

## Tuberculosis in England and Wales in 1993: results of a national survey

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### Abstract

**Background** – A national survey of tuberculosis notifications in England and Wales was carried out in 1993 to determine the notification rate of tuberculosis and the trends in the occurrence of disease by ethnic group in comparison with the findings of similar surveys in 1978/79, 1983, and 1988. The prevalence of HIV infection in adults notified with tuberculosis in the survey period was also estimated.

**Methods** – Clinical, bacteriological, and sociodemographic information was obtained on all newly notified cases of tuberculosis in England and Wales during the six months from 2 January to 2 July 1993. The prevalence of HIV infection in 16–54 year old patients with tuberculosis notified throughout 1993 was assessed using “unlinked anonymous” testing supplemented by matching of the register of patients with tuberculosis with that of patients with AIDS reported to the PHLS AIDS centre. Annual notification rates were calculated using population estimates from the 1993 Labour Force Survey.

**Results** – A total of 2706 newly notified patients was eligible for inclusion in the survey of whom 2458 were previously untreated; the comparable figures for 1988 were 2408 and 2163. The number of patients of white ethnic origin decreased from 1142 (53%) in 1988 to 1088 (44%) in 1993 whereas those of patients of Indian, Pakistani, or Bangladeshi (Indian subcontinent (ISC)) ethnic origin increased from 843 (39%) in 1988 to 1014 (41%) and those of “other” (non-white, non-ISC) ethnic origins increased from 178 (8%) to 356 (14%). The largest increase was seen in the black African ethnic group from 37 in 1988 to 171 in 1993. Forty nine per cent of patients had been born abroad and the highest rates were seen in those who had recently arrived in this country. The overall annual notification rate for previously untreated tuberculosis in England and Wales increased between 1988 and 1993 from 8.4 to 9.2 per 100 000 population. The rate declined in the white, Indian, and black Caribbean ethnic groups and increased in all other groups. In the white group the rate of decline has slowed since the last survey; in several age groups the rates were higher in 1993 than 1988 but the numbers in these groups were small. Thirty six (4.1%) of the 882 previously un-

treated respiratory cases were resistant to isoniazid and three (0.3%) to isoniazid and rifampicin. Sixty two (2.3%) adults aged 16–54 years were estimated to be HIV infected. Evidence of under-reporting of HIV positive tuberculosis patients was found. **Conclusions** – The number of cases and annual notification rate for previously untreated tuberculosis increased between 1988 and 1993. Although the decline in rates in the white population has continued, the rate of decline has slowed. The high rates in the ISC ethnic group population have continued to decline since 1988 whereas rates in the black African group have increased. An increased proportion of cases were found among people born abroad, particularly those recently arrived in this country. In previously untreated cases the level of drug resistance remains low and multi-drug resistance is rare. A small proportion of adults with tuberculosis were infected with HIV but there may be selective undernotification of tuberculosis in these patients.

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The steady decline in tuberculosis notifications in England and Wales which continued after the Second World War ceased in the mid-1980s<sup>1,2</sup> and subsequently small increases over the previous year have been observed in 1988, 1989, 1991, 1992, and 1993.<sup>3</sup> Several factors have been suggested as possible causes for the recent increases including the HIV epidemic, an ageing indigenous population, an increase in the number of recent immigrants from high prevalence countries, poverty,<sup>4</sup> and an increase in the number of homeless persons.<sup>5</sup> The information available from the routine notification system is insufficiently detailed to monitor the epidemiology of the disease, in particular the trends in different subgroups of the population.

Surveys of tuberculosis notifications were first undertaken in England and Wales in the 1960s to examine the occurrence of tuberculosis in greater detail following the recognition of the emerging problem of tuberculosis in immigrant groups.<sup>6</sup> The most recent surveys were carried out by the Medical Research Council (MRC) in 1978–79,<sup>7</sup> 1983,<sup>8</sup> and 1988.<sup>9</sup> The present survey was carried out in 1993 using similar methodology to previous

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Table 1 Notifications of tuberculosis in six months

	1983	1988	1993
Notifications to "proper officers"	3839	2748	3298
Duplicate notifications	107	71	141
Exclusions:			
Patients receiving chemoprophylaxis	207	105	199
Patients already notified	11	4	1
Diagnosis changed by physician	104	51	65
Disease due to mycobacteria other than <i>M tuberculosis</i>	101	106	165
Other**	7	3	21
Total newly notified eligible patients	3302	2408	2706
Total newly notified previously untreated patients	3002	2163	2458
No. of notifications reported to the OPCS*	3609	2669	3140

\* Total corrected notifications.

\*\* Includes patients not resident in the UK, patients with inactive disease notified after death, or patients with BCG abscess.

