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*SECULAR TRENDS OF TUBERCULOSIS IN WESTERN EUROPE:  
EPIDEMIOLOGICAL SITUATION IN 14 COUNTRIES*

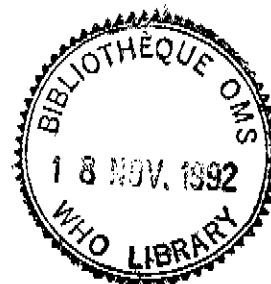
*Mario C. Raviglione<sup>1</sup>*

*Philippe Sudre<sup>1</sup>*

*Hans L. Rieder<sup>2</sup>*

*Sergio Spinaci<sup>1</sup>*

*Arata Kochi<sup>2</sup>*



*Tuberculosis Programme, World Health Organization, Geneva, Switzerland<sup>1</sup>*

*Federal Office of Public Health, Berne, Switzerland<sup>2</sup>*

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### Abstract

Introduction There are suggestions that in some Western European countries the recorded decline of tuberculosis notifications has come to an end. However, no detailed analysis has been reported on the tuberculosis situation in Western Europe. The aim of this article is to assess trends in tuberculosis mortality and morbidity in fourteen countries of Western Europe.

Methods Data were obtained mainly from national statistical reports provided by the Ministries of Health and reports from national tuberculosis associations.

Results Deaths due to tuberculosis have uniformly decreased in all countries, and most have occurred among the population 65 years of age or older. In recent years, tuberculosis case notifications have continued to decline in Belgium, Finland, France, Germany, and Spain, and have levelled off in Sweden and the United Kingdom, while increases have been recorded in Austria, Denmark, Ireland, Italy, the Netherlands, Norway, and Switzerland.

Discussion Interpretation of available data is difficult because of changes in case definitions and reporting criteria over time within countries, and because of differences between countries. Nevertheless, conclusions can be drawn from this analysis. In Denmark, the Netherlands, Norway, Sweden, and Switzerland an increasing number of cases among the foreign-born has contributed to a change from the expected downward trend. HIV infection appears to contribute only marginally to the overall tuberculosis morbidity. However, it appears to be important in Paris and surroundings areas, and tuberculosis is very common among HIV-infected persons in Italy and Spain. Despite these recent changes in incidence, there is currently no report of increased transmission of tuberculosis infection within the youngest segments of the indigenous population. Properly designed disease surveillance systems are critical to monitor the tuberculosis trends for each country to identify its own high risk groups and target interventions to prevent, diagnose and treat the disease. Tuberculosis remains a global disease and because of increasing human migrations, its elimination in Western Europe can not be achieved without improvement of control in high-incidence, resource-poor countries.

### Introduction

In several industrialized countries the regular decline in tuberculosis notifications, as expected from years of observation, appears to have become disturbed. The phenomenon was first noticed in the United States (1). The average 5.7% annual decline in notification rates seen in that country between 1975 and 1984 was halted in 1985, and reversed from 1986 onward (2). As a result about 28 000 more cases were accumulated during the period 1985-1990 than would have been expected if the previously observed downward trend had continued (2). This has been attributed, in part, to the spreading of the human immunodeficiency virus (HIV). Homelessness, increased drug abuse, immigration from countries where tuberculosis is common, and the deterioration of health care delivery to the poor and of their living conditions have also been implicated as factors contributing to the increase (3,4).

Similarly, in recent years a levelling off or a reversed trend in tuberculosis notifications has been reported from several Western European countries. The reasons for this phenomenon are complex, differ from one country to another, and have not been entirely elucidated (5).

In this paper, recent data on tuberculosis mortality rates and incidence and their trends in Western European countries are reviewed to allow for a more precise assessment of the epidemiological situation. Because relatively uniform reporting systems have been available only for a few years, this analysis was limited to the past two decades. This most recent period represents only a small time window in the tuberculosis epidemic which has spanned centuries in Western Europe. With the ending of the epidemic, heralding the elimination of the disease among the general indigenous populations of Western Europe, new factors superimposed on the baseline epidemic course may become increasingly important in contributing to reported tuberculosis morbidity. The purpose of this article is to review available data and to disentangle, to the extent possible, factors and groups that make up the composite picture of tuberculosis notifications in various Western European countries. Isolation of specific factors should allow to define better groups at risk and to whom intervention strategies should be targeted.

### Methods

Data were obtained from national statistical reports produced by the Ministries of Health, from reports of national tuberculosis and respiratory diseases associations, published literature and personal communications. Rates (per 100 000 population) were obtained using population data provided by the World Health Organization (WHO)'s Division of Epidemiological Surveillance and Health Situation and Trends Assessment (6) and, for the 1990-1991 populations of some countries, from estimates provided by the United Nations Population Division. Western European countries with very small populations or whose data could not be validated were not included in this study. Mortality information for the period 1980-1990 was provided by the Global Health Situation Assessment and Projection Unit, Division of Epidemiological Surveillance and Health Situation and Trend Assessment, WHO, Geneva.

For this review, a case of tuberculosis was defined as a case officially notified in the country studied.

### Results

Fourteen Western European countries were studied. Tables 1 and 2 present the annual notifications and notification rates (per 100 000 population) of tuberculosis in Western Europe for the period 1974-1991, and table 3 presents an overview of the morbidity and mortality situation. Tuberculosis notification rates of all 14 countries combined showed an almost constant exponential decline over the period of observation with an average decline of 5.4% per year (figure 1), declining by more than 50% from 31.9 to 14.0 per 100 000 population from 1974 to 1990. However, the rate of decline differed between individual countries (figure 2). Generally, in countries with initially relatively high rates, tuberculosis declined more rapidly than in countries with initially relatively low rates. While the range of notifications was wider at the beginning of the observation period (*i.e.*, ranging from 7.8 to 76.3 per 100 000 in 1974, an almost 10-fold difference), the gap had become considerably narrower at the end of the period (6.6 to 19.7 per 100 000 in 1990, a 3-fold difference).

A further breakdown to annual changes within each country shows that, in a large number of countries, tuberculosis notification rates have not appreciably declined in most recent years, and an increase has actually been noticed in several (figure 3). However,

figure 3 also points to difficulties in interpreting available surveillance data. Large changes from one to the next year are generally unlikely to reflect changes inherent to the tuberculosis epidemic, but rather to reporting biases. An interval twice as large as the observed average annual decline was chosen arbitrarily on both sides of the null-line to indicate the interval beyond which factors other than those determining the natural course of tuberculosis notifications may play an important role. For instance, a 40% increase in one year followed by a 60% decrease in the subsequent year is not likely to be due to large fluctuations in the actual numbers of cases occurring. The composite of annual changes may suggest a slight concavity away from the null-line towards the decline, indicating that decreases in individual countries may have been largest in the middle and smallest at the beginning and the end of the observation period.

### **Austria**

In Austria, tuberculosis deaths have decreased significantly in the past 10 years from 404 in 1980 (3.1 per 100 000) to 141 in 1990 (1.8 per 100 000). The proportion of these deaths occurring in persons 65 years of age or older has remained stable at about 64%, and there has been no increase in the proportion of deaths in the 25- to 44-year-old age group.

Tuberculosis notifications decreased almost every year in Austria until the second half of the eighties. In the period 1986-1988 a levelling off around 18 cases per 100 000 was evident. The lowest number of cases ever reported was in 1989 (1280 total cases, rate 16.8 per 100 000). In 1990, 1521 cases (19.7 per 100 000) were notified, an increase of 18.8% over the previous year. Preliminary data from 1991 show a 6.6% decrease from the 1990 figures (Dr W. Michtner, Ministry of Health, Vienna, personal communication, 1992). No data are available on influence of the HIV epidemic on the problem and on nationality of cases.

### **Belgium**

In Belgium, the number of tuberculosis deaths decreased from 232 (2.4 per 100 000 population) in 1980 to 103 (1.0 per 100 000) in 1987, the latest year for which mortality data are available. About 65% of all tuberculosis deaths occurred among individuals 65 years of age or older.

The reported tuberculosis cases include post-primary disease as well as symptomatic primary disease. Tuberculosis notifications showed large fluctuations at the beginning of the observation period and then declined from 2838 cases in 1981 to 1457 cases in 1991. This corresponds to an average annual decrease in rate of 7%. However, a levelling off of this decrease occurred during the last 3 years.

