

## **Tuberculosis in London a decade and a half of no decline TB epidemiology and control**

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### **Key words**

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## ABSTRACT

**Background:** London accounts for nearly half of the national burden of tuberculosis. The incidence of tuberculosis has more than doubled in London in the last 15 years.

**Methods:** Data from enhanced tuberculosis surveillance 1999-2003, the national TB surveys of 1993 and 1998, and TB notifications were compared and analysed.

**Results:** In 2003, 3048 patients with tuberculosis were reported in London; 45% of the national total. This represents an incidence of 41.3 per 100,000, five times higher than the rest of England and Wales, and in parts of London TB incidence is nine times the national average. Seventy-five percent of people with TB in London are born abroad; nearly half have lived in the UK for less than five years but a third for over ten years. Eighty-six percent are from an ethnic minority group and incidence is highest in black Africans at 283 per 100,000 compared to 141, 141 and 8 for Pakistanis, Indians and whites respectively. In absolute terms a third of London TB patients are from Africa and nearly a third from the Indian subcontinent. Specific groups affected also include the homeless, prisoners, and hard drug and alcohol users, as well as the immunosuppressed.

**Conclusions:** London reflects the worldwide rise in TB with increasing incidence in ethnic minorities. Work has been done to combat this rise but more is needed. TB control and prevention strategies should be mindful of the changing epidemiology of TB in London and provide information, diagnosis and treatment tailored to the specific needs of the capital and its at risk groups.

## INTRODUCTION

Tuberculosis (TB) is increasing across the UK and is a particular public health concern in London. In England and Wales (E&W), the incidence of TB declined throughout most of the 20th century.[1] However, since the mid-1980's this trend has reversed.[2] Contributing to the rise are changing patterns of immigration,[3][4][5][6] increased homelessness [3][7][8][9][10][11] and HIV infection [3][9] as well as an ageing population. Over forty percent of TB cases in E&W live in London.[2] Research published in the last few years shows that the incidence of TB in London is especially high in recently arrived immigrants;[2][12] and varies significantly by borough.[13] This paper provides a summary of the changing epidemiology of TB in London over the past decade and a half.

## METHODS

London data from enhanced TB surveillance (ETS) 1999-2003, the national TB surveys of 1993 [14] and 1998 [2] and TB notifications were compared and analysed. Since 2002 surveillance in London has been possible through the Health Protection Agency London TB Register (LTBR) which is a web-based system used in every TB clinic across the city. Validation of this data is on-going at both regional and national levels and methodologies for the 1993 and 1998 national TB surveys have been described elsewhere.[2][14] Estimates of population denominator data were obtained from the 1991 and 2001 Census. Geographic information systems were used to plot cases by postcode and borough.

## RESULTS

### Cases, age and sex

In 2003, London accounted for 45% of the national TB burden; 3048 TB cases were reported via ETS (the LTBR). This represents an incidence of 41.3 per 100,000, five times higher than the rest of England and Wales at 8.2 per 100,000. Over the last 15 years TB notifications have doubled in London from just over 20 per 100,000 in 1987; but have remained fairly constant in the rest of England and Wales (Figure 1).

The age distribution of new cases of TB in London has changed over the past seven years (Figure 2). TB notifications rose most rapidly in the 25-34 year old age group and remain highest in this group. In 2003 the incidence of TB in 25-34 year old men was 60 per 100,000 and for women 52 per 100,000 (Figure 3). Since 2001 rates have fallen slightly in those over 45.

### Geographic distribution

TB is concentrated in particular areas of London. In 2003, of 33 London boroughs, 14 (one third) had TB incidence over 40 per 100,000; these 'hot spots' are not exclusively inner city districts, but also include suburban areas with well-established ethnic

communities. Hot spots have not changed much over the time period of our review. (Figure 4).

In 2003, Newham, Hackney and Brent had the highest formal notification rates (96.4, 91.8 and 64.2 per 100,000 population respectively). However, there has been a decrease from a high in 2001 of 116 per 100,000 in Newham (North East London) and 103 in Brent (North West London). Since 1987 TB rates have risen fivefold in Hillingdon (West) and Sutton (South West), four-fold in Greenwich (South East) and threefold in Enfield (North), Hackney, Barking & Dagenham (North East).

### **Ethnicity and country of birth**

In 2003, 86% of TB cases in London were from a non-white ethnic group; 35% were black African and 31% were from the Indian Subcontinent. Between 1999 and 2003 the proportion of TB notifications in the white population fell, but rose in nearly all other ethnic groups. In the past 5 years TB in black African communities has risen significantly. In 2003 the TB incidence in black Africans was 283 per 100,000 compared to 141, 141 and 8 for Pakistanis, Indians and whites respectively (figure 5). The incidence in black Africans aged 25-44 was 407/100,000 compared to 41/100,000 for all ages and ethnic groups across London and 8.2/100,000 across the rest of England and Wales. In black Africans TB is found more commonly in new entrants and those who have lived in the UK for less than 5 years.