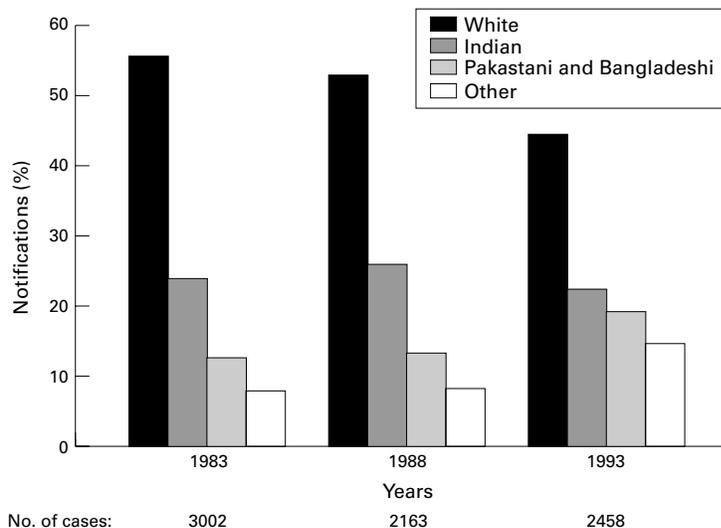


Figure 1 Tuberculosis notifications by ethnic group in the three surveys.

surveys but with an additional aim of obtaining an estimate of the prevalence of HIV infection in notified cases.

### Methods

The study methodology was similar to that described previously.<sup>9</sup> Briefly, consultants in communicable disease control (CCDCs) provided copies of all notification forms for tuberculosis received during 1993. The notifying clinicians were asked to provide further demographic information on a clinical form for all patients notified during the first six months and during the second six months of the survey period for patients aged less than 55 years only. The six regional tuberculosis centres and the Mycobacterium Reference Unit of the Public Health Laboratory Service (PHLS) provided results of species identification and sensitivity tests on all first isolates of *Mycobacterium tuberculosis* complex received in 1993. For patients on whom no clinical form was received, the survey team contacted the notifying clinicians or other staff directly.

In order to estimate the prevalence of HIV infection in adults notified in the survey, unlinked anonymous testing methodology was used. All patients aged 16–54 years notified throughout 1993 were eligible for inclusion. Clinicians were asked to provide limited demo-

graphic information on each patient (insufficient to permit identification of the patient) on a special form which was attached to a filter paper card. Drops of blood or serum from the patient were placed on an attached filter paper card which was returned to the study centre by post for analysis. Specimens were examined by the PHLS Virus Reference Division for HIV-1 and HIV-2 infection.<sup>10</sup> In addition the register of all patients reported in the survey was matched with the register of cases of AIDS and HIV infection reported to the PHLS AIDS Centre at the Communicable Disease Surveillance Centre.

Data on all cases notified with tuberculosis from 2 January to 2 July 1993 are reported here. To permit comparison with the results of previous notification surveys, patients who had previously been treated for tuberculosis have been excluded from the analyses but have been included in estimates of the annual notification rates. Annual rates were estimated by multiplying the total number of notifications in the first six months by a scaling factor (1.886) which is the ratio of all cases reported in 1993 to those reported in the first six months. Population estimates were obtained from the 1993 Labour Force Survey (commissioned tables). The trends in rates for the white ethnic group were examined for England only to enable comparison with rates published for previous surveys. The trends in age and sex specific rates for the white and Indian subcontinent population were also examined.

Data for the main survey were entered into an Oracle database and analysed using SPSS.<sup>11</sup> Data for the HIV prevalence estimate were entered into and analysed with Epi-Info.<sup>12</sup>

### Results

After exclusions and removal of duplicates (table 1) 2706 notifications were eligible for inclusion in the survey but a further 248 previously treated patients were excluded from the analyses (unless otherwise stated). Clinical forms were received for 2296 (93%) of the 2458 previously untreated patients. Although the 1993 figure represented an increase of 13.6% in the 1988 total, there was a decline of 18.1% from the 1983 total.

#### ETHNIC GROUP

Both the number and proportion of white patients in England and Wales decreased from 1142 (53%) in 1988 to 1088 (44%) in 1993, whereas the number of patients of ISC ethnic origin increased from 843 (39%) to 1014 (41%). Cases of "other" ethnic origin nearly doubled from 178 (8.2%) in 1988 to 356 (14.5%) in 1993 (fig 1). The largest increase in the "other" ethnic groups occurred among black Africans who accounted for 1.7% (37 cases) of all notifications in 1988 and 7.0% (171 cases) in 1993. In the black Caribbean group (classified as "West Indian" in previous surveys) the number of cases dropped from 70 in 1988 to 49 in 1993. Notifications increased