In 1991 more cases were reported from the region of Flanders (653) than from the region of Wallonia (470) or from the region of Brussels (334), while the incidence rates were 11.3, 14.4, and 34.3 (per 100 000 population), respectively.

The high incidence rate in Brussels is not a new phenomenon and here too the previous decline seems to have come to an end. In this city in 1991 the incidence among native Belgians was 23.5 per 100 000, as opposed to 61.2 among the foreign-born (data

from FARES, Fondation contre les Affections Respiratoires et pour l'Education à la Santé, and from VRGT, Vlaamse Vereniging voor Respiratoire Gezondheidszorg en Tuberculosebestrijding, compiled by Prof F. Portaels and Dr G. Carpels, 1992).

#### **Denmark**

In Denmark, the number of tuberculosis deaths notified has remained relatively stable in the past 10 years (70, 1.4 per 100 000 in 1980 and 52, 1.0 in 1990). Most deaths occurred in the elderly population 65 years of age and older (69% in 1980 and 71% in 1990).

The lowest number of tuberculosis cases ever was notified in 1984 (265, 5.2 per 100 000 population) and has increased by 21% since then (321 cases, 6.2 per 100 000 population in 1991). In 1986, 42 of 229 bacteriologically confirmed cases occurred among foreigners (18.3%); this number more than doubled to 113 of 300 cases in 1990 (37.7%).

An increased number of cases among foreigners accounts for most of the recent countrywide increase in tuberculosis notifications. The number of new cases of acquired immunodeficiency syndrome (AIDS) notified annually is increasing slowly and the proportion of AIDS patients among tuberculosis cases has not changed recently. There is no evidence that the HIV epidemic plays any role in the upward trend (Dr A. Andersen, Mycobacteria Department, Statens Seruminstitut, Denmark, personal communication, 1992).

#### **Finland**

Tuberculosis deaths have decreased in the past 10 years from 240 in 1980 (5.0 per 100 000, the highest mortality rate in the 14 countries studied) to 82 in 1989 (1.7 per 100 000). An increasing proportion of these deaths (66% in 1980 and 80% in 1989) occurred in persons 65 years of age or older.

In the mid-seventies, Finland had the highest case notification rate of the 14 countries studied (76.3 per 100 000 population in 1974). The annual decrease has been steady since 1974. With the exception of 1985, when there was a small increase of 1.6%, 1991 was the first time in 17 years that tuberculosis notifications did not decrease substantially in Finland (rate in both years 15.5). In 1991, of the 771 reported cases, 26 (3.4%) were among foreign citizens. Finally, HIV has not had any influence on the situation in Finland so far (Prof E. Tala, Department of Diseases of the Chest, University of Turku, Preitilä, Finland, 1992, personal communication and data from the Living Environment Department, Health Protection Unit, 1992).

#### **France**

In France, tuberculosis deaths have decreased in the past 10 years from 1604 in 1980 (3 per 100 000) to 971 in 1989 (1.7 per 100 000). Most of these deaths (70% and 76%, respectively) occurred in persons 65 years of age or older. In the same 10-year period, age-specific tuberculosis mortality did not increase in the 25- to 44-year-old age group.

The incidence of tuberculosis regularly declined by about 4% per year between 1970 and 1988, when 9191 total cases (16.4 per 100 000 population) were reported (7). In 1989 and 1990, however, the number of cases reported stabilized and the notification rate remained unchanged (16.1 per 100 000 population) (8). There are some significant regional differences, and notification rates increased slightly between 1988 and 1989 in the Paris region while decreasing elsewhere. In 1988 detailed information was available on a non-random sample of 3863 cases (43% of all reported cases). Twenty-seven percent of them occurred among foreigners who, in general, were younger than French nationals. Almost half (47.7%) were less than 35 years of age compared to 25.2% of French nationals. Conversely, 47.8% of French nationals were 55 years of age or older compared to only 19.5% of foreign-born patients (9).

The impact of the HIV epidemic on the incidence of tuberculosis seems important in the Paris area where HIV-infected tuberculosis patients alone account for the excess in the number of cases over that expected from the previous years (8). Further, the HIV seroprevalence among patients with tuberculosis in Paris and a nearby Département was much higher (12% and 18%, respectively) than in all the other areas of the country (1%). About 40% of all HIV-infected tuberculosis cases were foreign-born (of which 46% from sub-Saharan Africa) and about half of the HIV-seropositive French patients with tuberculosis were intravenous drug users (8). In 1991, about 10% of all known AIDS cases had active tuberculosis (Prof J. Grosset, personal communication, 1992).

The stabilization of the downward trend in tuberculosis incidence seems to result from a combination of an increasing number of cases among the HIV-infected and the foreign-born in the urban area of Paris, and a decreasing incidence in other regions. Although the HIV epidemic may have contributed to the recent trend in certain areas, other factors may be at play.

## Germany

In Germany, there were 2048 tuberculosis deaths in 1980 (3 per 100 000 in East Germany and 2.5 per 100 000 in West Germany) and 1089 in 1989 (1.6 per 100 000 in East Germany and 1.3 per 100 000 in West Germany). Persons over the age of 65 years represented 68% of all tuberculosis deaths in 1980 and 64% in 1989.

Data for morbidity in Germany were analyzed including notifications from the former Federal Republic and Democratic Republic. Between 1974 and 1984 an annual decline of 5% in number of cases was observed (from 43 199 cases to 20 243). Similarly, there was a decline in rate from 54.7 to 26.0 per 100 000 population (10). Since 1984, however, the rate of decrease has somewhat slowed down.

Analysis of reports by nationality shows that among German citizens, the decline is continuing, although at a slower rate. Among non-German citizens, the decline ended in 1986 and an average annual increase of 7.8% was observed between 1986 and 1989. Data from West Germany also showed an increased case notification rate among foreigners from 50.9 per 100 000 in 1986 to 63.1 in 1989. Non-German citizens represented 14.5% of all cases in the 1982 - 1986 period and 19.7% of all cases in 1989. In this group, the case notification rate (63 per 100 000 population) was more than 3 times that of the country as

a whole in 1989. The HIV epidemic appears to have an impact on the tuberculosis situation in Berlin (Dr. J. Hallauer, Federal Ministry of Health, Bonn, Germany, personal communication, 1992) and in Frankfurt. In Frankfurt, more than 10% of AIDS patients were reported to have suffered an episode of tuberculosis during the period 1984-1988 (11).

Age-specific information available from the former Federal Republic indicates that there was a reduction in rate among males in all age groups (except in 0-1 year olds) between 1987 and 1989, whereas among females there was an increase in cases among those 0-1 and 75-85 years of age (10). Adults 65 years of age and older represent an increasing proportion of all cases: 24.6% in 1987, 25.4% in 1988, and 28.9% in 1989.

### Ireland

In the Republic of Ireland in the past 10 years tuberculosis deaths have decreased by 50% from 120 in 1980 (3.5 per 100 000) to 60 in 1989 (1.7 per 100 000). An increasing proportion of these deaths (54% in 1980 and 73% in 1989) occurred in persons 65 years of age or older.

The lowest number of tuberculosis cases ever was notified in 1988, but after years of decline there was an important increase of 24.7% in 1989. In 1990, the case notification rate remained higher than in 1988 (17.9 vs 15.1 per 100 000 population) (Drs L. Clancy and P. Kelly, Peamount Hospital, Newcastle, Ireland, personal communication, 1992).

### Italy

In Italy, tuberculosis deaths have decreased in the past 10 years from 1530 in 1980 (2.7 per 100 000) to 770 in 1988 (1.3 per 100 000). An increasing proportion of these deaths occurred in persons 65 years of age or older (53% in 1980 and 67% in 1988). In the same period, age-specific tuberculosis mortality did not increase in the 25- to 44-year-old age group.

In this country, reports of tuberculosis cases have followed a peculiar pattern: after a regular decline from the late 1970s to 1981 (when the lowest number of notified cases was reported), an increase occurred in 1982-1983. Between 1986 and 1988, the number of cases declined again, but in 1989 and 1990 increases of 24.5% and 2.6%, respectively, were observed. The highest annual figure since 1983 was reported in 1990 (4185 bacteriologically proven cases; 7.3 per 100 000 population).

