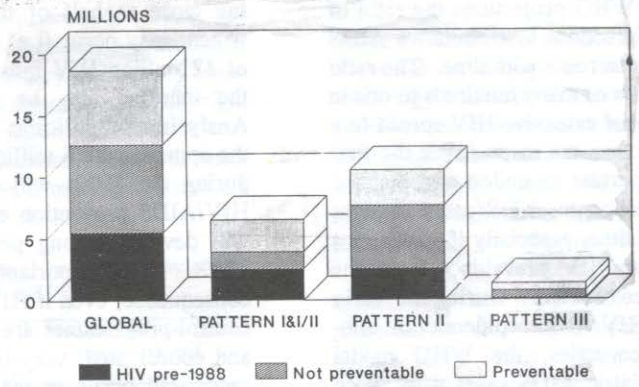
Perhaps more noteworthy is the suggestion from these projections that during the next decade, HIV /AIDS prevention and control programmes are potentially capable of preventing close to half of the new HIV infections which may occur (i.e., instead of an increase of 12 million HIV infections during the 1990s the increase may be limited to 6 million). Analysis also indicates that more than half of the approximate 5 million AIDS cases expected during the 1990s will occur despite effective HIV /AIDS prevention efforts since these cases will develop among persons infected prior to 1989. It is important to appreciate that in consequence, even if HIV/AIDS prevention and control programmes are adequately supported and coordinated, very large increases of AIDS cases will occur in the 1990s. For the year 1988, a global total of over 90,000 adult AIDS cases was estimated. In contrast, the total annual AIDS cases in the years 1995 and 2000, even with a coordinated global prevention and control effort, are projected to be about 450,000 and over 600,000, respectively. Health and social service systems throughout the world need to strengthen their capabilities to respond to this very large projected increase in AIDS cases.

Figure 1: Projected annual AIDS cases in sub-Saharan Africa, 1990-91[a]



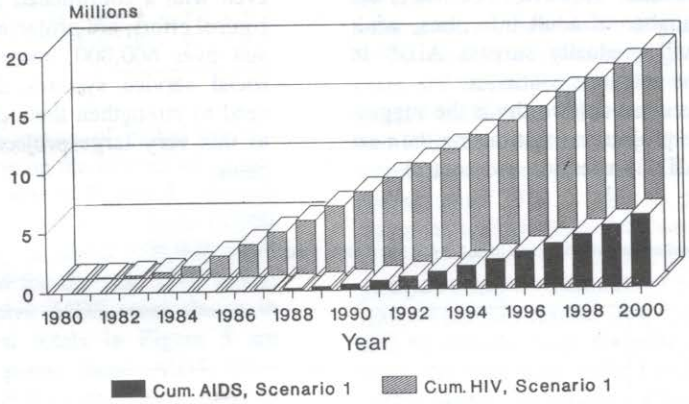
[a] Projections were obtained by using the WHO projection model and indicate that by 1991 there will be over 600000 cases of AIDS in adults, and about t80000 in children aged 0-4 years. Up to 1985. paediatric cases are estimated to have exceeded those in adults

Fig. 2 **Delphi projections of HIV prevalence in adults in the year 2000.***



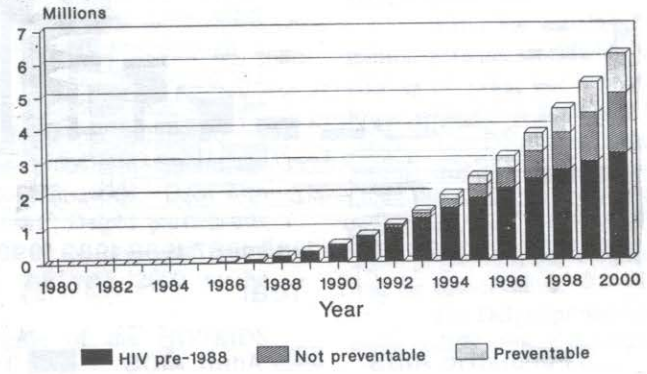
* Despite a coordinated effort to prevent and control HIV/AIDS, a substantially increased number of HIV-infected persons will have occurred worldwide by mid-2000. This anticipated increase in HIV-infected persons could be reduced to the level of the top of the hatched portions of each bar, if a coordinated effort to prevent and control HIV/AIDS is implemented (see text: scenario 2—with coordination). Such a reduction is thought to be more likely in patterns I and I/II areas rather than pattern II areas.

Fig. 3 **Cumulative (cum.) adult AIDS cases by the Delphi projection of HIV prevalence (see text: scenario 1, with no coordination) and the WHO model for forecasting AIDS cases, 1980–2000.***



* Only a small proportion of worldwide cumulative adult AIDS cases projected for mid-2000 will occur prior to 1990.

Fig. 4 **Cumulative adult AIDS cases by Delphi projection of HIV prevalence, 1980–2000.***



* About three million cumulative adult AIDS cases are expected to arise by mid-2000 from the pool of approximately five million individuals infected with HIV as of mid-1988. The figure illustrates that a further three million cumulative adult AIDs cases could be the additional global AIDS burden in the absence of coordinated prevention and control efforts (scenario 1). This additional three million adult cases could potentially be reduced by as much as 40% to about 1.8 million with a globally and regionally coordinated prevention and control effort (scenario 2) in the 12 years from mid-1988 to mid-2000.

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