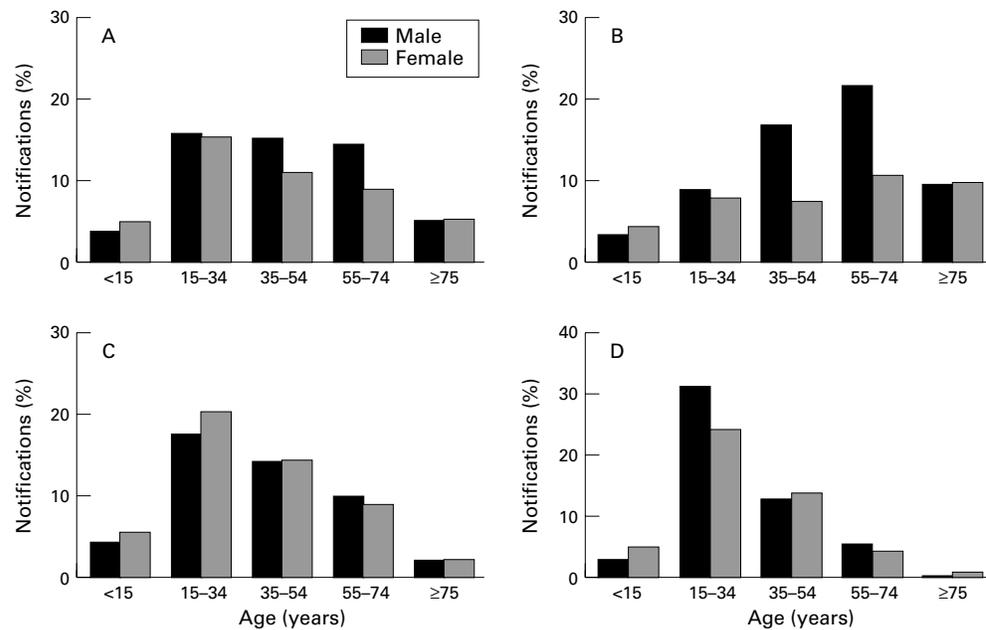


Figure 2 Age and sex distribution of newly notified previously untreated cases in first six months of 1993 in (A) all patients ( $n=2458$ ), (B) white patients ( $n=1088$ ), (C) patients of Indian, Pakistani and Bangladeshi ethnic groups ( $n=1014$ ), and (D) patients of "other" ethnic groups ( $n=356$ ).

substantially in the remaining groups of "other" ethnic origin (mainly other Asian, Arab and mixed race) from 67 in 1988 to 135 in 1993.

Forty nine per cent of all previously untreated patients in the survey whose place of birth was known were born abroad compared with 45% in 1988. Among the 139 black African patients whose date of entry to the UK was known, 103 (74%) had first arrived in the United Kingdom during the previous five years whereas among the ISC group the proportion was 31%.

#### AGE AND SEX

The white patients were generally older than patients from the ISC and those of "other" ethnic origins: 588 (51%) of white patients were over 55 years compared with 24 (24%) of ISC and 38 (11%) of "other" ethnic origins

(fig 2). While the proportion of white patients and those of "other" ethnic origins remained little changed from 1988, the proportion of ISC patients over 55 years had increased from 16%. A slightly higher proportion of white patients were male (60%) than those of ISC (48%) or "other" ethnic groups (52%).

#### ANNUAL NOTIFICATION RATES

The annual rate of newly notified previously untreated tuberculosis in England and Wales increased between 1988 and 1993 from 8.4 to 9.2 per 100 000 (table 2). The rate increased in England from 8.6 to 9.4 but decreased in Wales from 5.3 to 4.9. The rates declined in the white, Indian and black Caribbean ethnic groups and increased in all other groups. The highest rates were seen in the Indian, Pakistani

Table 2 Annual notification rates per 100 000 population in England and Wales by ethnic group (excluding those previously treated)

Country	Ethnic origin	1983			1988			1993		
		No. of cases‡	Population estimate (1000s)	Rate per 100 000†	No. of cases‡	Population estimate (1000s)	Rate per 100 000†	No. of cases‡	Population estimate (1000s)	Rate per 100 000†
England	White	1550	42 994	6.9	1072	43 938	4.7	1025	44 632	4.3
	Indian	718	773	178.0	556	800	134.6	546	897	114.7
	Pakistani or Bangladeshi	374	422	169.0	281	541	100.5	461	724	120.1
	Black Caribbean**	78	494	30.0	70	464	29.2	49	478	19.4
	Black African¶	)	)	)	37	119	60.4	168	234	135.2
	Other	156	634	47.0	)	)	)	)	)	)
	All	2876	46 164*	12.2	2085***	46 829*	8.6	2384	47 772*	9.4
Wales	All	126	2 778	8.7	78	2 823	5.3	74	1 874	4.9
	England & Wales	3002	48 942	12.0	2163	49 652	8.4	2458	50 646	9.2

\* Includes 847 000 in 1983, 296 000 in 1988 and 11 600 in 1993 whose ethnic origin was unclassified and were distributed among the other groups in proportion to reported figures for calculation of rates.