Enhanced TB Surveillance (ETS) data from the LTBR show that the majority of TB cases in the white population are aged over 45 years, while in black African communities most cases are aged 25-44 years and in the Indian Sub Continent there is a mix of middle and older aged people (Figure 6).

The vast majority of TB cases in London are born abroad (Figure 7). In 2003, 75% were born abroad (where place of birth was known). This percentage has risen steadily since 1993 from 55%. In the last 10 years India has remained the most commonly reported country of birth for TB cases born abroad. The other top ten countries have remained similar apart from a substantial rise in Somalian cases between 1993 and 1998, and since 1999 a rise in Afghan cases.

In 2003, 46% of TB cases born abroad had entered the UK within the last 5 years and 27% had lived in the UK for more than 10 years. On further analysis of those born abroad in the two largest ethnic minority subgroups, black Africans were more likely to be new entrants or resident in the UK for less than 5 years (52%) whereas TB patients from the Indian Subcontinent were more likely to have lived in the UK for over 10 years (Fig 8).

### **TB and HIV**

Co-infection with TB and HIV is an increasing problem in London (see Table 1). In 1993, 3.3% of TB cases were co-infected; by 1998 this had risen to 5.4% [15] and by 2001 the rate was 6.5% (personal communication: Valerie Delpech, HPA Colindale, 2005). This is thought to be an underestimate. Reports from London hospitals suggest rates of co-infection are as high as 17 to 25%.[16][17] It has been estimated that over three-quarters of the national HIV and TB co-infected population live in London, the

majority of whom are black African.[15] Between 1993 and 1998, co-infection increased by a factor of 2.5 in black Africans and by a factor of 0.6 in whites.[15] It was estimated that between 1993 and 1998, 11% of the rise in London's TB cases could be attributed to HIV.[15] It is important in London to offer and recommend HIV testing for all TB cases so that both infections can be properly treated.

**Table 1:** TB / HIV co-infection

	<b>1993</b>	<b>1998</b>
London	3.3% (39)	5.4% (86)
England and Wales	2.2% (61)	3.3% (112)

**Source:** Rose et al. *Thorax* 2002 [15]

### **Drug Resistant TB**

Both isoniazid resistant and multi-drug resistant (MDR) TB are bigger problems in London than elsewhere in England and Wales. In 2003, 9.4% of isolates were isoniazid resistant in London (Figure 9) compared to 7.5% nationally. Rates of isoniazid resistant TB were relatively stable until 2000 but have risen slightly since then due mainly to a large outbreak of isoniazid mono-resistant TB.[18] Over the past five years rates of MDR TB have been around 1-1.5% in London with just a slight rise to 2% in 2003 (the most recent year for which data is available).

### **Outcome of Treatment**

In 2003 treatment outcome data was available through the LTBR. Patients notified during 2002 were followed up one year after commencing treatment. 82% had completed a full course of treatment, 10% had not completed treatment and 8% were either lost to follow-up or had an unknown outcome. Of the 10% not completing treatment, two-thirds had died and for just under half of these TB caused or contributed to death.

### **Molecular Epidemiology of TB**

Research published in 2002 using molecular typing showed that TB in London was mainly caused by reactivation or importation of infection by recent immigrants.[19] New infections were common in people with recognised risk factors such as alcoholism or HIV. The main findings were the importance of preventive interventions and early diagnosis in immigrants, along with thorough contact tracing and monitoring of treatment outcome in groups at higher risk of new infection. This molecular study was conducted in the late 1990s before a large outbreak of drug resistant TB in North London; its findings may now have changed. The outbreak has emphasized the vulnerability to recent new infection of groups such as drug users and prisoners in London.[18]

### **Risk groups**

A cross sectional survey performed in London in July 2003 found the overall prevalence of TB to be 27 per 100,000 but reached 788 in people sleeping rough or using direct access homeless hostels, 550 in prisoners, 172 in drug users and 878 in patients diagnosed HIV positive. This survey demonstrated a prevalence of disease in recent migrants of 149/100,000 and among refugees and asylum seekers of 92/100,000.[20]

## DISCUSSION

TB is an increasing problem in London. Over the last 15 years its incidence has doubled to 41.3 per 100,000 and continues to rise. In 2003, 3048 cases were reported via enhanced TB surveillance, 45% of the national total. A discrepancy exists between statutory notifications and LTBR data as shown in Figure 1. In 2003, 2745 TB cases were formally notified in London compared to 3048 notified via the LTBR. Enhanced TB surveillance is likely to better reflect the true incidence of TB as it undergoes more rigorous validation than statutory notifications. Caution has been advised in the interpretation of statutory notification data.[21]