Notifications must be analyzed with caution for at least three reasons: i) first, official epidemiological data have not been reported since 1978 and analyses have been based on reports from the National Health Statistics (12); ii) second, only bacteriologically proven cases were officially notified until 1990, although a survey done in one region in 1986 showed that only half of reported cases were bacteriologically proven (13); iii) third, underreporting is recognized as a problem (14) and a recent study based on prescriptions for antituberculosis drugs showed that the total number of cases treated for tuberculosis was seven times higher than official notifications (15). As a result, it was estimated that

as many as 20 000 cases of tuberculosis (16) or up to 35 cases per 100 000 may be occurring yearly in Italy (12,14).

Available notification reports indicate that in the past decade there was an increasing proportion of cases occurring in adults 45 years of age or older (50.5% of all cases in 1980, 55% in 1986 and 54.3% in 1990), and a decreasing proportion among younger adults 15 to 44 years of age (40% in 1980, 37% in 1986 and 35% in 1990) (data from National Health Statistics, Istituto Nazionale di Statistica, Rome, 1978-1991). The average age-specific rates of tuberculosis notifications for the triennium 1978-1979-1980 were compared with those of the biennium 1989-1990. While rates decreased in many age groups, small increases were seen among children 0 to 4 years of age (+0.97 per 100 000), and adults 25 to 34 years (+0.75 per 100 000). Larger increases were seen in adults 65 years of age or older: 18% in the 65- to 74-year-old group (+1.85 per 100 000) and 54% among persons 75 years of age or older (+4.56 per 100 000).

Although the majority of tuberculosis cases occur in age groups with low HIV prevalence, there was also some increase among adults 25 to 34 years of age. A study on 1691 patients with AIDS, representing 41% of all AIDS cases reported for the biennium 1988-1989, showed that 11.4% had tuberculosis (17). This figure is higher than in some other industrialized countries (18,19).

Because patients who develop tuberculosis after AIDS may not be reported as a case of tuberculosis and because culture-negative tuberculosis, not uncommon in AIDS patients, is not officially reported, it may appear that HIV is not producing any effect on the increasing tuberculosis incidence, and its impact among young adults might have gone unnoticed. However, the high proportions of older adults with tuberculosis suggests that other factors, like the increased incidence among the elderly, are primarily responsible for the overall increase seen in the available official figures. There is also some evidence that the recent immigration of large numbers of residents from countries where tuberculosis is highly prevalent (20 and Dr G.B. Migliori, personal communication 1992) contributes to the increasing trend of notifications among young adults. While in 1986 3% of a non-random sample of new cases of pulmonary tuberculosis occurred among immigrants from South-East Asia and Africa, in 1990 this proportion increased to 16% (14).

### **Netherlands**

In the Netherlands, the number of all tuberculosis deaths, which had regularly decreased until 1984, reached the lowest figure ever in 1987 after two years of temporary increase. However, increases of 30% and 9% have been documented in 1988 and 1989, respectively. The average mortality has been 43 per year, 0.3 per 100 000 population, with the vast majority (85% in 1989) of deaths occurring among the elderly (65 years of age or older). A recent analysis of registration cards from the Tuberculosis Control Programme showed that during the period 1974-1984 the case fatality of bacteriologically proven pulmonary tuberculosis as well as the standardized mortality rates increased. This increase was seen predominantly among male adults aged 65 years or more (21).

The annual notification rate declined regularly between 1975 and 1987 (from 16.3 per 100 000 population to 8.4 per 100 000 population, an overall decrease of about 48%). The

lowest number of cases ever (1227) was reported in 1987. After that year, the downward trend reversed and the number of cases increased 9.3% in 1988 and 3.9% in 1990 (22 and Dr J.F. Broekmans, Royal Netherlands Tuberculosis Association, personal communication, 1992).

Information on the nationality of tuberculosis cases indicates that the tuberculosis decline has continued among native Dutch at a average rate of 4.3% per year between 1984 and 1990, and 5.4% between 1989 and 1990. On the other hand, tuberculosis notifications increased steadily among foreign-born residents at an average rate of 13.6% per year between 1984 and 1990 with an increment of 21.2% in 1990. In 1990, 41% of the cases of tuberculosis occurred among foreigners (Dr J.F. Broekmans, Royal Netherlands Tuberculosis Association, personal communication, 1992) (figure 4).

The recent levelling off in tuberculosis incidence seems to result from the combination of a continued decline among native Dutch offset by a continued increase among foreign-born residents. The low prevalence of tuberculosis infection among Dutch 15 to 44 years of age will minimize any potential impact of the HIV effect in this population (23), and there is currently little evidence suggesting that the HIV epidemic is responsible for the end of the secular decline of tuberculosis in the Netherlands. However, an increase in tuberculosis incidence from 16 cases per 100 000 in 1984 to 33 in 1988 has been detected among Dutch males 25 to 49 years of age in Amsterdam, whereas no increase was observed among Dutch males of the same age outside Amsterdam and of different age in Amsterdam (24).

### Norway

In Norway, the number of tuberculosis deaths notified remained stable between 1980 and 1985 (2.2 to 2.0 per 100 000). Subsequently, only mortality due to new cases was reported and in 1990 there were 17 deaths (0.4 per 100 000). Most deaths occurred in the elderly population 65 years of age or older (71% in 1980 and 88% in 1989). In the past 10 years, there was a total of 559 tuberculosis deaths and only 6 (1.1%) occurred in the 24- to 44-year-old group.

The notification rate has been decreasing for a number of years and the lowest number of cases, including relapses, was reported in 1988 and 1989 (294 cases in both years; 7.0 per 100 000). Recently, however, case notifications increased by 13.6% (7.9 per 100 000) and by 8.4% (8.5 per 100 000) in 1990 and 1991, respectively. In 1977, 4% of all cases were among the foreign-born and this proportion reached 23% in 1990. Although this increase may explain, at least in part, the slow rate of decline in tuberculosis notifications since 1977, an increased case notification rate has been observed both in Norwegians and the foreign-born in the past 2 years. The proportion of "non-infectious cases" ("active cases with no bacilli excreted") has increased in Norway, but registry matching of AIDS and tuberculosis cases indicates that HIV does not play a significant part in this phenomenon nor in the overall increase in tuberculosis notifications. Only 7 tuberculosis cases were reported among over 230 AIDS patients between 1985 and 1991 (Dr K. Bjartveit, Central Tuberculosis Register, National Health Screening Service, Oslo 1992, personal communication, 1992).

## Spain

In Spain, deaths attributed to tuberculosis decreased from 1469 in 1980 to 939 in 1987. About 54% of tuberculosis deaths occurred in the elderly 65 years of age and older and this proportion has remained stable over the past few years. In 1987, the latest year for which mortality data are available, 34 non-respiratory tuberculosis deaths were reported in the 15- to 44-year-old age group, compared to an average of 18 deaths in the previous 7 years in the same age group. When all forms of tuberculosis are considered together, the proportion of deaths in this age group also increased from less than 10% until 1985 to 11.4% in 1986 and 13% in 1987.

In Spain, only pulmonary cases of tuberculosis are notified. The number of tuberculosis notifications increased steadily since the early seventies mainly because of improved reporting. The declining trend which began in 1987 is still present and the 7597 cases reported in 1990 (19.4 per 100 000 population) represent a 5.7% decrease from the previous year (25,26 and National Statistical Institute, Madrid, 1991). However, it was estimated that 19 800 new cases of tuberculosis occurred in 1990 (26).

Age-specific data from the Health Department of Barcelona and other sources indicate that tuberculosis is still a problem of young adults 15 to 44 years of age (27). In Spain, extrapulmonary cases of tuberculosis, which are common among HIV-infected persons, are not reported. As a result, the effects of the HIV epidemic on the tuberculosis incidence is not yet statistically apparent although data from series of AIDS patients showed a high occurrence of tuberculosis in this group: 37% among 434 patients in Barcelona and 36% among 112 in San Sebastian (28,29), and the HIV seroprevalence among tuberculosis patients was over 20% in 1990 in Barcelona (report from Drs J. Cayla and P. March to Dr R. Rey, Ministry of Health, Madrid, personal communication, 1992). The HIV epidemic will likely increase the incidence of tuberculosis among the estimated 16 000-27 000 co-infected persons, many of whom are intravenous drug users (Dr R.Rey, Ministry of Health, Madrid, personal communication, 1992). Nevertheless, the impact of the HIV epidemic on tuberculosis in the general population may not be important (27).