† For calculation of annual rates the numbers of cases in a year in each survey were estimated by multiplying the number of cases in the first six months with a scaling factor which was based on the proportion of cases reported to the OPCS in the first six months to the number reported in the whole year. The scaling factors used were: 1.9348 in 1988 and 1.886 in 1993.

‡ Number of cases in six months.

¶ Classified as African in 1983 and 1988.

\*\* Classified as West Indian in 1983 and 1988.

\*\*\* Includes two cases of unknown ethnic origin.

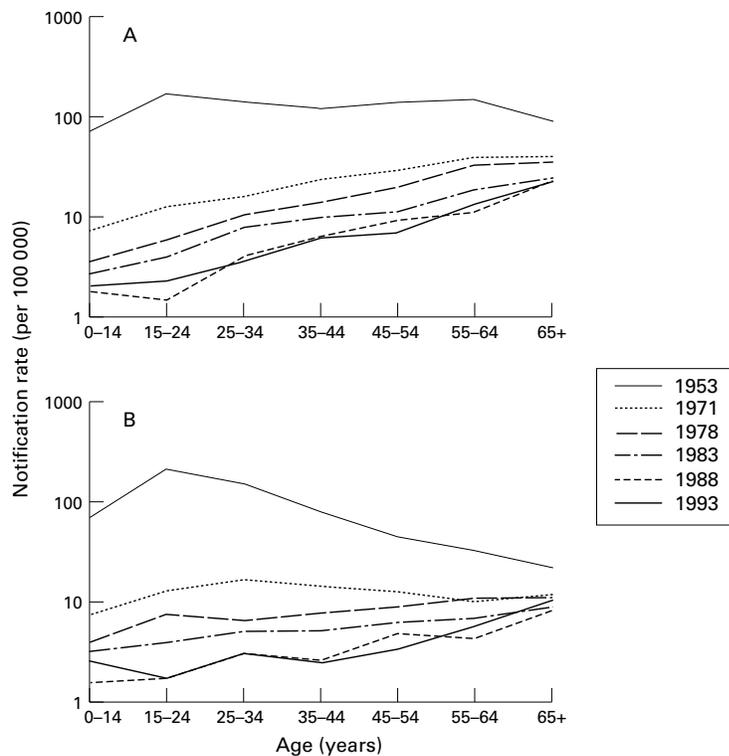


Figure 3 Tuberculosis notification rate in the white ethnic group in England, including those previously treated, 1953-93, by age group in (A) male and (B) female subjects.<sup>815</sup>

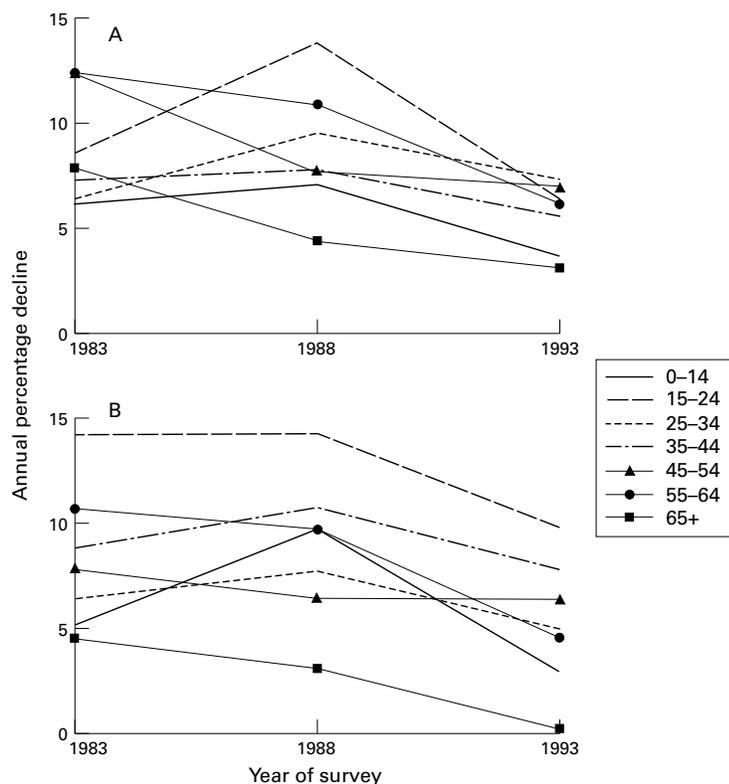


Figure 4 Estimated annual percentage decline in notification rates in the white ethnic group since 1978 in England by year of survey, including those previously treated, in (A) male and (B) female subjects.<sup>815</sup>

and Bangladeshi and black African ethnic groups and were 20-30 times those in the white population.