The incidence of TB varies substantially between different ethnic groups. In 2003, 86% of TB cases in London were from an ethnic minority, a reflection of the impact in London of the global epidemic of TB.[22] Three quarters of cases were born abroad in countries where TB incidence is much higher. The importance of this for prevention and control is that primary care / community services need to be increasingly aware of at risk groups and target case finding and treatment appropriately. We have shown that incidence varies across London boroughs from <10/100,000 to 96/100,000 (nearly 10 times the national average) and in recent years London's TB 'hot spots' have remained largely unchanged although a few areas have seen increases of up to fivefold. The hot spots are not just inner city districts, but include suburban areas with well-established ethnic communities. Immigration patterns to the UK have changed over time,[6] with more people arriving from the Indian Subcontinent over 10 years ago and young Africans more recently. Africans made up 41% of all asylum applications in 2003, Asians 27%.[23] Our results reflect the changing patterns of immigration (with higher rates of TB in older Asians with longer residency and younger more recently arrived Africans) and highlight the fact that it is not just recently arrived immigrants who are developing TB. TB control and prevention strategies need to be mindful of this and provide information, diagnosis and treatment to newly arrived immigrants as well as for more established ethnic communities.

Approximately 7 million people live in London [Census data 2001]. From 1991 to 2001 the proportion of people from an ethnic minority increased from 20% to 29%. The increase was evident in all ethnic minority groups with the greatest increase seen for black Africans - a doubling from 2.4% to 5.4%. As a reflection of this, TB in black African communities has risen significantly in the past 5 years. The current notification rate for all ages is 283/100,000 and for the 25-44 age group 407/100,000. In black Africans TB is found more commonly in new entrants and those who have lived in the UK for less than 5 years. This suggests that a greater understanding of this group is needed and more resources to assess and diagnose newly arrived black Africans in addition to further prevention work.

The rise in TB notification in London is likely to have many causes. Apart from the changing patterns of immigration other factors that impact on TB epidemiology include; increased detection through increased staff to patient ratios and heightened awareness of TB in both the public and health care staff; increased opportunities for international travel

with exposure to TB in high incidence countries; HIV infection in London at an all time high and the emergence of drug resistant TB - rising slowly and mainly due to a large outbreak of isoniazid mono-resistant TB.[18] In addition incidence and prevalence rates of TB are documented to be high in the homeless [8][11] and prison populations;[18][20] groups that are often marginalised and difficult to reach and engage.[24]

### **Can we learn from the New York experience?**

In the early 1990's TB had reached epidemic proportions in New York City (NYC). This epidemic differed in several ways to that in London; London has a much higher proportion of TB infected immigrants (London 80% c.f. NYC 25%), a much lower proportion of HIV co-infected TB patients (London 6.5% c.f. NYC 38%) and lower levels of MDR TB (London 1.2% c.f. New York 19%).[25] However there are similarities between the two epidemics, such as similar numbers of cases at the epidemic peak and a higher prevalence in lower socio-economic classes, ethnic minorities and the homeless. NYC's epidemic was brought under control by broadening treatment regimes, using directly observed therapy and structured guidelines for control and prevention.[26] The reduction in cases in NYC has largely been confined to those born in the US.[27] As TB in London is mostly found in non-UK born ethnic minorities the lessons learnt in New York may not all be appropriate. However, New York suffered a sub-epidemic of drug resistant TB and lessons learnt from containment of this might be helpful for London. Similarly for TB patients co-infected with HIV, London might benefit from reviewing New York's policies; as the fastest growing group of TB patients are 25-34 year old black Africans who also have the highest rates of co-infection.

### **What does all this mean for London?**

TB in London is an increasing public health concern but there have been some service improvements reported in each of London's five sectors together with the creation of multidisciplinary TB networks. Service improvements include greater monitoring of treatment completion; an increase in the number of TB nurses and the use, since 2002, of the Health Protection Agency London TB Register (LTBR) in all TB clinics. The LTBR is a web-based electronic case management and surveillance system which allows patients to be tracked as they move between clinics and so improves local service monitoring of patient outcomes. A mobile screening project using targeted digital radiography is being piloted within London to evaluate how this approach could strengthen the screening of defined populations including for example prisoners or hostel dwellers.

