

Tuberculosis in children: a national survey of notifications in England and Wales in 1988

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Abstract

A survey of all notified cases of tuberculosis in England and Wales in children (less than 15 years old) in 1988 was undertaken to study changes in the frequency and distribution of disease in the population since similar surveys in 1978-9 and 1983. There were 294 children with newly notified previously untreated tuberculosis, an annual rate of 3.1/100 000. Children of Indian, Pakistani, and Bangladeshi (Indian subcontinent) ethnic origin formed the largest group (134 (46%)), but only 29 (22%) of these children were born outside the UK. The rate for children of Indian subcontinent ethnic origin born abroad (53/100 000) was twice that for those born in the UK (26/100 000), but the latter was 17 times higher than the rate for white children (1.5/100 000). These ratios have changed little since the first survey in 1978-9 and highlight the need for improvement in the prevention and control of tuberculosis in children known to be at increased risk.

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Tuberculosis in children is, necessarily, due to recent infection; therefore disease, particularly in the youngest age groups, reflects continuing transmission in the population. Although there are now relatively few cases of tuberculosis in children in England and Wales, surveys have shown considerable variation in the rates of disease in different ethnic groups.^{1,2} Children of Indian, Pakistani, and Bangladeshi ethnic origin, even if born in the UK, are at particular risk. Children are the target of a number of primary preventive measures against tuberculous infection, including the schools BCG vaccination programme and selective vaccination of infants and children at increased risk. Continued surveillance is important for the monitoring of both disease transmission and the success of preventive measures.

Since 1978 there have been three national surveys of notified cases of tuberculosis in children in England and Wales. The results are reported here of the latest of these in 1988.

Methods

The methods were the same as those of previous surveys in 1978-9¹ and 1983.² Briefly, medical officers for environmental health throughout England and Wales provided copies of all tuberculosis notification forms received during the survey period and these were checked against the weekly infectious diseases returns to the Office of Population Censuses and Surveys (OPCS). All cases of tuberculosis in children under the age of 15 years in England and Wales reported to OPCS from 2 January 1988 to 30 December 1988 were included.

For each patient in the survey additional clinical information was requested from the notifying doctor. This included ethnic origin, country of birth and year of first arrival in the UK, sites of disease, results of any bacteriological and histological investigations, and BCG vaccination history. In addition, the six regional centres for tuberculosis bacteriology and the Mycobacterium Reference Unit of the Public Health Laboratory Service provided results of identification and sensitivity tests on all first isolates of *Mycobacterium tuberculosis*.

Population estimates were obtained from the 1988 Labour Force Survey (OPCS: commissioned tables) for the calculation of rates. As in previous surveys, the small number of subjects whose ethnic origin was not stated were distributed in proportion to the population for whom ethnic origin was known. For the 1978-9 survey population estimates were derived from the National Dwelling and Housing Survey,¹ which did not include Wales; rates by ethnic origin in 1983 and 1988 were calculated for England only so that they were comparable with the figures for 1978-9.

Results

During 1988 there were 449 notifications of tuberculosis in children to medical officers for environmental health. Of these, 119 (27%) were receiving chemoprophylaxis and were excluded from the survey, as were 22 (5%) others for reasons listed in table 1. For comparison with earlier surveys, analyses were restricted to newly notified patients who had not been treated for tuberculosis previously; there were 294 children in 1988, 452 in 1983, and 747 in 1978-9 (seasonally adjusted annual estimate based on 353 in six months). This represents a 60% decrease in the annual number of newly notified cases since 1978.

