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

D Kumar, J M Watson, A Charlett, S Nicholas, J H Darbyshire on behalf of a Public Health Laboratory Service/British Thoracic Society/Department of Health Collaborative Group

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 sub-continent (ISC)) ethnic origin increased from 843 (39%) in 1988 to 1041 (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 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 untreated 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.

(Thorax 1997;52:1060–1067)

Keywords: tuberculosis, UK.

The steady decline in tuberculosis notifications in England and Wales which continued after the Second World War ceased in the mid-1980s and subsequently small increases over the previous year have been observed in 1988, 1989, 1991, 1992, and 1993. Several factors have been suggested as possible causes for the recent increases including the HIV epidemic, poverty, and an increase in the number of homeless persons. The prevalence of HIV infection in 16–54 years was estimated to be 37 in 1988 to 171 in 1993. 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. The most recent surveys were carried out by the Medical Research Council (MRC) in 1978–79, 1983, and 1988. The present survey was carried out in 1993 using similar methodology to previous
Tuberculosis in England and Wales in 1993

Table 1  Notifications of tuberculosis in six months

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

* 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.

Methods

The study methodology was similar to that described previously. 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-

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
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)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>No. of cases</td>
<td>Population estimate (1000s)</td>
<td>Rate per 100 000</td>
</tr>
<tr>
<td>England</td>
<td>White</td>
<td>1550</td>
<td>42 994</td>
<td>6.9</td>
</tr>
<tr>
<td></td>
<td>Indian</td>
<td>714</td>
<td>773</td>
<td>178.0</td>
</tr>
<tr>
<td></td>
<td>Pakistani or</td>
<td>374</td>
<td>422</td>
<td>169.0</td>
</tr>
<tr>
<td></td>
<td>Bangladeshi</td>
<td>281</td>
<td>341</td>
<td>169.0</td>
</tr>
<tr>
<td></td>
<td>Black Caribbean**</td>
<td>78</td>
<td>494</td>
<td>30.0</td>
</tr>
<tr>
<td></td>
<td>Black African¶</td>
<td>156</td>
<td>634</td>
<td>47.0</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>126</td>
<td>2778</td>
<td>8.7</td>
</tr>
<tr>
<td>Wales</td>
<td>All</td>
<td>2876</td>
<td>46 164*</td>
<td>12.2</td>
</tr>
<tr>
<td></td>
<td>England &amp; Wales</td>
<td>3002</td>
<td>48 942</td>
<td>12.0</td>
</tr>
</tbody>
</table>

* 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 West Indian in 1983 and 1988.
*** Includes two cases of unknown ethnic origin.
Tuberculosis in England and Wales in 1993

1063

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...
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).

**BACTERIOLOGY**

Of the 2458 previously untreated patients 1372 (56%) were reported to have had a positive
Tuberculosis in England and Wales in 1993

1065

white, ISC and “other” ethnic groups: 59%, increases have been reported from the United
than outside London (0.8%), and was higher the reduction in the annual rate of decline is
consistent with a continuation of that trend. Using
proportion positive was higher in men (2.5%) in most age and sex subgroups of the white
for inclusion in the HIV prevalence estimate. Since 1953 a steady reduction in the rate of
Specimens were received from 1059 (39%) of liable to be less reliable as they are based on a
other drugs. hence small numbers of cases the estimated
results available. Thirteen (13%) were resistant the number of cases and the notification rate
resistance to isoniazid in combination with one partly to a relatively smaller number of new
immigrants. or more other drugs was reported in five
notifications in the ISC ethnic group occurred
immigrants. 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 resis-
ance 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 white, ISC, black Caribbean, or black African
previously treated patients between 1988 and 1993. In ethnic
previous treated 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. Similar
increases have been reported from the United States and several European countries. Similar
Notifications in England and Wales in 1994, however, declined by 5.6% from the 1993
figure, a similar decline to that seen in the
USA in 1993 and 1994. 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 con-	

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 re-
sistance 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. Similar
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 95 years of age, the confidence limits around the 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 the rates in the white population presented in figures 3 and 4 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 4.2% 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 were 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. 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 unfamiliar with the 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 ISC or “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. 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. 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.
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.21

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 multidrug 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.

The authors would like to thank Dr Ken Citron, Dr Jane Leese and Dr Peter Ormerod for their detailed comments and the remainder of the collaborative group for their support (Dr C. Skinner, Dr D. Mercy, Dr A.V. Swan, Dr R. Wilson, Dr S. Meredith, Dr I. Sutherland, and Dr A. Noone). We are grateful to Dr John Parry and colleagues in the PHLS Virus Reference Division for carrying out the HIV-1 and HIV-2 testing. We would like to express our thanks to the Chest Clinic and other hospital staff as well as clinicians, microbiologists, and consultants in communicable disease control for their help in the collection of data for this survey. The survey was funded by the Department of Health and there are no conflicts of interest.


D Kumar, J M Watson, A Charlett, S Nicholas and J H Darbyshire

Thorax 1997 52: 1060-1067
doi: 10.1136/thx.52.12.1060

Updated information and services can be found at:
http://thorax.bmj.com/content/52/12/1060

These include:

Email alerting service
Receive free email alerts when new articles cite this article. Sign up in the box at the top right corner of the online article.

Topic Collections
Articles on similar topics can be found in the following collections

Drugs: infectious diseases (968)
HIV/AIDS (194)

Notes

To request permissions go to:
http://group.bmj.com/group/rights-licensing/permissions

To order reprints go to:
http://journals.bmj.com/cgi/reprintform

To subscribe to BMJ go to:
http://group.bmj.com/subscribe/