Further improvements are possible and these include: improved case finding in high risk groups by screening those known to be at particular risk e.g. residents of hostels for refugees, asylum seekers or the homeless;[11][28] early detection in new entrants and better access to primary care services;[12][28][29][30] early recognition of symptoms by doctors and patients; a continuing emphasis on treatment continuity and completion with the use of DOT where appropriate to help reduce drug resistance;[26][31] better

diagnosis of TB/HIV co-infection to enable treatment of both conditions appropriately[32][33] and an increased awareness of the social dimensions of TB control so that health services work more closely with other agencies.[26][29][34]

The Chief Medical Officer's TB Action Plan [35] published in October 2004 provides a helpful framework to assist TB prevention and control and builds on the existing structures and multi-disciplinary working across London's TB networks. The National Institute for Clinical Excellence (NICE) has recently issued TB clinical diagnosis and management guidelines.[28] These guidelines make recommendations on good practice and attempt to focus NHS resources where they will most effectively combat the spread of TB.

## **CONCLUSION**

The global rise in TB continues and TB in London reflects this with increasing rates in ethnic minorities. Drug resistance and co-infection with HIV are growing problems. Control of TB in London needs to improve and ultimately treatment and control services should be tailored to the specific needs of the capital and its at risk groups. This is the time to apply the full weight of political, organisational and individual will, to tackle London's TB problem.

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### **Competing Interests**

None

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**Figure 1.** TB notifications in London and outside London, 1982-2003  
ETS = enhanced TB surveillance data, London TB Register (LTBR).

**Figure 2:** TB notifications in London by age group 1997-2003

**Figure 3:** TB notification rates in London by age and sex in 2003

**Figure 4:** Geographic distribution of TB cases in London 2003

**Figure 5:** London TB Notification rates by ethnic group: 1999, 2001 and 2003

**Figure 6:** Number of TB cases in London by age and ethnic group, 2003

**Figure 7:** Number of TB cases born in UK and abroad in 1993 and 2003 by age group

**Figure 8:** Years since entry into the UK for TB cases from black Africa and the Indian subcontinent

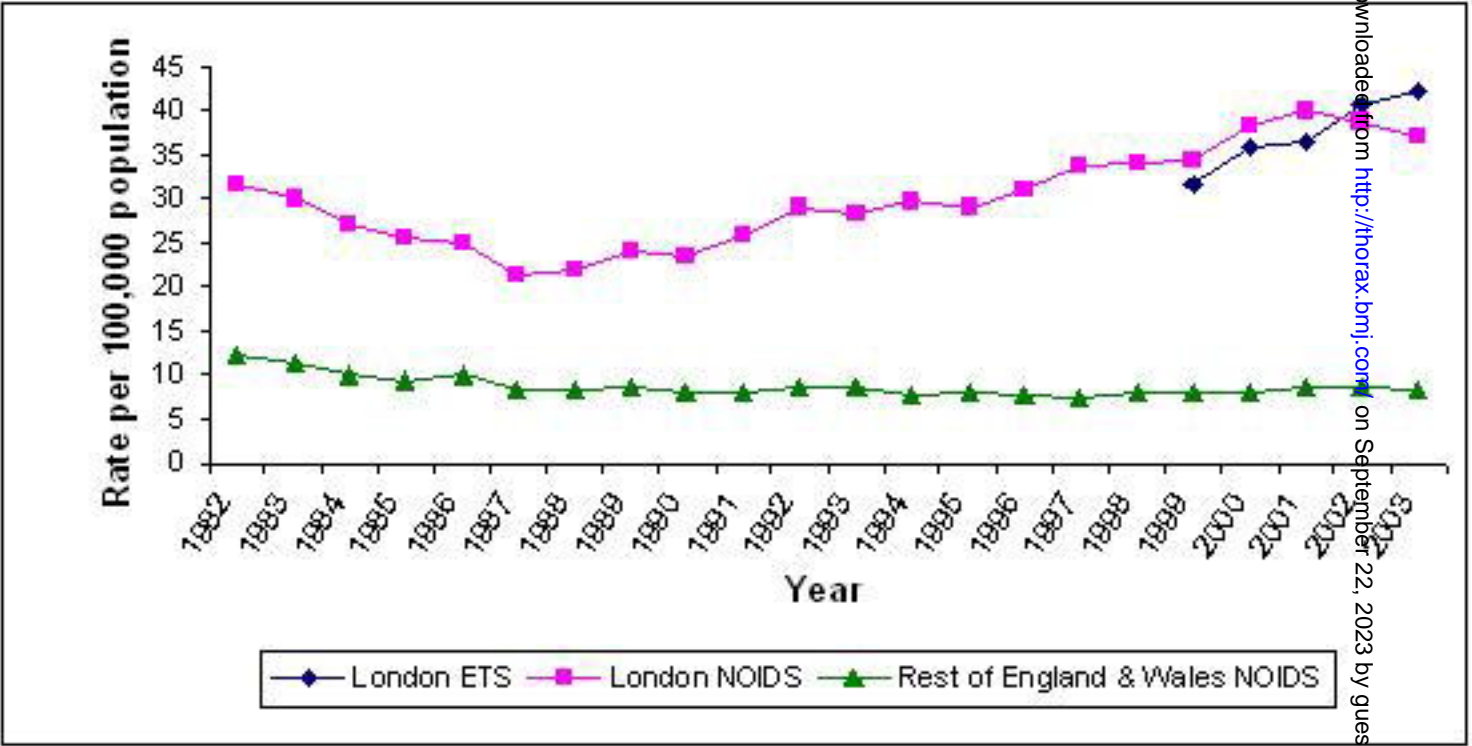
**Figure 9:** TB drug resistance in London 1994-2003