*White population*

An increase in rates with age was seen in England in 1993, particularly in men (fig 3). In several age groups the rates were higher in 1993 than in 1988, particularly in female subjects aged less than 15 years and males aged 15-24 years. The rates were higher in males than in females in all age groups except those age under 15 years; in the older age groups the rates were approximately twice as high in male subjects.

From 1953 until 1993, while notification rates have fallen in most age and sex groups, there has been a slowing in the rate of decline of the notification rate. The percentage annual declines in rates since 1978/79 (the first survey to use the current methodology) are shown in fig 4 for the 1983, 1988, and 1993 surveys. The considerable variation in the rate of decline between the different surveys in some of the age groups, in particular in young adults, is likely to be due, at least in part, to the relatively small numbers of notified cases in these groups in the later surveys. In all age groups the annual rate of decline was lower in 1993 than 1983. In some groups there appeared to be a marked increase in the rate of decline in 1988 followed by a similar reduction in 1993.

Between 1988 and 1993 the rates decreased in the Indian and Bangladeshi ethnic groups but increased in the Pakistani groups resulting in a small increase in the combined Pakistani/Bangladeshi rate but an overall decline in the ISC ethnic group. In all three ethnic groups the rates increased with age and were higher in those born abroad than those born in the UK (table 3). For individuals in the ISC ethnic group born abroad the rates were highest in those who had most recently arrived, as in previous surveys; in individuals arriving within the previous five years the rates were 10 times higher than for those who had first arrived more than 15 years previously. For children of ISC ethnic origin, both born in the UK and born abroad, the rates were, if anything, higher in 1993 than 1988.

Rates in the ISC ethnic group were directly standardised to the 1983 population to take into account the effect of age, country of birth, and year of first entry to the UK (table 3); the directly standardised rate declined more between 1983 and 1988 than between 1988 and 1993.

*Other ethnic groups*

Between 1983 and 1988 there was little change in the notification rate in the black Caribbean ethnic group but between 1988 and 1993 the rate and the number of cases decreased (table 2). In contrast there was a marked increase in both the number of cases and the notification rate in the black African ethnic group. As in the ISC ethnic group, the highest rates in the black African ethnic group were in those who had most recently arrived (the number of cases

Table 3 Annual notification rates in the population of Indian subcontinent ethnic origin in England by age, place of birth, and years since first entry to the UK (excluding those previously treated)

Age (years)	Place of birth and years since first entry	1983		1988		1993		
		Population estimate (1000s)	Rate per 100 000	Population estimate (1000s)	Rate per 100 000	Population estimate (1000s)	Rate per 100 000	
<15	UK	369	47	410	24	461	34	
	Abroad	77	64	55	46	61	50	
>15	UK	61	67	144	69	223	83	
15-34	Abroad							
	>15 years	(	(	127	86	133	53	
	11-15 years	(	(213	84	101	74	63	
	6-10 years		242	69	221	64	180	
	<5 years		72	702	70	512	69	440
>35	Abroad							
	>15 years	(	(	286	126	427	105	
	11-15 years	(	(200	59	134	54	230	
	6-10 years		52	316	22	474	28	426
	<5 years		22	773	18	799	26	1110
Total		1220	175	1350	120	1621	117	
Directly standardised rate*			175		140		132	

\* Standardised to the 1983 population estimates taking into account age, place of birth, and year of first entry into the UK.

Table 4 Site of disease by ethnic group in 1993

	White	ISC	Other	Total
Newly notified previously untreated patients	1088	1014	356	2458
Respiratory				
No. of patients*	834	612	253	1699
Type of lesion† (%)				
Pulmonary	778 (93)	484 (79)	219 (87)	1481 (87)
Pleural	59 (7.1)	70 (11)	24 (9.5)	153 (9.0)
Intrathoracic lymph nodes	6 (0.7)	52 (8.5)	13 (5.1)	71 (4.2)
Other	11 (1.3)	34 (5.6)	7 (2.8)	52 (3.1)
Non-respiratory				
No. of patients*	241	428	125	794
Type of lesion† (%)				
Lymph node	91 (38)	201 (47)	79 (63)	371 (47)
Bone and joint	35 (15)	60 (14)	10 (8.0)	105 (13)
Genitourinary tract	41 (17)	16 (3.7)	7 (5.6)	64 (8.1)
Abdomen	16 (6.6)	54 (12.6)	11 (8.8)	81 (10)
Central nervous system	9 (3.7)	19 (4.4)	2 (1.6)	30 (3.8)
Miliary	20 (8.3)	29 (6.8)	8 (6.4)	57 (7.2)
Abscess	8 (3.3)	21 (4.9)	7 (5.6)	36 (4.5)
Other	29 (12)	42 (9.8)	8 (6.4)	79 (9.9)
Site of disease not known	36	27	11	74

ISC = Indian subcontinent (India, Pakistan and Bangladesh).