## Sweden

In Sweden, the number of notified tuberculosis deaths decreased from 131 in 1980 (1.6 per 100 000) to 56 in 1988 (0.7 per 100 000). Most deaths occurred in the elderly population 65 years of age or older (84% in 1980 and 87% in 1988).

The lowest number of cases ever was notified in 1988 (536, 6.4 per 100 000 population). After years of decline, more cases were notified in the following two years (595 cases in 1989, 7.0 per 100 000, and 557 cases in 1990, 6.6 per 100 000). Information on the country of birth and the age of the cases reported for 1989 and 1990 indicates that, during these two years, 37% of cases occurred among the foreign-born (430 of 1152). In 1990, 70% of cases among individuals born in Sweden occurred in patients 65 years of age and older, whereas 66% of cases among individuals born abroad were in the 20- to 44-year-old group. The case notification rate in 1990 was 4.2 per 100 000 population among individuals born in Sweden (16 per 100 000 in persons 65 years of age and older) and 30.1 per 100 000 among individuals born abroad (76.3 per 100 000 in the 25- to 29-year-old age

group) for a relative rate of 7.2. In 1990, there were 58 cases among individuals born in Africa, a 49% increase over the 39 cases in 1989, and in this group the notification rate was 229 per 100 000. In Sweden, the proportion of cases occurring among the foreign-born has increased from 23% (162 of 702) in 1985 to 41% (228 of 557) in 1990, thus contributing substantially to the recent upward trend. Among the total 645 cases of AIDS notified since 1982, tuberculosis was reported in 1.3% of Swedes (6 of 464) and in 6% of foreigners (11 of 181) (Dr V. Romanus, the National Bacteriological Laboratory, Stockholm, personal communication, 1992).

### Switzerland

In Switzerland, the number of tuberculosis deaths decreased from 181 in 1980 (2.9 per 100 000) to 86 in 1990 (1.3 per 100 000). The vast majority of deaths occurred among the population 65 years of age or older (83% in 1980 and 78% in 1990).

The reporting system and the case definition were modified in 1987. The case definition for tuberculosis notification now includes pulmonary and extrapulmonary disease, symptomatic or not, bacillary or not, as well as asymptomatic primary infection. Importantly, it became policy that in addition to requiring physicians to report all such cases, laboratories were required to report any isolation of *Mycobacterium tuberculosis* complex. The lowest number of cases ever was notified in 1986 and the incidence of tuberculosis declined between 1975 and 1986 at an average of about 5.0% per year from 33.1 to 13.8 per 100 000 population. However, in 1987, 1988 and 1990 there were marked increases in notification of 15.5%, 13.4% and 15.6%, respectively. In 1990, 1229 cases were notified (18.4 per 100 000 population), the largest number since 1979 (30.31). The introduction of a new notification system and a new case definition may have spuriously increased the number of reports received by the Federal Office of Public Health in 1990, although asymptomatic recent tuberculin conversions were excluded from statistical analysis.

In 1990 49% of the reported cases occurred among Swiss natives and 51% among foreign-born residents, mainly from Yugoslavia, Turkey and Portugal. The estimated notification rate was 50.6 per 100 000 among foreign-born residents and 11.3 per 100 000 population among Swiss (rate ratio: 4.5).

Age-specific notifications from 1988 to 1990 show no increase among Swiss natives, but a definite increase among the foreign-born, particularly those 25 to 29 years of age. In 1990, of 791 bacteriologically confirmed cases, 428 (54%) occurred among Swiss natives and 363 (46%) among foreign-born residents: 49% of the Swiss patients were 65 years old or more, indicating that tuberculosis among Swiss natives has become a disease of the elderly, whereas 80% of foreign-born patients were 45 years old or less (30-32) (figure 5).

No increase in tuberculosis case notifications has been observed recently among young Swiss persons belonging to the age groups at higher risk of HIV infection, probably because the prevalence of tuberculous infection is very low in this segment of the population. Tuberculosis is more common among foreign-born young adults, and the increase seen in this population has played the major role in the overall increase of notifications observed in recent years.

### United Kingdom of Great Britain and Northern Ireland

In the United Kingdom, tuberculosis deaths have decreased in the past 10 years from 707 in 1980 (1.3 per 100 000) to 441 in 1990 (0.8 per 100 000). An increasing proportion of these deaths (56% in 1980 and 73% in 1990) occurred in persons 65 years of age or older, and the proportion of tuberculosis deaths in the 25- to 44-year old age group has decreased from 6.5% in 1980 to 4.1% in 1990.

A reversal in the decline in notifications of tuberculosis was observed beginning in 1988 (0.8%, 4.3% and 1.7% increases in rate in 1988, 1989 and 1991, respectively) (Dr J. Watson, PHLS Communicable Disease Surveillance Centre; Dr D. Reid, Scotland Communicable Disease Unit; Dr L. Mitchell, Department of Health and Social Services of Northern Ireland; personal communications, 1992). The lowest rate ever was observed in 1987 (10.1 per 100 000).

Detailed information available from England and Wales indicates that the highest notification rates were observed among males above 65 years of age, and that small increases between 1987 and 1989 occurred among both sexes over 65 and in females 25- to 44-year-old (19,33). The highest tuberculosis notification rates were found in areas with a high proportion of residents of Indian sub-continent ethnic origin. Low rates were observed among young white adults although the largest proportion of AIDS cases in England and Wales was reported in this group. In addition, only about 4% of the AIDS cases had suffered from tuberculosis (19).

For this reason and because the two populations at the highest risk for tuberculous and HIV infection, namely persons from the Indian sub-continent and young white males respectively, overlap only marginally, it is unlikely that the HIV epidemic plays an important role in the recent upward trend in tuberculosis notifications (19). A continued high incidence among persons of Indian sub-continent ethnic origin and the elderly are likely to be among the important factors responsible for the recent levelling off in tuberculosis notifications (33).

Table 4 presents an overview of the impact of the HIV epidemic and the foreign-born on the tuberculosis situation in some Western European countries. The proportion of patients with tuberculosis among AIDS cases is highly variable in different groups with a low of 2.6% in Sweden and a high of 37% in Spain. The contribution of the foreign-born to all tuberculosis cases also varies greatly between countries but is apparently increasing in most of them.

### Discussion

Death from tuberculosis is the gravest outcome of the tuberculosis epidemic. The latest recorded epidemic in Western Europe has apparently spanned centuries claiming, at its height, perhaps one percent of the population annually as its death toll in several European metropolitan areas (34). By the end of the 1980s, the annual rate of death from tuberculosis has declined, with few exceptions, to 1 to 2 per 100 000 population, a 500- to 1000-fold reduction. The vast majority of deaths has been increasingly occurring in the population 65 years of age or older.

Tuberculosis morbidity has been recorded less reliably and for a shorter period of time. Thus, the existing tuberculosis notification systems in Western Europe allow only assessment of the tailing off of a long-lasting epidemic. Tuberculosis at its full force always claims its highest toll among young adults, while a shift towards the elderly population is epidemiologically a sign of success (35). In all countries examined, tuberculosis among the indigenous population has become a disease of the elderly, indicating that it may be occurring largely as a result of endogenous reactivation of an infection acquired years in the past when the risk of infection was much higher. With time, this pool of infected individuals will be depleted, and currently infected cohorts will successively be replaced by cohorts with less and less infection.

However, recent observations in some industrialized countries that tuberculosis has failed to decline at the previously observed pace have led to concerns that tuberculosis may be resurgent in industrialized countries due to immigration and/or the HIV epidemic. A comparative analysis of Western European tuberculosis notification data is fraught with problems. Within each country, case definitions and reporting criteria have changed, and between countries, large differences in the quality of surveillance and reporting criteria do exist (36). Nevertheless, several conclusions can be drawn from this analysis.