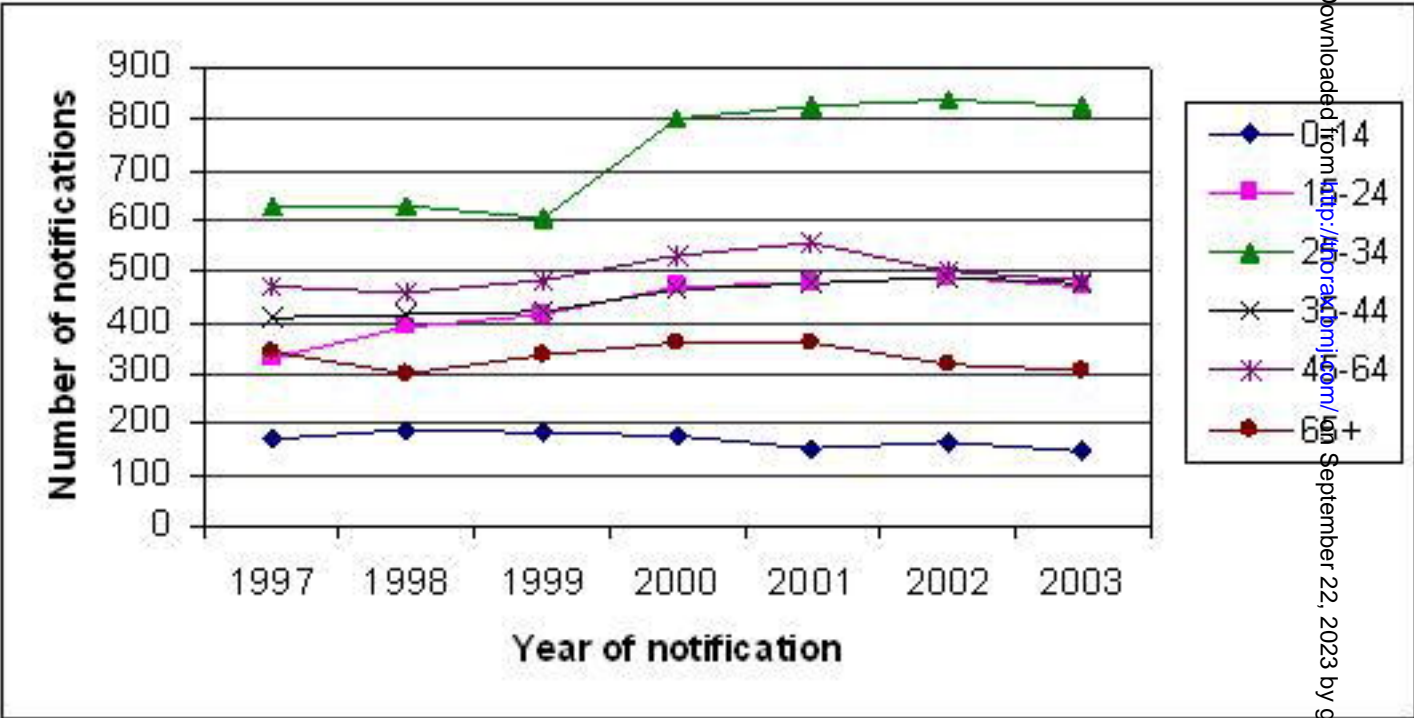
**Source:** HPA Mycobacterial Resistance Network (MycobNet)