\* 23 white patients, 53 patients of ISC ethnic origin, and 53 of "other" ethnic origins had both respiratory and non-respiratory disease.

† Some patients had lesions at more than one site (percentages are of total respiratory and non-respiratory lesions respectively in each ethnic group).

in 1983 was too small to assess). The "other" ethnic groups, which included other Asian (such as Chinese, Vietnamese, Sri Lankan, Malaysian and Philippino), Arab and those of mixed ethnic origin, also showed an increase in both numbers of cases and notification rates.

#### Increase in population size

Between the 1988 and 1993 surveys the relative increases in the size of the populations of black Caribbean and white ethnic origin were small compared with the other ethnic groups. The largest increases in population were seen in the Bangladeshi and black African ethnic groups but, while the notification rate in the former group declined, it showed a marked increase in the latter.

#### SITE OF DISEASE

Respiratory tuberculosis alone, defined as pulmonary, pleural or mediastinal disease, was reported in 1590 (66.7%) of the 2384 patients in whom the site of the disease was reported (table 4). A further 109 (4.6%) patients had

both respiratory and non-respiratory disease and 685 (28.7%) had non-respiratory disease alone. The proportion with non-respiratory disease increased slightly from 30.1% in 1988 to 33.3% in 1993.

There were considerable differences in the sites of disease by ethnic group: 811 (77%) of patients of white ethnic origin had respiratory disease alone compared with 559 (57%) of the patients of ISC ethnic origin and 220 (64%) of those of "other" ethnic origins; 218 (21%) of the patients of white ethnic origin had non-respiratory disease alone compared with 375 (38%) and 92 (27%) in the ISC and "other" ethnic groups, respectively. Lymphadenopathy was more common in patients of ISC ethnic origin occurring in 201 (20%) cases, whereas genitourinary disease was more common in the white ethnic origin group occurring in 41 (3.9%) cases.

#### BACTERIOLOGY

Of the 2458 previously untreated patients 1372 (56%) were reported to have had a positive

culture (*Mycobacterium tuberculosis* was isolated in 1336 cases, *M bovis* in 15, *M africanum* in six, and in 15 the species within the *M tuberculosis* complex was not reported) and 387 (16%) were culture negative; in 699 (28%) no culture result was available. Bacteriological results were available for 1222 (83%) of 1481 patients with pulmonary disease of which 941 (64%) were culture positive and 653 (44%) sputum smear positive. In 1988 a total of 939 (65%) out of 1443 patients with pulmonary disease had a positive culture and 614 (43%) had a positive sputum smear. Four hundred and thirty one (44%) of the 977 cases of non-pulmonary disease only in 1993 were culture positive. The proportion of cases in which the diagnosis of tuberculosis (pulmonary or non-pulmonary) was supported by culture was similar in the white, ISC and "other" ethnic groups: 59%, 50% and 63%, respectively.

#### DRUG SENSITIVITY

##### *Previously untreated patients*

Sensitivity test results were available for 882 isolates from previously untreated patients with respiratory disease of which 44 (5.0%) were resistant to one or more drugs compared with 32 (3.6%) in 1988. In 1993, 27 (3.1%) were resistant to isoniazid alone, nine (1.0%) to isoniazid in combination with one or more drugs, and one (0.1%) to rifampicin alone. The equivalent figures in 1988 were 10 (1.2%), seven (0.8%), and one (0.1%), respectively. Resistance to isoniazid and rifampicin (with or without other drugs) was reported in three patients in 1993 (0.3%) compared with one (0.1%) in 1988. Resistance to isoniazid alone was reported in eight (1.7%) white subjects, 12 (4.3%) of ISC origin, and seven (4.9%) patients from "other" ethnic groups, and resistance to isoniazid in combination with one or more other drugs was reported in five (1.1%), two (0.7%), and two (1.4%), respectively.

##### *Previously treated patients*

Two hundred and forty eight patients were reported to have been previously treated for tuberculosis, of whom 141 (57%) had positive cultures and 101 (41%) had drug sensitivity results available. Thirteen (13%) were resistant to one or more drugs including six (6%) to isoniazid alone and four (4%) to isoniazid and rifampicin, two of whom were also resistant to other drugs.