Although data reported in some countries are not entirely reliable, in Western Europe as a whole, tuberculosis notifications have declined fairly regularly at 5.4% per year from 1974 to 1991. The decline has been more rapid in those countries with initially higher rates than in those with initially lower rates, and by 1990 rates had stabilized at 15-20 per 100 000 population in the former countries and at 7-10 per 100 000 in the latter. However, although overall data show a regular decline, in recent years tuberculosis has failed to decline or has increased in several countries.

Our analysis suggests that a major factor responsible for this change is the increased migration of people from high to low incidence countries (table 4). Examples are the Netherlands and Switzerland which have recorded increases of notifications in the past few years, increases which are almost entirely attributable to cases occurring among young foreign-born adults (figures 4 and 5). Figure 5 also shows that, among their Swiss age peers, no increase was recorded, indicating that neither increased transmission from the foreign to the indigenous population, nor increased endogenous reactivation as a result of HIV-induced immunosuppression has thus far played any apparent role in the observed overall increase.

From a public health point of view, it is of utmost importance what happens to the generation of today's parents. As tuberculosis is not easily transmitted beyond the context of close contacts, transmission will largely occur within families. If parents are free from tuberculosis, their children are very likely to escape infection. Currently, there is no indication which directly or indirectly suggests an increased transmission within the young segments of the population.

On the other hand, there is evidence that tuberculosis among the foreign-born living in Western Europe occurs with a frequency similar to that observed in their country of origin. Whether they come predominantly from Africa (as in the case of France, Italy, and Sweden), Yugoslavia, Portugal and Turkey (Switzerland), or the Indian sub-continent (England and Wales), they all share a past experience of exposure to tuberculosis, as they

all come from high tuberculosis incidence areas. However, it is unlikely that their high incidence of tuberculosis will have a significant impact on the course of the epidemic in Western Europe. Nonetheless, interventions are needed to tackle the problem more efficiently. These might include improvement of targeting screening procedures to detect infection and disease, provision of preventive therapy for those infected with *M. tuberculosis*, and prompt curative intervention for those with the disease.

Although there is a temporal association between the levelling off of the secular trend of tuberculosis incidence in many European countries and the AIDS pandemic, the contribution of HIV infection is presently very limited and likely to have only a marginal influence on the tuberculosis situation in Western Europe (37). This is explained by the overall low prevalence of tuberculosis infection among the indigenous population of young adults at high risk for HIV infection. Notable exceptions may be selected areas of France, and Italy and Spain, where tuberculosis infection is relatively frequent among the intravenous drug users, who constitute the main pool of HIV-infected persons in those countries. Thus, the available data do not suggest that either international migration or the HIV pandemic will be able to alter substantially the course of the tuberculosis epidemic in the general indigenous populations of most Western European countries.

The basic strategies to counteract effectively the increase in reported cases of tuberculosis in some European countries may be derived, in part, from the suggestions of a workshop jointly supported by the International Union against Tuberculosis and Lung Disease (IUATLD) and WHO (38). They include: 1) direct government responsibility for supervision of diagnosis, treatment, and prevention of tuberculosis; and 2) maintenance of properly designed disease surveillance systems. This may require new systems, such as the ones adopted by Switzerland (5) and Sweden and based on mandatory reporting of tuberculosis cases by both physicians and laboratories.

Tuberculosis control in Western Europe, with the ultimate goal of tuberculosis elimination, will require that each country identifies its own high risk groups and designs targeted interventions to prevent the disease among the infected individuals and to ensure better diagnosis and treatment follow-up. Tuberculosis remains a global disease. Given the ever-increasing human migrations and travels, tuberculosis elimination in industrialized countries is critically dependent upon improvement of the tuberculosis situation in resource-poor countries.

**ADDENDUM: Portugal**

Data from Portugal became available only after completion of the study. As the figures from this country are markedly different from those of the other Western European countries, it was decided to present them separately.

In Portugal, all tuberculosis deaths have regularly decreased from 577 (5.8 per 100 000 population) in 1980 to 274 (2.8 per 100 000) in 1990. Nevertheless, these figures represent the highest tuberculosis mortality rates in Western Europe.

Tuberculosis notifications include new cases only. The highest number of cases was reported in 1982 (7309, 73.7 per 100 000 population). Thereafter, a regular decline was observed until 1990 (5894 cases, 57 per 100 000) with the exception of 1987. In 1991 5993 cases were reported (60.8 per 100 000). Despite the recent decline, the notification rate remains the highest in Western Europe. Tuberculosis in this country is predominantly a disease of young adults. In 1990 55% of all cases occurred in the 15 to 44 years old, as compared to 36% in older age groups (Direcção-Geral dos Cuidados de Saude Primarios. Tuberculose em Portugal 1990. Lisboa 1991:1-21).

Immigrants from African countries contribute up to 10% of all cases in some districts. However, overall they do not seem responsible for the persisting high rate observed in Portugal (Dr M.L. Antunes, Ministry of Health, Lisboa, personal communication 1992). In a random sample of 500 tuberculosis cases diagnosed in 1990-1992 the HIV seroprevalence was 1.5%. However, 226 of 882 AIDS cases (25%) reported between 1983 and 1992 had tuberculosis.

The tables below show numbers of cases and rates by year in Portugal.

1974	1975	1976	1977	1978	1979	1980	1981	1982
7099	6304	6002	6641	7069	6363	6647	7216	7309
80.8	66.7	61.9	68.0	72.0	64.5	67.5	73.3	73.7
1983	1984	1985	1986	1987	1988	1989	1990	1991
7052	6908	6889	6624	7099	6234	6359	5894	5993
71.3	69.7	67.0	66.9	71.7	60.5	61.6	57.0	60.8

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Table 1. Reported number of cases of tuberculosis in 14 western European countries, 1974 to 1991.

Year	A	B	DK	SF	F	D	IRL	I	NL	N	E	S	CH	UK	Total
1974	2462	3110	na	3581	26784	43199	1204	4309	2119	455	3558	1625	1831	12496	106733
1975	2366	4301	na	3497	25024	40233	1154	4189	2230	497	3131	1478	2091	12620	102811
1976	2506	5118	400	3095	22911	38599	1061	na	2081	na	3335	1307	1823	11781	94017
1977	2311	6531	375	3027	20087	36605	1145	4516	1974	427	3658	1105	1648	11156	94592
1978	2240	2546	303	2757	18924	34334	1151	4316	1911	352	3642	1127	1575	11204	86382
1979	2200	2959	343	2508	17341	32034	1099	4105	1765	378	4165	991	1447	10722	82057
1980	2191	2687	359	2247	17199	29991	1152	3311	1701	497	4859	926	1160	10488	78766
1981	2061	2838	329	2204	16459	27083	1018	3182	1734	461	5488	875	1193	9290	74215
1982	1942	2654	313	2170	15425	24865	975	3750	1514	447	7936	784	1167	8436	72378
1983	1825	2190	295	1882	13831	22977	924	4253	1423	396	9091	832	1097	7814	68830
1984	1765	2149	265	1791	12302	20243	837	4008	1400	373	10640	754	946	7026	64499
1985	1442	1956	275	1819	11290	20074	804	4136	1362	374	10752	702	961	6666	62613
1986	1377	1894	266	1546	10535	17906	602	4037	1238	343	13841	640	881	6841	61947
1987	1390	1772	283	1419	10241	17102	581	3819	1227	307	9468	545	1018	5732	54904
1988	1402	1588	304	1078	9191	16282	534	3262	1341	294	8497	536	1160	5793	51262
1989	1280	1648	328	970	9027	15385	672	4068	1317	294	8058	595	1063	6059	50764
1990	1521	1577	349	772	9030	14653	624	4185	1369	334	7597	557	1229	5908	49705
1991	1426	1457	321	771	na	na	na	na	na	362	na	na	na	6028	10365

A: Austria; B: Belgium; DK: Denmark; SF: Finland; F: France; D: Germany; IRL: Ireland; I: Italy; NL: the Netherlands; N: Norway; E: Spain; S: Sweden; CH: Switzerland;  
UK: United Kingdom

na: No data available

Table 2. Reported number of cases of tuberculosis per 100 000 population in 14 western European countries, 1974 to 1991.