ETHNIC GROUP

During the nine and a half years covered by the three surveys there was a small reduction in the

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Table 1 Notifications of tuberculosis in children in the three surveys. Values are number (%)

	1978-9 (six months)	1983 (one year)	1988 (one year)
Notifications to medical officers for environmental health	512 (100)	788 (100)	449 (100)
Exclusions			
Duplicates	3 (1)	14 (2)	7 (2)
Chemoprophylaxis	135 (26)	247 (31)	119 (27)
BCG abscess	0 (0)	21 (3)	0 (0)
Altered diagnosis	13 (3)	50 (6)	15 (3)
Previous treatment	8 (2)	4 (1)	14 (3)
Newly notified, previously untreated	353 (69)	452 (57)	294 (65)
Corrected OPCS total*	479	617	380

*Includes previously treated

Table 2 Ethnic origin of children notified with tuberculosis. Values are number (%)

	1978-9 (six months)	1983 (one year)	1988 (one year)
White	176 (50)	217 (48)	129 (44)
Indian	74 (21)	79 (17)	64 (22)
Pakistani/Bangladeshi	61 (17)	104 (23)	70 (24)
West Indian	18 (5)	19 (4)	14 (5)
Other	24 (7)	33 (7)	17 (6)
Total	353 (100)	452 (100)	294 (100)

proportion of notifications for white children and an increase in the proportion for children of Indian subcontinent ethnic origins – that is, Indian, Pakistani, or Bangladeshi (table 2). As before, nearly 90% of children were white or of Indian subcontinent ethnic origin. Only 29 (22%) of the 134 children of Indian subcontinent ethnic origin were born abroad compared with 26% in 1983 and 41% in 1978-9.

AGE AND SEX

Just over half (52%) of the 294 children were girls, including 59 (46%) of the 129 white children and 72 (54%) of the 134 of Indian subcontinent ethnic groups. White children were on average younger; 55 (43%) were less than 5 years old and 35 (27%) 10 to 14 years old compared with 29 (22%) and 68 (51%) respectively of the children of Indian subcontinent ethnic origin. This difference was in part due to there being very few young children in the group born abroad; 20 (69%) of the 29 children of Indian subcontinent ethnic origin born abroad were older than 10 years.

Table 3 Sites of disease by ethnic group (1988 survey)

	White	Indian subcontinent	Other	All
Respiratory disease				
Pulmonary	76 (84)	73 (72)	17 (81)	166 (78)
Pleural	2 (2)	8 (8)	2 (10)	12 (6)
Intrathoracic lymph nodes	19 (21)	31 (31)	5 (24)	55 (26)
Total patients with respiratory disease*	91	101	21	213
Non-respiratory disease				
Peripheral lymph nodes	34 (76)	20 (43)	7 (70)	61 (60)
Central nervous system	6 (13)	9 (20)	0 (0)	15 (15)
Miliary	2 (4)	4 (9)	1 (10)	7 (7)
Abdominal	0 (0)	5 (11)	2 (20)	7 (7)
Bone and joint	2 (4)	3 (7)	1 (10)	6 (6)
Other	3 (7)	10 (22)†	0 (0)	13 (13)
Total patients with non-respiratory disease*	45	46	10	101

*Twenty children (seven white and 13 of Indian subcontinent ethnic origin) had both respiratory and non-respiratory disease. Several children had lesions at more than one site.

†These included three children with genitourinary lesions and two with abscesses.

TYPE OF DISEASE

Two thirds of the 294 children were reported to have respiratory tuberculosis only – that is, disease of the lungs, pleura, or intrathoracic lymph nodes. Eighty one (28%) had non-respiratory disease only and 20 (7%) both respiratory and non-respiratory lesions. Table 3 gives details of the sites of disease. The distribution of disease was broadly similar in the different ethnic groups, though white children had more peripheral lymph node disease and most of the abdominal disease was in children of Indian subcontinent ethnic origin. Eighteen children had the most serious forms of childhood tuberculosis – meningitis or miliary disease – including four who were reported to have both. Eight of these were less than 5 years old – three with miliary disease and five with meningitis alone.