#### ESTIMATE OF HIV PREVALENCE

Specimens were received from 1059 (39%) of the 2706 adults (aged 16–54 years) eligible for inclusion in the HIV prevalence estimate. Twenty one (2.0%) were HIV positive. The proportion positive was higher in men (2.5%) than in women (1.3%), but was similar in both sexes in the 16–34 year and 35–54 age groups. HIV prevalence was higher in London (4.3%) than outside London (0.8%), and was higher in those of "other" ethnic origin (6.0%) and

lower in those of ISC ethnic origin (0.4%) than in those of white ethnic origin (1.6%).

Information provided by clinicians on the clinical forms, and from the register matching exercise, identified a further 41 (2.5%) HIV positive patients among the 1647 eligible adults who had not been included in the unlinked anonymous HIV prevalence estimate. Thus, the overall estimate was that at least 62 (2.3%) of the 2706 eligible adults were HIV positive.

#### Discussion

The 13.6% increase in the number of newly notified previously untreated cases between the survey periods in 1988 and 1993 is consistent with the increase in notifications reported in England and Wales from 1987 to 1993.<sup>3</sup> Similar increases have been reported from the United States and several European countries.<sup>13,14</sup> Notifications in England and Wales in 1994, however, declined by 5.6% from the 1993 figure,<sup>15</sup> a similar decline to that seen in the USA in 1993 and 1994.<sup>16</sup>

The largest increase in notifications between the 1988 and 1993 surveys was in the Indian subcontinent (ISC) ethnic group from 843 in 1988 to 1014 in 1993. This is likely to be due to changes in the population size and structure as the overall rate in this ethnic group is continuing to decline, whether expressed as a crude rate or when standardised for age and year of entry into this country. However, the rate of decline appears to be slower than that seen between 1983 and 1988. The increase in notifications in the ISC ethnic group occurred mainly in the Pakistani group, particularly among female subjects, and was associated with high rates among recent immigrants, especially in the older age groups. The decline in notification rate in the Indian group may be due partly to a relatively smaller number of new immigrants.

The largest relative increase in both the number and rate of notifications occurred in individuals of black African ethnic origin (from 37 notifications in 1988 to 171 in 1993) and those of "other" ethnic origins – that is, not of white, ISC, black Caribbean, or black African ethnic origin – from 71 in 1988 to 135 in 1993, and these were largely associated with recent immigration to this country. By contrast, both the number of cases and the notification rate in those of black Caribbean ethnic origin decreased between 1988 and 1993. In ethnic groups with small populations in the UK and hence small numbers of cases the estimated rates are likely to be subject to considerable variation due to chance. In addition, the estimates of the population denominators are liable to be less reliable as they are based on a sampling survey.

Since 1953 a steady reduction in the rate of decline in notification rates has been apparent in most age and sex subgroups of the white population and the results from 1993 are consistent with a continuation of that trend. Using the 1978/79 survey as the starting point (fig 4), the reduction in the annual rate of decline is apparent in most age groups and both sexes

between 1983 and 1993. However, the rate of decline appeared to increase markedly in some age and sex subgroups in 1988 followed by a large reduction in the decline in 1993. While the overall decline in the number and rate in the white group is reassuring, the small numbers in some age and sex groups make the changes difficult to interpret. Despite continuing the survey for the full 12 months in 1993 for cases up to 55 years of age, the confidence limits around estimates of the annual rate of decline in groups below this age remain wide. While the results may reflect true changes in the trends in the incidence rates, it is also possible that the annual rate of decline in these subgroups of the white population was over estimated in the 1988 survey for reasons which are not apparent.

To be comparable with the published estimates of notification rates in the white population from previous surveys<sup>17</sup> the rates in the white population presented in figs 3 and 4 have included previously treated patients and re-notified and de-notified patients. However, a more appropriate comparison of the change between 1988 and 1993 excludes those inappropriately notified (such as those which were re-notified and those in whom the diagnosis was subsequently changed) while including those previously treated. On this basis, for male and female subjects combined, a 4.2% increase (95% confidence intervals (CI) -0.3 to 8.5) was seen in notifications in the 0-14 year group, a 4.3% increase (95% CI -0.8 to 9.2) in the 15-24 year group, and a 1.2% decrease (95% CI -5.0 to 2.4) in the 25-34 year group. These non-significant changes illustrate the difficulties in determining the trends in the age groups for which the impact of the schools' BCG programme is relevant, despite extending the survey to a full year in these groups.