Year	A	B	DK	SF	F	D	IRL	I	NL	N	E	S	CH	UK	Total
1974	32.7	31.9	na	76.3	51.0	54.7	39.0	7.8	15.6	11.4	10.2	19.9	29.0	22.3	31.9
1975	31.5	43.9	na	74.2	47.5	51.1	36.9	7.5	16.3	12.4	8.9	18.0	33.1	22.6	30.6
1976	33.4	52.1	7.9	65.5	43.3	49.3	32.9	na	15.1	na	9.3	15.9	28.8	21.1	33.4
1977	30.7	66.4	7.4	63.9	37.8	46.8	35.0	8.0	14.2	10.6	10.1	13.4	26.0	20.0	27.6
1978	29.8	25.9	5.9	58.0	35.5	44.0	34.7	7.6	13.7	8.7	9.9	13.6	24.8	20.1	25.1
1979	29.3	30.0	6.7	52.6	32.4	41.0	32.6	7.2	12.6	9.3	11.2	11.9	22.8	19.2	23.8
1980	29.2	27.3	7.0	47.0	32.0	38.3	33.9	5.8	12.0	12.2	12.9	11.1	18.7	18.7	22.8
1981	27.5	28.8	6.4	45.9	30.5	34.5	29.6	5.6	12.2	11.2	14.5	10.5	18.7	16.5	21.4
1982	25.9	26.9	6.1	45.0	28.3	31.7	28.0	6.6	10.6	10.9	20.9	9.4	18.2	15.0	20.8
1983	24.2	22.2	5.8	38.8	25.3	29.4	26.3	7.5	9.9	9.6	23.8	10.0	17.0	13.9	19.8
1984	23.4	21.8	5.2	36.7	22.4	26.0	23.7	7.0	9.7	9.0	27.8	9.0	14.6	12.4	18.5
1985	19.1	19.8	5.4	37.1	20.5	25.8	22.7	7.2	9.4	9.0	27.9	8.4	14.8	11.8	17.9
1986	18.2	19.2	5.2	31.4	19.0	23.0	17.0	7.1	8.5	8.2	35.9	7.6	13.8	12.1	17.7
1987	18.3	18.0	5.5	28.8	18.4	22.0	16.4	6.7	8.4	7.3	24.5	6.5	15.5	10.1	15.6
1988	18.5	16.1	5.9	21.8	16.4	20.8	15.1	5.7	9.1	7.0	21.8	6.4	17.7	10.2	14.5
1989	16.8	16.7	6.4	19.5	16.1	19.6	19.1	7.1	8.9	7.0	20.6	7.0	15.9	10.6	14.3
1990	19.7	16.0	6.8	15.5	16.1	18.4	17.9	7.3	9.2	7.9	19.4	6.6	18.4	10.3	14.0
1991	18.3	14.8	6.2	15.5	na	na	na	na	na	8.5	na	na	na	na	13.0

A: Austria; B: Belgium; DK: Denmark; SF: Finland; F: France; D: Germany; IRL: Ireland; I: Italy; NL: the Netherlands; N: Norway; E: Spain; S: Sweden; CH: Switzerland;  
UK: United Kingdom

na: No data available

Table 3: Overview of the situation of tuberculosis in Western Europe and its trend

Country	Case notification				Mortality				
	Latest report (Year)		Lowest number of cases ever	Most recent trend	Total deaths (Year)		Deaths in > 64 years	Trend in 25-44 years	Death to case ratio (%)
	Number	Rate (*)			Number (**)	Rate (*)	%	Trend	
1 Austria	1426 (91)	18.3	1989	Up	141 (90)	1.8	64	Stable	9.3
2 Belgium (§)	1457 (91)	14.8	1991	Down	103 (87)	1.0	65	Stable	5.6
3 Denmark	321 (91)	6.2	1984	Up	52 (90)	1.0	71	Stable	14.9
4 Finland	771 (91)	15.5	1991	Down	82 (89)	1.7	80	Up	8.4
5 France	9030 (90)	16.1	1989	Down	971 (89)	1.7	76	Up	10.7
6 Germany	14653 (90)	18.4	1990	Down	1089 (89)	1.4	67	Stable	7.1
7 Ireland	624 (90)	17.9	1988	Up	60 (89)	1.7	73	Up	8.9
8 Italy (§§)	4185 (90)	7.3	1988	Up	770 (88)	1.3	67	Up	20.4
9 Netherlands	1369 (90)	9.2	1987	Up	47 (89)	0.3	85	Stable	3.6
10 Norway	362 (91)	8.5	1988	Up	17 (89)	0.4	88	Up	5.8
11 Spain (#)	7597 (90)	19.4	1990	Down	939 (87)	2.4	54	Stable	8.2
12 Sweden	557 (90)	6.6	1988	Stable	56 (88)	0.7	87	Stable	10.4
13 Switzerland (#)	1229 (90)	18.4	1986	Up	86 (90)	1.3	78	Stable	7.0
14 United Kingdom	6028 (91)	10.5	1987	Stable	441 (90)	0.8	73	Up	7.5

(\*) All rates per 100,000 population  
 (\*\*) In Italy and Spain, only respiratory TB deaths are included  
 (§) Definition includes post primary TB and symptomatic primary infection  
 (§§) Bacteriologically proven cases only reportable  
 (#) Definition includes respiratory TB only  
 (#) Definition includes all forms and symptomatic primary infection

Table 4. Tuberculosis and the HIV epidemic and the foreign-born in selected Western European countries.

Country	% HIV among TB cases	% TB among AIDS cases	TB cases among Foreign-born	
			% (year)	Trend
Denmark		1	38 (1990)	Up
France	1-18	10	27 (1988)	?
Germany		>10	20 (1989)	Up
Italy		11	16 (1990)	Up
Netherlands			41 (1990)	Up
Norway			23 (1990)	Up
Spain	22	37	6 (1987-90)	?
Sweden		2.6	41 (1990)	Up
Switzerland			51 (1990)	Up
United Kingdom		4		

Figures

Figure 1. Number of notified tuberculosis cases per 100 000 population in 14 Western European countries combined (uninterrupted line) and expected secular trend fitted to observed data by linear regression (dotted line), logarithmic scale, 1974 to 1991.

Figure 2. Notifications (per 100 000 population) of tuberculosis in 14 Western European countries, logarithmic scale, 1974 to 1991.

Figure 3. Year-to-year change (in per cent) in tuberculosis notifications (per 100 000 population) in 14 Western European countries, logarithmic scale, 1974 to 1991.

Figure 4. Number of tuberculosis notifications in the Netherlands, by citizenship, logarithmic scale, 1974 to 1991.

Figure 5. Age specific notifications (per 100 000 population), by citizenship, Switzerland, 1988 to 1990. Lines smoothed over 5-year age groups.

