

The outcome of contact procedures for tuberculosis in Edinburgh, Scotland 1982–1991

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We have reviewed the records of 632 (80%) of the 788 index cases of tuberculosis notified in Edinburgh from 1982–1991 to assess the value of contact procedures for tuberculosis. Screening was by tuberculin testing and radiological follow-up for 6 months.

Fifty (7.9%) of 632 notifications were detected by contact procedures and a further 35 contacts had recent infection qualifying for chemoprophylaxis. Tuberculosis was diagnosed at the first clinic visit in 38 (76%) cases and a further 11 (22%) were diagnosed at 3 months.

Twenty-seven (54%) contacts with tuberculosis were in the 0–14 year age group. BCG vaccination offered 59% protection.

Forty-two (84%) cases of tuberculosis were in contacts of sputum smear-positive respiratory index cases.

Contact procedures continue to be effective in identifying new cases of tuberculosis in Edinburgh. Most cases occur in children who are close contacts of smear-positive respiratory index cases and are identified within 3 months of initiating screening. Screening of close contacts other than those of smear-positive respiratory disease is usually unnecessary.

Introduction

In 1984 we reported a review of contact procedures for tuberculosis in Edinburgh for the 5-year period 1977–1981 (1). We found that 8.2% of notified cases of tuberculosis were detected by contact procedures; 95% being diagnosed within 3 months and 100% within 6 months of first attendance at the contact clinic. Most disease was found in contacts of smear-positive pulmonary index cases and it was to those contacts that we suggested attention should continue to be directed.

Since then, the view, initially expressed by Spencer-Jones (2,3), that routine contact procedures are relatively unproductive has been supported by reports from Gwent (4) and Cardiff (5). In contrast, Leeds (6), Birmingham (7) and Blackburn (8) all find contact procedures yielding 7.6%, about 10% and 7.7% of all tuberculosis notifications. Blackburn (8) supports the British Thoracic Society recommendation that all Heaf skin-test positive contacts of smear-positive pulmonary index cases should be followed radiologically for 1 yr and for 2 yr if Asian (9);

Birmingham recommended follow-up for 6 months and for 1 yr if Asian (7); while Leeds recommends radiological follow-up of all such contacts irrespective of ethnic group for 2 yr (6). The discrepancies between the findings and recommendations of these recent reports from different centres in the U.K. have led us to examine the Edinburgh experience of tuberculosis contact procedures for the 10-yr period from 1982–1991 to see if our more recent findings indicate any temporal change in tuberculosis patterns.

Methods

INDEX CASES

The records of 632 (80%) of a total of 788 index cases of tuberculosis notified in the Edinburgh area from 1982–1991 were reviewed. One hundred and fifty-six (20%) notifications were excluded from the review because the records of their contacts had been mislaid. The Edinburgh area includes East Lothian, Midlothian and the City of Edinburgh with a total population of 601 365 in 1986.

All patients with tuberculosis diagnosed as a result of contact procedures were identified and details obtained of age, sex, BCG vaccination status, chest radiograph, Heaf test result and bacteriological findings. Closeness of contact with the index case and

Received 31 March 1994 and accepted in revised form 8 July 1994.

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ethnic origin were defined using the British Thoracic Association study criteria for 'close' and 'casual', 'Asian' and 'non-Asian' (10). The type of disease in the index case was determined.

CONTACTS

Details of age, sex, closeness of contact, BCG vaccination status and ethnic origin were determined for all 3688 contacts of the 632 index cases.

THE CONTACT PROCEDURE IN EDINBURGH 1982-1991

Delay between notification and initial contact tracing was minimal ($<2/52$) since notifications are usually made to or copied direct to the Contact Clinic. Every contact was offered a Heaf test with chest radiography for all adults and all tuberculin positive children. The tuberculin test was repeated in negative reactors at 6 weeks, BCG vaccination being offered to those aged under 35 years with a second negative Heaf test. Chest radiography was repeated at 3 and 6 months in contacts with strongly positive Heaf tests and if no evidence of disease was found the contact was usually discharged. From a period from February 1984 to July 1986 radiological follow-up was extended to include radiological review 1 and 2 yr after initial attendance at the clinic (11).