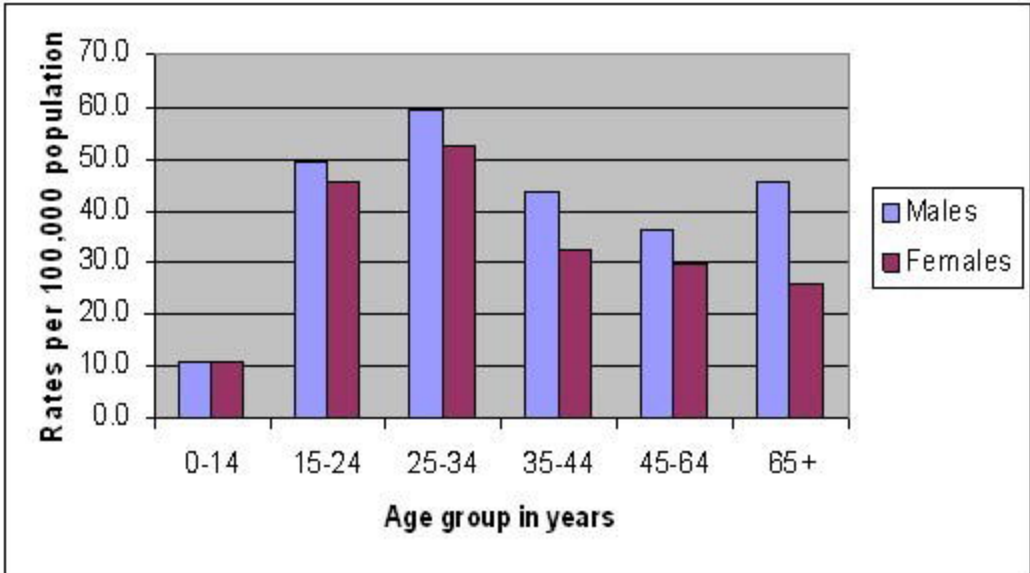
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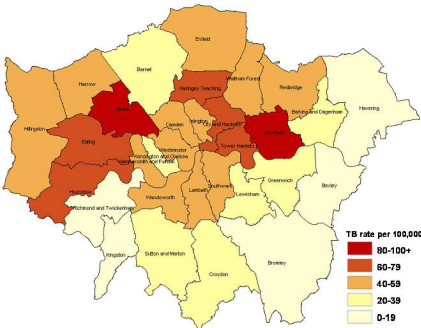
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