BACTERIOLOGY

Bacteriological results were available for 133 (45%) of the 294 cases: 66 (31%) of the 213 children with respiratory disease and 67 (67%) of the 101 with non-respiratory lesions. Thirty three of the 66 specimens (50%) from patients with respiratory disease were positive on culture for *M tuberculosis*, of which 12 were also positive on direct smear. Sensitivity test results were available in 30 (91%) of the 33 positive cultures of which only one (3%), resistant to streptomycin only, was not fully sensitive to standard drugs for tuberculosis (that is, streptomycin, isoniazid, rifampicin, and ethambutol).

Of the 67 non-respiratory cases for which culture results were known, only 27 (40%) were positive, and sensitivity results were available in 20 of the 27 (74%). In 17 cases the strain was fully sensitive to standard drugs for tuberculosis; one child of Indian ethnic origin had a strain resistant to both isoniazid and streptomycin, and resistant strains were also isolated from two children of 'other' ethnic groups; one resistant to isoniazid and the other to streptomycin.

BCG VACCINATION HISTORY

There were 104 children of Indian subcontinent ethnic origin known to have been born in the UK (the country of birth of one child was unknown). It has been recommended since 1972 that such children are given BCG vaccination in the neonatal period.³⁻⁵ Thirty four (63%) of the 54 children of Indian and 22 (55%) of the 40 of Pakistani or Bangladeshi parentage for whom BCG status was known were reported to have been given BCG. Seventeen (45%) of the 38 children reported not to have been vaccinated were less than 5 years old, 74% of the 23 children of Indian subcontinent ethnic origin in that age group born in the UK.

ANNUAL NOTIFICATION RATES

The overall tuberculosis notification rate for children in England and Wales was 3.1/100 000. Only six (2%) of the 294

Table 4 Annual notification rates by ethnic group in England

	1978/79		1983		1988		Average annual % decrease 1978-9 to 1988
	Cases (six months)	Rate/ 10 ⁵	Cases (one year)	Rate/ 10 ⁵	Cases (one year)	Rate/ 10 ⁵	
White	164	3.6	201	2.4	123	1.5	8.4
Indian	74	74	79	32	64	28	9.3
Pakistani/Bangladeshi	60	92	101	52	70	29	10.9
West Indian	18	21	19	17	14	13	4.7
Other	20	27	32	15	17	6	14.0
Total	339	7.0	432	4.7	288	3.3	7.2
Indian subcontinent							
Total	134	77	180	40	134	29	9.3
Born UK	78	59	131	36	105	26	7.9
Born abroad	56	133	48	63	29	53	8.8

children notified were from Wales, a rate of 1.1/100 000. The rate for England was 3.3/100 000 in 1988, compared with 4.7 in 1983 and 7.0 in 1978-9; this represents an average reduction over the decade of 7.2% per year (table 4).

As in previous surveys the rate for children of Indian subcontinent ethnic origin (29/100 000) was about 20 times that for white children (1.5/100 000), and within the former group the rate in children born abroad was nearly twice that for children born in the UK (table 4). The rate for children of West Indian ethnic origin was eight times that for white children. High rates were also found in children from all other ethnic minorities combined, but numbers of these were too small to provide accurate estimates for individual groups.

Table 5 gives the rates by age group for white children and those of Indian subcontinent ethnic origin born in the UK in the three surveys. Two different patterns may be seen. For white children there did not appear to be a substantial variation in risk by age group, though the youngest children tended to have slightly higher rates. There was, however, a downward trend in rates of tuberculosis over time for the cohort of children less than 5 years of age in 1978-9 (3.6/100 000), 5 to 9 years old in 1983 (2.3/100 000), and 10 to 14 years old in 1988 (1.4/100 000). For the children of Indian subcontinent ethnic origin born in the UK, rates were higher in the older age groups in all surveys. No consistent decrease in risk for the corresponding cohort (aged less than 5 years in 1978-9 and 10 to 14 years old in 1988) was seen (table 5).