Only 56% of cases in the survey were confirmed by culture of the tubercle bacillus, and this proportion was higher in those with pulmonary disease (64%) than in those with non-pulmonary disease only (44%). These results are similar to those in 1988 suggesting that the increase in total notifications between the surveys is not due to an increase in diagnoses made on clinical grounds only. These proportions, however, may underestimate the true proportions somewhat as in 28% of cases (17% pulmonary, 35% non-pulmonary) a bacteriological result was not available either because a specimen had not been sent for bacteriological examination or because the result was not known. Nevertheless, a large proportion of cases are diagnosed and treated without bacteriological confirmation. Although the white population now contributes less than half of all notified cases of tuberculosis, it continues to contribute 55% of the infectious cases in the community (335 out of 614 pulmonary smear positive cases).

The prevalence of resistance to isoniazid in newly notified previously untreated patients in 1993 has increased since 1988 but the total numbers remain low. Initial resistance was more common in individuals of ISC or "other"

ethnic origins as in previous surveys and in the USA.<sup>18</sup> The numbers of previously untreated cases with multi-drug resistant isolates – that is, resistant to isoniazid and rifampicin with or without resistance to other drugs – also increased but the numbers involved (one isolate in 1988 and three isolates in 1993) are too small to identify a trend. Multi-drug resistance was proportionately higher in previously treated patients (4%) than in previously untreated patients (0.3%), but again the numbers are low. Isolated resistance to pyrazinamide or rifampicin also remains rare.

The participation rate in the HIV prevalence survey is disappointing but may be understandable; there are likely to be particular difficulties in conducting HIV testing in patients with tuberculosis, even using unlinked anonymous methodology, as most of the patients are not from recognised risk groups and the physicians looking after the patients are often not familiar with unlinked testing methodology. The 61% of eligible cases who were not included were demographically similar to those who were included (data not presented) and the estimate of the HIV prevalence in this group (based on alternative sources of information) is also similar (2.5%), suggesting that the results from the survey may be reasonably representative of the prevalence in all notified cases of tuberculosis (although because of the methodology used, the latter estimate could not include individuals whose HIV infection status was not known). The higher prevalence in those of "other" ethnic origins compared with the white population, the lower prevalence in those of ISC origin, and the higher prevalence in male subjects and in London was to be expected in the light of the well established distribution of AIDS cases in different groups of the population of England and Wales.<sup>19</sup> As a result of the exercise to identify co-infected patients, a further 60 cases of tuberculosis were identified among patients reported with AIDS to the PHLS AIDS Centre in 1993 who were not included in the present survey and therefore had not been notified at all. In some or even the majority of cases this may be the result of an intentional failure to notify tuberculosis in patients with HIV infection.<sup>20</sup> Thus the true prevalence of co-infection may be higher in patients with tuberculosis than the 2.3% estimated from this survey; the addition of a further 60 cases would increase the prevalence estimate to a maximum of 4.5%. However, as the level of under-notification of tuberculosis in the HIV negative population is not known, an overall point estimate of the prevalence cannot easily be made.

As in previous surveys, problems occurred in the reporting and classification of cases. Nearly 200 chemoprophylaxis cases were notified and subsequently excluded: in some it was made clear on the notification form that the patient was on chemoprophylaxis only but in others this only became clear from data provided on the clinical form. A substantial number of cases was excluded because the diagnosis of tuberculosis was later changed, highlighting the importance of de-notifying cases. This was

associated with an increase in the number of cases of non-tuberculosis mycobacterial lymph node infections in children and *M avium intracellulare* infections in patients with HIV infection. The continuing problems in the notification system have been reviewed by a subgroup of the Joint Tuberculosis Committee of the British Thoracic Society.<sup>21</sup>

Improved notification of tuberculosis cases following the appointment of CCDCs to all districts in England and Wales may have contributed to some of the apparent increases in cases in recent years. In addition, extra cases have certainly occurred as a result of the HIV epidemic but, although it is likely that this contribution is relatively small and concentrated in London, the extent of this excess may be underestimated due to failure to notify all such cases. Other factors linked with poverty, such as overcrowding, low income, malnutrition and homelessness, have been associated with increased levels of tuberculosis but this survey cannot throw any light on the contribution of these factors to the increase in tuberculosis in recent years.

In conclusion, the increase in the number of cases of tuberculosis in England and Wales between 1988 and 1993 has been largely associated with extra cases occurring in certain ethnic minority subgroups of the population, particularly in patients who have recently arrived in this country. Tuberculosis has continued to decline in the white population but the rate of decline has continued to slow. Changes since the previous survey in 1988 in tuberculosis rates in specific age/sex groups in the white population are difficult to interpret because of low numbers of cases and wide confidence intervals. Drug resistance in previously untreated cases remains low and multi-drug resistance is rare. About 2.3% of adults with tuberculosis notified in the survey were HIV infected but the true prevalence of co-infection may be higher because of selective undernotification of tuberculosis in HIV infected patients. More detailed reports from the survey are being prepared on trends in the geographical distribution of disease, tuberculosis in children, and the overlap with the HIV epidemic.

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