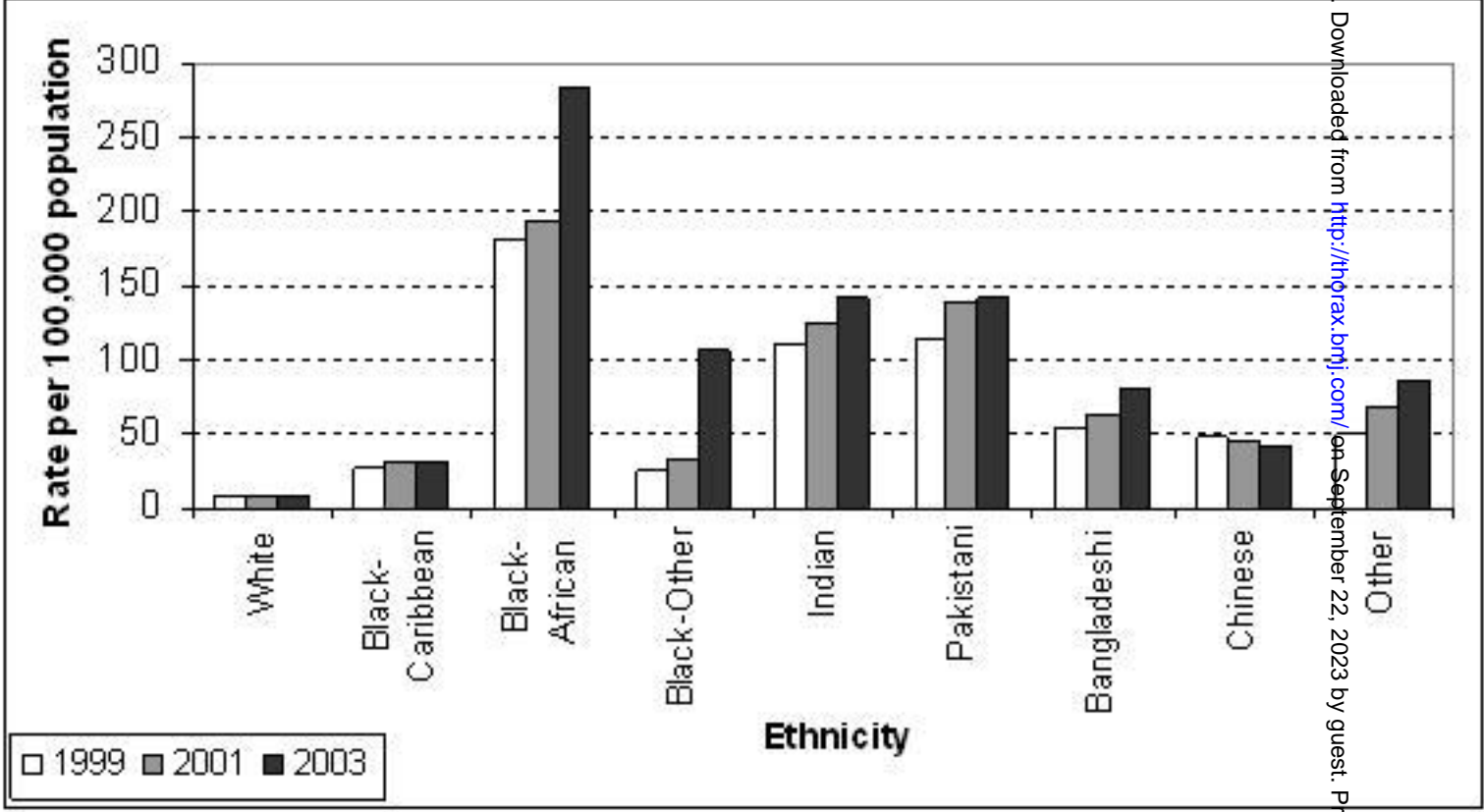
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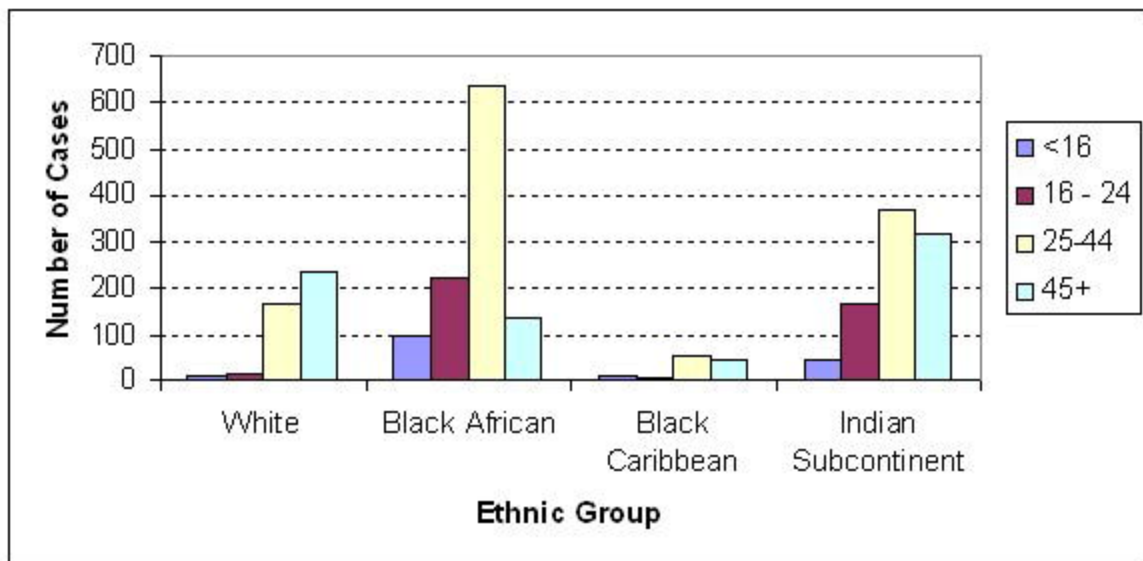