Statistical analysis of the results has been undertaken using the Chi-square method, with Yates correction. Results have been tabulated in a form which enables comparison with those of our own previous (1) and also the British Thoracic Association (10) study.

Results

INDEX CASES

Seven hundred and eighty-eight patients with tuberculosis were notified from 1982-1991 of whom only 632 are reviewed here since contact tracing records had been misfiled for 156 patients. Fifty patients (7.9%) with tuberculosis were discovered solely as a result of contact procedures with a further 35 contacts qualifying for chemoprophylaxis on the basis of skin-test evidence of recent infection.

Forty-eight (7.6%) of the 632 index cases were Asian from a total Asian population of about 5000 (1991 Census) giving an average annual notification rate of about 100×10^{-5} compared to about 10×10^{-5} in non-Asians. The overall male to female ratio was 1.5:1.0 with no significant difference between the Asian and non-Asian groups. Non-respiratory tuberculosis was commoner in the Asians than in the non-Asians (39% vs. 17%, $P < 0.01$) (Table 1).

In 516 patients with respiratory tuberculosis a positive bacteriological diagnosis was made in 296 (57%) of whom 195 (38%) were sputum smear-positive. The Asian group had a smaller proportion of smear positive disease than the non-Asian group (17% vs. 39%, $P < 0.01$) (Table 2).

CONTACTS (TABLE 3)

A total of 3688 contacts were screened yielding 50 (1.4%) new patients with tuberculosis and 35 (1.0%) who qualified for chemoprophylaxis. No new cases were found in contacts of Asian index cases.

(i) Close

Of 647 close contacts of the 195 smear-positive respiratory index cases, 36 (5.6%) new cases were found and 17 (2.6%) patients required chemoprophylaxis. Of 284 close contacts of the 101 smear-negative, culture-positive respiratory index cases, only two (0.8%) had tuberculosis and a further two (0.8%) required chemoprophylaxis. No disease or requirement for chemoprophylaxis was found in the 315 close contacts of the 142 bacteriologically negative respiratory index cases. Only one close contact (0.9%) of 116 cases of non-respiratory tuberculosis was found to have tuberculosis.

(ii) Casual

Only six (0.4%) of the 1351 casual contacts of the 195 smear-positive respiratory index cases proved to have tuberculosis and only nine (0.7%) required chemoprophylaxis. No significantly greater detection rate of tuberculosis or requirement for chemoprophylaxis was found in any other group of casual contacts apart from three cases (2.4%) among the 126 casual contacts of the 78 index cases for whom no bacteriological results were available (70% of whom had primary tuberculosis).

AGE OF CONTACTS WITH TUBERCULOSIS (TABLE 4)

Twenty-seven (54%) of contacts with tuberculosis were in the 0-14 yr age group; 17 (34%) were aged 15-44 yr; four (8%) were aged 45-64 years and only two (4%) were over 65 years of age.

TIME OF DETECTION OF DISEASE IN CONTACTS (TABLE 4)

Tuberculosis was diagnosed at the initial visit to the contact clinic in 38 (76%) of the 50 cases of disease in contacts. Eleven (22%) were diagnosed at 3 months and only one (2%) at 6 months. Tuberculosis has not subsequently been notified in any of the contacts.