Table 5 Annual notification rates by age for white children and those of Indian subcontinent ethnic origin born in the UK

Age (years)	1978-9		1983		1988	
	Cases	Rate/ 10 ⁵	Cases	Rate/ 10 ⁵	Cases	Rate/ 10 ⁵
White						
0-4	43	3.6	73	2.8	54	2.0
5-9	74	4.7	59	2.3	35	1.3
10-14	47	2.7	69	2.2	34	1.4
Total	164	3.6	201	2.4	123	1.5
Indian subcontinent origin born in the UK						
0-4	29	51	52	31	25	15
5-9	25	56	30	27	32	22
10-14	24	100	49	54	48	48
Total	78	62	131	36	105	26

Discussion

The annual number of notified cases of tuberculosis in children less than 15 years old in England and Wales reported by OPCS decreased substantially over the decade covered by the three surveys (from 905 in 1978 to 380 in 1988).⁶ Since then there has been no evidence of a further decrease; indeed, the number of notifications has increased and there were 429 notifications in 1989, 402 in 1990, 452 in 1991, and 495 in 1992.⁶ Notifications may not be an accurate measure of disease incidence, however. On the one hand under-notification certainly occurs,⁷ though its extent in children is not known. On the other hand, over a quarter of the children notified in each of the survey years did not have clinical disease but were receiving chemoprophylaxis only and should not have been notified. These factors need to be borne in mind when interpreting notification data. The increase in the number of notifications in children is of great concern, however, and the results of a national survey of cases notified in 1993 will provide much needed information on where and in which groups in the population the increases have occurred.

As in adults,⁸ most tuberculosis in children was respiratory, though a higher proportion of children than adults had intrathoracic lymph node disease rather than pulmonary disease. Extrathoracic lymph node tuberculosis was the most common form of non-respiratory disease in adults and children. The most serious types of infection, miliary tuberculosis or disease affecting the central nervous system, were rare, occurring in only 18 children (6% of the total) four of whom were reported to have both forms of disease.

Only one fifth of the cases were confirmed bacteriologically. It is often difficult to obtain adequate specimens from children, and where the disease is confined to intrathoracic lymph nodes it may in practice be almost impossible. Of those that were confirmed, all but four (7%) grew strains that were fully sensitive to standard chemotherapeutic drugs for tuberculosis, and two of the four were resistant only to streptomycin, which is rarely, if ever, used in children in this country.²

Notification rates had decreased at an average rate of 7.2% per year over the decade. By 1988 the risk of disease in white children was very low; their annual notification rate was less than two new cases per 100 000

population. Despite the substantial reduction in notifications, the rates of disease remained high in several ethnic minority groups. As in previous surveys the highest rates were found in the population of Indian, Pakistani, and Bangladeshi ethnic origin, in particular those born abroad, but other children were also at increased risk. The rate for those of West Indian origin was eight times that for white children and their rate of decrease was less; a similar picture was found in adults.⁸ Numbers were too small to provide accurate estimates of the rates in other ethnic groups, but children of African, Arab, and Chinese parentage also appeared to have higher rates than white children.

The reduction in risk seen in the cohort of white children who were less than 5 years old in 1978–9 was also observed in adults.⁸ The lack of a similar trend in children of Indian, Pakistani, and Bangladeshi ethnic origin born in the UK may be due to inaccuracies in population measurement. Labour Force Survey estimates are based on a sample of households, and in the case of small population groups there may be some error. It may, however, be due in part to some of the older children being infected during visits to Asia,⁹ or the high risk of infection in some households.

Although children of Indian, Pakistani, and Bangladeshi ethnic origin born abroad had the highest rates of disease, they were a very small group. Only 12% of the population of children in Indian subcontinent ethnic groups in England were born abroad, and only 22% of the patients. Not only do children born in the UK form a larger proportion of the population than those from abroad, but they should be more easily accessible for preventive measures such as BCG vaccination.