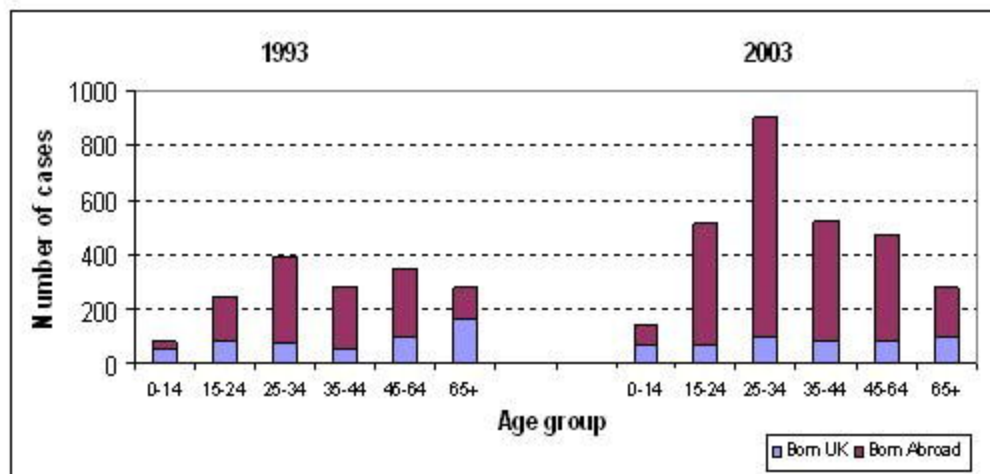


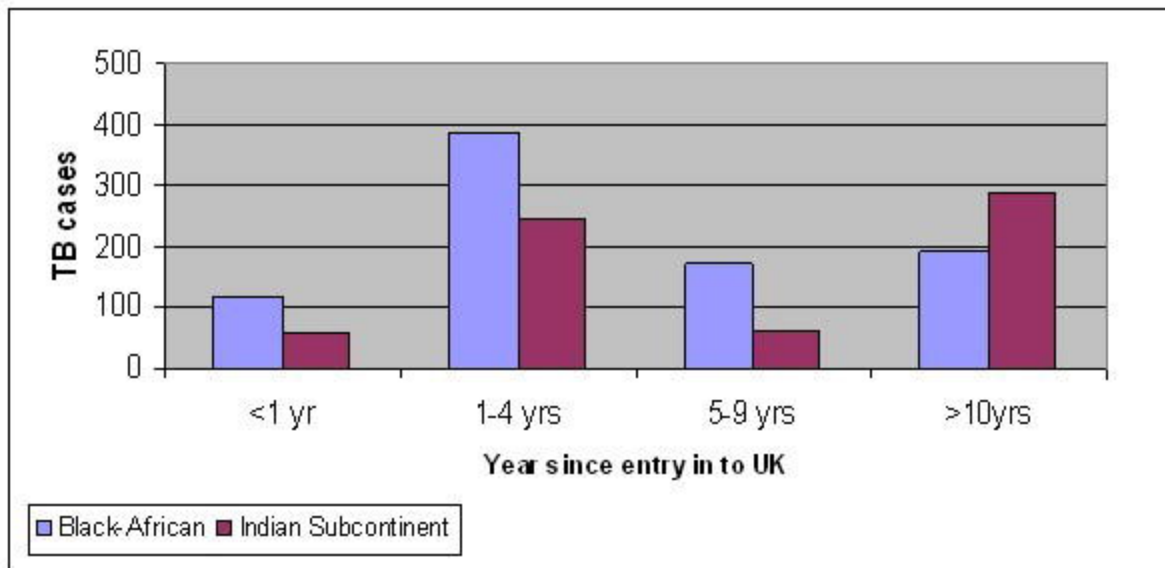


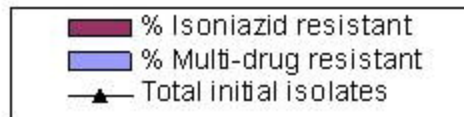
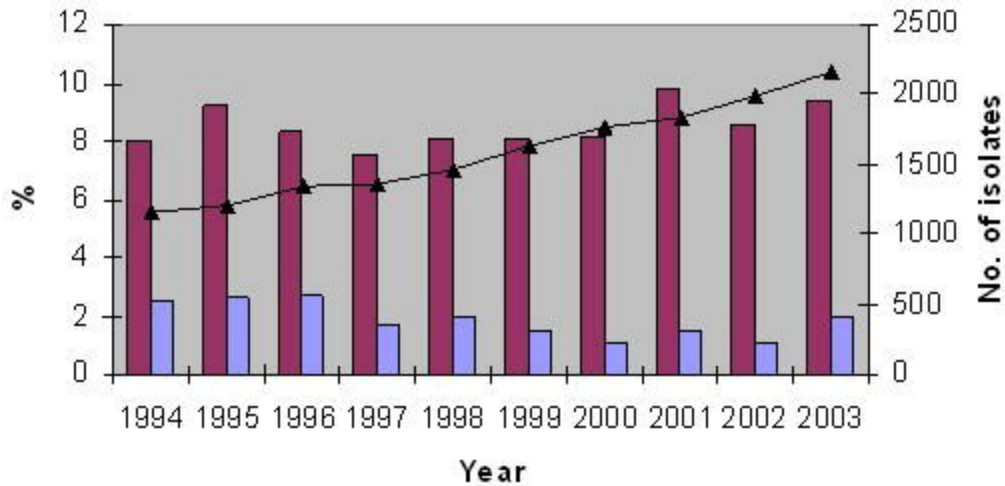












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### Corrections

Figure 9 of the article by Sarah R Anderson *et al* in the February issue of *Thorax* (Tuberculosis in London: a decade and a half of no decline in tuberculosis epidemiology and control. *Thorax* 2007;62:162-7) was incorrectly labelled. A corrected version of the figure is available at: <http://thorax.bmj.com/cgi/content/full/thx.2006.058313/DC1>.

Also, the title has been amended and the online version is different to the printed version (revised title: Tuberculosis in London: a decade and a half of no decline).

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Appendix 3 of the supplement *Pandemic flu: clinical management of patients with an influenza-like illness during an influenza pandemic* (*Thorax* 2007;62(Suppl 1):i1-46) was incorrectly labelled in one part. To the question "Does the patient have pneumonia?" the Yes and No labels on the following arrows were swapped. A corrected version of the figure is available at: [http://thorax.bmj.com/cgi/content/full/62/suppl\\_1/1/DC1](http://thorax.bmj.com/cgi/content/full/62/suppl_1/1/DC1)

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