EFFECTS OF BCG VACCINATION (TABLE 4)

Chemotherapy for tuberculosis or chemoprophylaxis was prescribed in 23/1605 contacts (1.4%) who

Table 1 Type of tuberculosis in the index case according to ethnic group and sex

Sex	All index cases						Asian index cases						All other index cases					
	Total		Respiratory		Non-respiratory		Total		Respiratory		Non-respiratory		Total		Respiratory		Non-respiratory	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Male	384	61	325	52	59	9	31	65	20	42	11	23	353	60	305	52	48	8
Female	248	39	191	30	57	9	17	35	9	19	8	16	231	40	182	31	49	9
Total	632	100	516	82	116	18	48	100	29	61	19	39	584	100	487	83	97	17

Table 2 Index cases with respiratory tuberculosis, according to ethnic group and bacteriological status

Total	Smear positive		Culture positive		Culture negative		Path diagnosis		No bacteriology	
	No.	%	No.	%	No.	%	No.	%	No.	%
All index cases 519	195	38	101	19	118	23	24	5	78	15
Asian index cases 29	5	17	10	35	5	17	—	—	9	31
All other index cases 487	190	39	91	19	113	23	24	5	69	14

had previously had BCG and in 60/1761 (3.4%) who had not had BCG, consistent with a protective effect for BCG of 59%.

NATURE OF DISEASE IN CONTACTS (TABLE 5)

Only seven contacts, all adults, had smear-positive respiratory disease. Forty-two contacts had 'other' respiratory diseases of which primary tuberculosis was the commonest diagnosis occurring in 36/42 or 85%. One patient had spinal tuberculosis.

Discussion

From 1982–1991 the average annual notification rate for Edinburgh was 13×10^{-5} . Forty-eight of 788 notifications (7.6%) were of Asians, identical to the figure reported in 1984 (1), and representing a rate in this population 10 times higher than in the non-Asian population. As in previous studies, the Asian patients had more non-respiratory disease and less sputum smear-positive respiratory disease (12,13).

Of the 632 notifications studied, 7.9% were detected by contact procedures, a figure which compares with the 8.2% in Edinburgh in 1977–1981 (1) and is similar to figures reported from other centres (6–8). No Asian notifications were detected by contact procedures, perhaps reflecting, not only the small and stable Asian population in Edinburgh, but also the low degree of infectivity in the Asian cases who were notified. In addition to the 50 cases of tuberculosis identified among contacts, 35 contacts, 63% of whom were aged 14 years or less (Table 4), qualified for chemoprophylaxis. Chemoprophylaxis was only given to tuberculin-positive child contacts (Heaf grades 3, 4 and 2 without BCG) and to Heaf test converters.

In the present study 84% of the cases among contacts were in contacts of patients with sputum

smear-positive respiratory disease compared to 63% in 1977–1981 (1) and 100% in non-Asian contacts in Blackburn (8). This finding further emphasizes the importance of concentrating contact screening resources on contacts of this highly infectious group of patients (9).

Ninety-eight per cent of tuberculosis diagnosed in contacts was detected within the first 3 months of screening compared to 95% in 1977–1981 (1) and 100% in our 1984–1986 study when screening was also extended (unproductively) to 1 and 2 yr (11). None of the contacts screened in the present or in previous studies has subsequently been notified as a case of tuberculosis in Edinburgh where the Tuberculosis Service receives and investigates all notifications (14). On that basis we would be reluctant to extend radiological screening of Heaf-positive contacts of patients with smear-positive respiratory disease beyond the present limit of 6 months; indeed our findings suggest that extending screening to 6 months is not cost-effective.

The Joint Tuberculosis Committee of the British Thoracic Society (9) recommends radiological screening of non-Asian Heaf-positive contacts of smear-positive respiratory disease for 1 yr and of Asian Heaf-positive contacts of all respiratory disease for 2 yr. This recommendation is based on the observation that cases of tuberculosis have been detected among contacts at these time intervals in some studies (6,8,10). Our own suspicion, based now on 15 yr of closely monitored contact procedures in Edinburgh, is that the small number of cases detected at more remote screening intervals probably do not represent disease transmitted from the original index case (15). There does not appear to be a 'second wave' of disease development in contacts in Edinburgh. Some of these late cases may represent disease acquired from another (perhaps common) unknown source but, more likely, they may simply