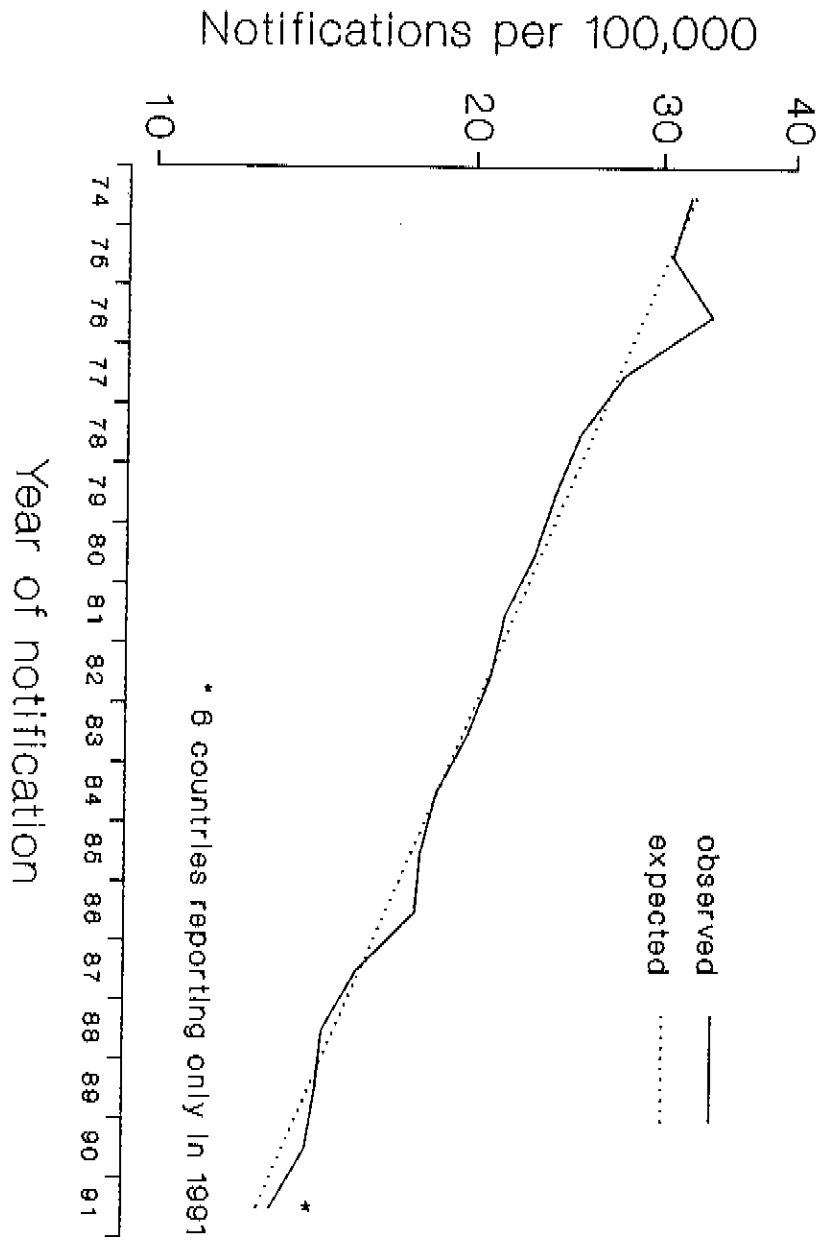


Fig. 1

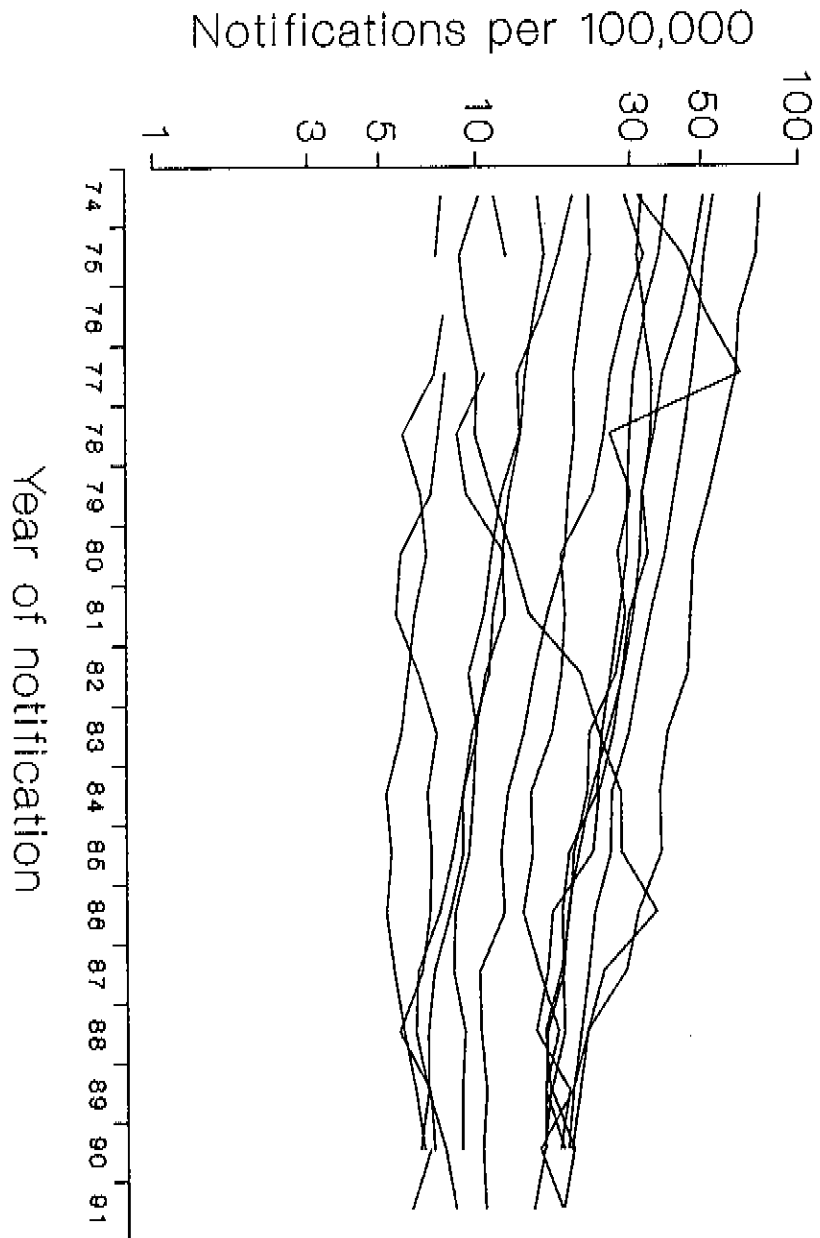


Fig. 2

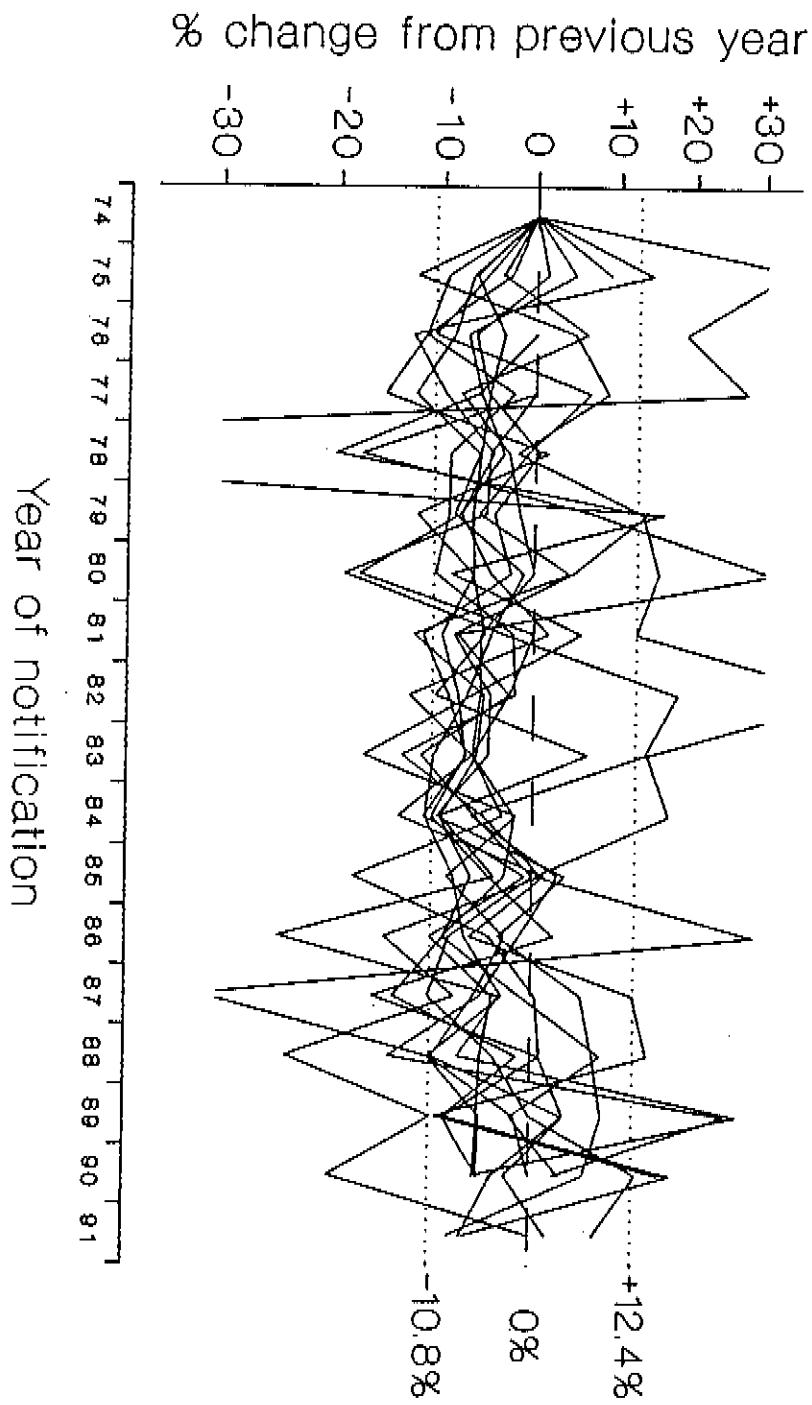