BCG vaccination in the first year of life in children of Indian subcontinent ethnic origin in England has been shown to confer a protection of between 49 and 64% against tuberculosis.^{10 11} Therefore even if all eligible children had been vaccinated we would still expect some cases of childhood tuberculosis in exposed populations. Of the 94 children of Indian subcontinent origin born in the UK for whom BCG status was known, 57% had been immunised, and among those less than 10 years old, 53% were known to have had BCG. Among those reported not to have been immunised were three of the 10 children of Indian subcontinent ethnic origin born in the UK who had miliary or meningeal tuberculosis.

It is possible to estimate the proportion of the population that has been vaccinated from the proportion of cases in immunised children and the vaccine efficacy.¹² From these data it is estimated that between 69 and 76% of children of Indian subcontinent ethnic origin

born in the UK and less than 10 years old had been vaccinated. This estimate should be treated with caution, however, as it was based on a fairly small number of cases and measures of vaccine efficacy which had broad confidence limits. It is worrying, particularly in view of the recent increases in numbers of notified cases reported to OPCS, that such a large proportion of the children at high risk of tuberculosis had not been vaccinated.

A survey of district health authorities in England and Wales found that 17% of districts did not offer BCG immunisation for any neonates, including several districts with populations of Indian subcontinent origin of 3% or more.¹³ There is clearly room for improvement in the prevention of tuberculosis in ethnic minority groups, and need for continued vigilance if all children in the UK are to have the same low risk of developing tuberculosis as white children.

This survey succeeded because of the enthusiastic cooperation of all medical officers for environmental health in England and Wales, all chest doctors and general doctors with a special interest in chest diseases, paediatricians, and a large number of clinicians in other specialties who provided clinical information, as well as nursing staff, secretaries, records clerks of many hospitals and chest clinics, and local authority infectious disease clerks.

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- 1 Medical Research Council Tuberculosis and Chest Diseases Unit. Tuberculosis in children in a national survey of notifications in England and Wales, 1978–79. *Arch Dis Child* 1982; 57: 734–41.
- 2 Medical Research Council Tuberculosis and Chest Diseases Unit. Tuberculosis in children: a national survey of notifications in England and Wales in 1983. *Arch Dis Child* 1988; 63: 266–76.
- 3 Department of Health and Social Security, Scottish Home and Health Department and Welsh Office. *BCG vaccination*. Memo 322/BCG (Revised 1972).
- 4 Public Health Laboratory Service Communicable Disease Surveillance Centre. BCG vaccination. *BMJ* 1983; 286: 876–7.
- 5 Department of Health, Welsh Office and Scottish Home and Health Department. *Immunization against infectious disease*. London: HMSO, 1990.
- 6 Office of Population Censuses and Surveys. Infectious diseases, March quarter 1978 – December quarter 1992. *OPCS Monitor MB2 78/3–93/5*. London: Government Statistical Service, 1978–93.
- 7 Sheldon CD, King K, Cock H, Wilkinson P, Barnes NC. Notification of tuberculosis: how many are never reported? *Thorax* 1992; 47: 1015–8.
- 8 Medical Research Council Cardiothoracic Epidemiology Group. National survey of notifications of tuberculosis in England and Wales in 1988. *Thorax* 1992; 47: 770–5.
- 9 McCarthy OR. Asian immigrant tuberculosis – the effect of visiting Asia. *Br J Dis Chest* 1984; 78: 248–53.
- 10 Packe GE, Innes JA. Protective effect of BCG vaccination in infant Asians: a case-control study. *Arch Dis Child* 1988; 63: 277–81.
- 11 Rodrigues LC, Gill ON, Smith PG. BCG vaccination in the first year of life protects children of Indian subcontinent ethnic origin against tuberculosis in England. *J Epidemiol Community Health* 1991; 45: 78–80.
- 12 Orenstein WA, Bernier RH, Dondero TJ, et al. Field evaluation of vaccine efficacy. *Bull World Health Organ* 1985; 63: 1055–68.
- 13 Joseph CA, Watson JM, Fern KJ. BCG immunization in England and Wales: a survey of policy and practice in schoolchildren and neonates. *BMJ* 1992; 305: 495–8.