Table 3 Cases of tuberculosis found among 3688 contacts according to the type of tuberculosis in the index case and closeness of contact

Type of tuberculosis	Asian index cases										All other cases										
	Total contacts					New cases					Total contacts					New cases					
	No. of index cases	Closeness of contact	No.	Contacts per index case	No. of index cases	New TB No.	%	Chemoprophylaxis %	Closeness of contact	No.	Contacts per index case	New TB No.	%	Chemoprophylaxis %	Closeness of contact	No.	Contacts per index case	New TB No.	%	Chemoprophylaxis %	
Respiratory																					
Smear positive	5	Close	9	1.8	190	—	—	Close	638	3.4	36	5.6	17	2.7	—	—	—	—	—	—	—
Culture positive	10	Casual	28	5.6	91	—	3.6	Casual	1323	7.0	6	0.5	8	0.6	—	—	—	—	—	—	—
Culture negative	5	Casual	16	3.4	113	—	—	Casual	250	2.7	2	0.6	2	0.8	—	—	—	—	—	—	—
Pathological diagnosis	—	Close	5	1.5	24	—	—	Close	177	2.5	1	0.6	—	—	—	—	—	—	—	—	—
No bacteriology	9	Casual	12	2.4	69	—	—	Casual	260	2.3	—	—	—	—	—	—	—	—	—	—	—
Non-respiratory	19	Close	—	—	97	—	—	Close	268	2.4	—	—	—	—	—	—	—	—	—	—	—
Sub-totals according to closeness of contact		Close	—	—	243	—	—	Close	50	2.1	—	—	—	—	—	—	—	—	—	—	—
		Casual	10	1.1	584	—	—	Casual	69	4.6	—	—	—	—	—	—	—	—	—	—	—
		Close	10	1.1	584	—	—	Close	107	1.5	1	0.9	1	0.9	—	—	—	—	—	—	—
		Close	60	3.2	97	—	—	Casual	116	1.7	3	2.6	1	0.8	—	—	—	—	—	—	—
		Casual	59	3.1	97	—	—	Close	120	1.2	1	0.8	—	—	—	—	—	—	—	—	—
		Close	118	2.5	584	—	—	Casual	67	0.7	—	—	—	—	—	—	—	—	—	—	—
		Casual	125	2.6	584	—	—	Close	1425	41.4	40	2.8	20	1.4	—	—	—	—	—	—	—
		Casual	125	2.6	584	—	—	Casual	2020	58.6	10	0.6	10	0.5	—	—	—	—	—	—	—
Total	48		243	5.1	584	—	2.1		3445	59.0	50	1.5	30	0.9	—	—	—	—	—	—	—

Table 4 Cases of tuberculosis found among 3688 contacts related to time of diagnosis, age, sex and vaccination status (NTB=New TB; CPX=chemoprophylaxis)

Characteristics of contact	All contacts of Asian index cases												All contacts of all other index cases					
	Initially new cases			3 months new cases			6 months new cases			Contacts examined			Initially new cases		3 months new cases		6 months new cases	
	NTB	CPX	Contacts examined	NTB	CPX	NTB	CPX	NTB	CPX	NTB	CPX	NTB	CPX	NTB	CPX	NTB	CPX	
Age (years)																		
0-4	—	—	42	—	—	—	—	—	—	—	—	10	6	2	1	—	—	—
5-14	—	—	37	—	—	—	—	—	—	—	—	11	11	4	2	—	—	—
15-24	—	1	42	—	—	—	—	—	—	—	—	4	2	2	2	1	—	—
25-44	—	—	75	—	—	—	—	—	—	—	—	8	—	2	2	—	—	—
45-64	—	—	42	—	—	—	—	—	—	—	—	4	2	—	—	—	—	—
65+	—	—	5	—	—	—	—	—	—	—	—	1	1	1	1	—	—	—
Sex																		
Male	—	—	116	—	—	—	—	—	—	—	—	18	6	6	3	—	—	—
Female	—	1	127	—	—	—	—	—	—	—	—	20	16	5	5	1	—	—
Vaccinations																		
BCG	—	1	62	—	—	—	—	—	—	—	—	11	5	2	3	1	—	—
No BCG	—	—	134	—	—	—	—	—	—	—	—	26	17	8	5	—	—	—
BCG status not known	—	—	47	—	—	—	—	—	—	—	—	1	—	1	—	—	—	—
Total	—	1	243	—	—	—	—	—	—	—	—	38	22	11	8	1	—	—