Fig. 3

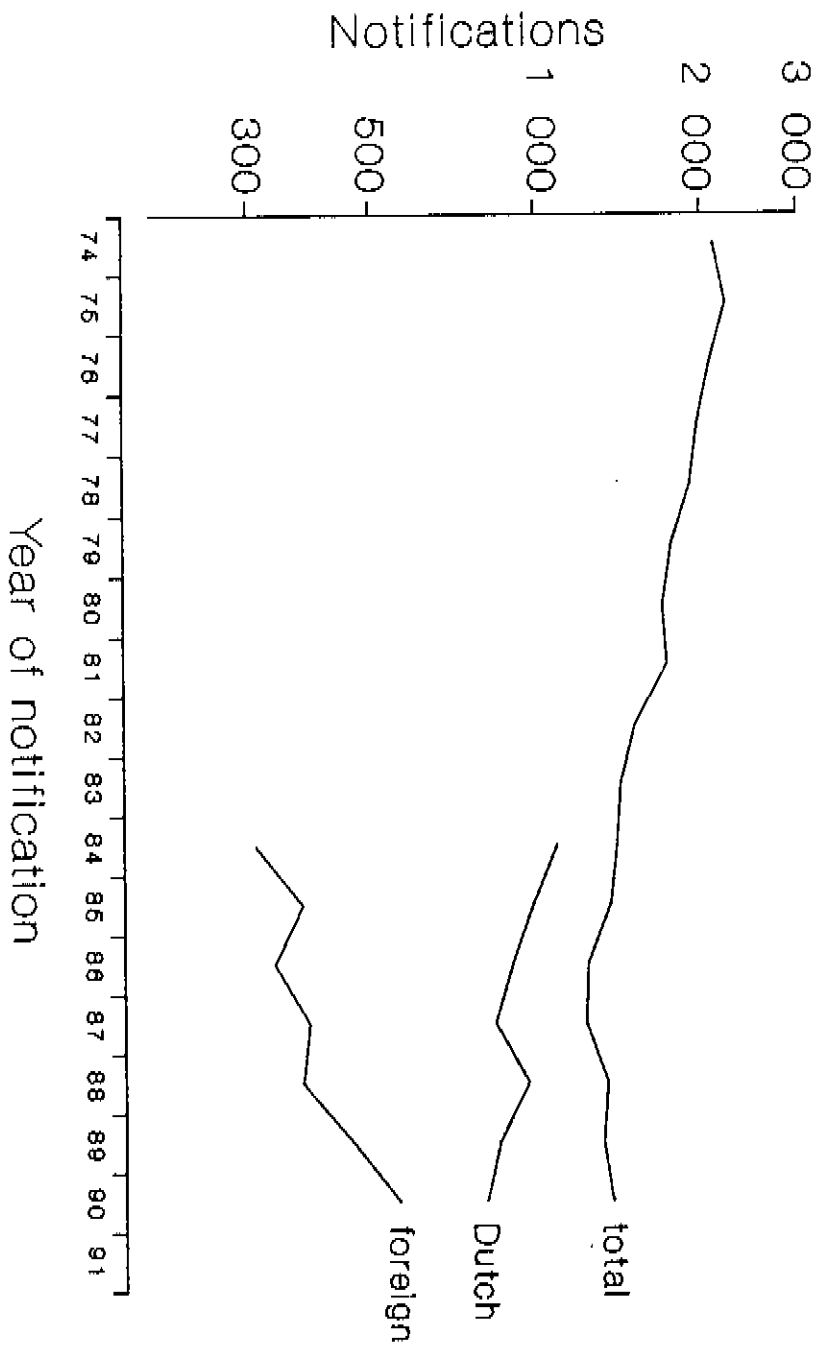


Fig. 4

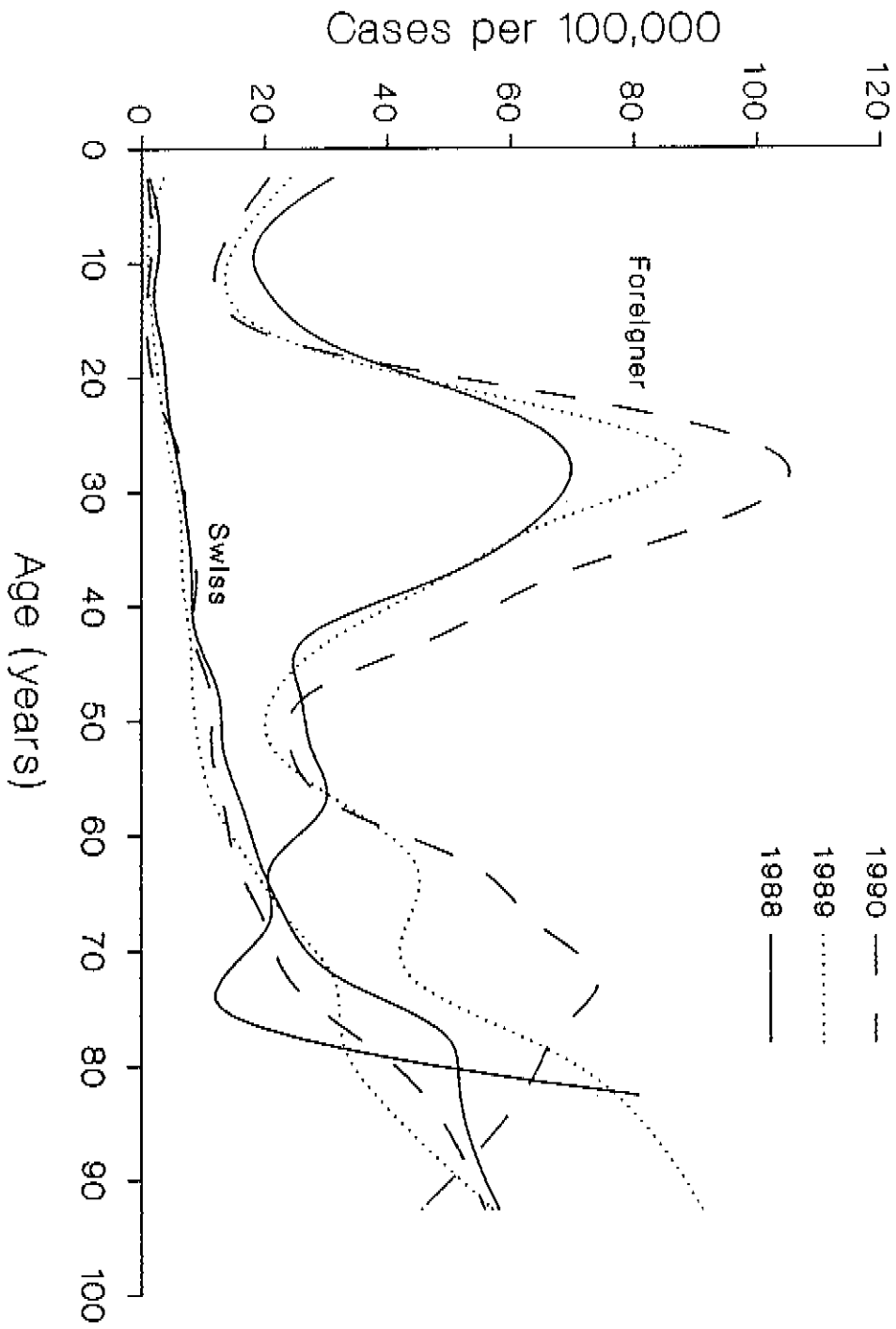


Fig. 5