Table 5 Cases of tuberculosis found among 3445 non-Asian contacts according to various characteristics of the contact (NTB=New TB; CPX=chemoprophylaxis)

Characteristics	Total contacts	Type of tuberculosis						Contacts given CPX	
		Contacts with NTB		Respiratory smear positive	Other respiratory	Non-respiratory	Contacts given CPX		
		No.	%				No.	%	
Age (years)									
0-4	249	12	4.8	—	12	—	7	2.8	
5-14	638	15	2.4	—	14	1	13	2.0	
15-24	538	7	1.3	3	4	—	4	0.7	
25-44	1092	10	0.9	3	7	—	2	0.2	
45-64	616	4	0.6	—	4	—	2	0.3	
65+	312	2	0.6	1	1	—	2	0.6	
Sex									
Male	1448	24	1.4	4	17	—	9	0.6	
Female	1997	26	1.5	3	25	1	21	1.1	
Vaccinations									
BCG	1543	13	0.8	5	8	—	8	0.6	
No BCG	1627	35	2.2	2	32	1	22	1.6	
BCG status not known	275	2	0.7	—	2	—	—	—	
Total	3445	50	1.4	7	42	1	30	1.0	

represent disease reactivation unrelated to the initial contact. Either of these explanations would be supported by the observation that the more remote diagnoses of tuberculosis in contacts are frequently non-infectious and often related to non-infectious index cases (6,8,10). The truth could be revealed in the future by applying 'DNA fingerprinting' or RFLP techniques to the organisms isolated from index cases and their contacts, however remote (16). The number of Asian index cases in the present study is small but our findings do not suggest that Asian contacts should be subjected to different screening procedures than non-Asians. The stability of our Asian population may explain the lower incidence of disease in both Asians and their contacts when compared with other studies (8).

This study also illustrates the extreme importance of screening the young; 54% of cases in contacts occurred in those aged 14 years or under and 88% in those aged under 45 (Table 4). This risk was greatest in those aged 0-4 years where 4.8% of contacts developed disease (Table 5). As in our previous report (1) we have demonstrated that BCG continues to exercise a protective effect of about 60% which compares favourably with values of 68% and over 70% in two British Thoracic Association surveys (10,17).

This study also documents some important negative findings. Screening of close contacts of all index cases other than smear-positive respiratory index cases is shown to be unrewarding. It cannot be recommended as a routine procedure except in clinical situations where there is a high index of suspicion that a source case may be found (15). Screening of casual contacts is also shown to be unrewarding, although a small number of cases was detected by screening very large numbers of casual contacts of smear-positive respiratory index cases. Extensive screening of all such casual contacts cannot be justified on rational or economic grounds (15). We suggest that screening of casual contacts of smear-positive respiratory index cases be restricted to those at particular risk e.g. children or the immunosuppressed and to contacts of highly infectious cases following 'the stone in the pond' principle (18). This is in keeping with the recommendations of the Joint Tuberculosis Committee of the British Thoracic Society (9).

In conclusion, we have demonstrated that contact procedures for tuberculosis continue to be effective in

identifying new cases of tuberculosis in Edinburgh. Most cases occur in the younger age groups, particularly children, and are detected within the first 3 months of screening the close contacts of sputum smear-positive respiratory index cases.

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