TUBERCULOSIS SURVEY IN SCHOOL-CHILDREN IN THE CALDER VALLEY

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Since the turn of the century different investigators have conducted surveys to determine the state of tuberculin sensitivity of different communities and races. Many of these older inquiries were originally of great epidemiological value but have become somewhat dated by the passage of time. Some of the more recent medical literature has assisted in presenting a picture of the changing epidemiological pattern during the past 50 years. Yet criticism has been directed against a number of these publications on the grounds that there has been a somewhat arbitrary selection of material and that the investigated groups are not necessarily representative samples of the community—namely, out-patients at tuberculosis clinics, in-patients in children's or chest hospitals, etc. A further problem in the interpretation of many results has been the striking lack of uniformity in technique and equipment employed by the various workers.

In 1949 the Medical Research Council decided to embark on a large-scale national survey to determine the level of tuberculin sensitivity among the school population in different regions in the country and to couple this with a miniature x-ray film of each tuberculin-tested child. The West Riding County Council of Yorkshire expressed its willingness to participate and co-operate with the M.R.C. in this venture.

There appeared to be two methods of approach in organizing this inquiry: the investigation of all scholars from a number of *selected* schools spread over a large region, or from *all* schools in a much smaller area of the county. After some deliberation it was decided to pursue the latter course, and thus an intensive survey of the entire school population of one divisional public health area of the West Riding of Yorkshire was adopted as our local policy. The Calder divisional public health area was selected. This is essentially rural in character but industrial in population. The reason for this apparently contradictory statement is that the area covers over 60,000 acres, with a population of under one per acre. The bulk of the population is concentrated into the deep valleys. Most of the housing is of the back-to-back type, and much of it is actually built into the hillsides. Small factories and mills intermingle with the houses. The principal industry is textiles, with marginal farming on the upland slopes. The largest towns in the area are Sowerby Bridge and Todmorden, with populations of

approximately 20,000, and Hebden Royd, with a population of 10,000. A few statistics relating to 1948 will illustrate the general health of the population more adequately than any description.

Birth rate	16.4 per 1,000
Death rate	14.7 per 1,000
Infant mortality	39 per 1,000 live births
Tuberculosis morbidity (all types notified)	460 per 100,000
Tuberculosis morbidity (respiratory notified)	245 per 100,000
Mortality due to pulmonary tuberculosis	30 per 100,000
Mortality due to pulmonary tuberculosis (England and Wales)	44 per 100,000

Method of Investigation

The technique was that prescribed by the M.R.C. Tuberculosis Survey Committee for all areas involved in the national survey. The interscapular area of each child was cleansed with acetone and then gently stroked six times with a 1-in. (2.5-cm.) wide strip of flourpaper (*British Medical Journal*, 1950; Dick, 1950). A "V" was then written with tuberculin jelly on the abraded zone of the child's back, and this was covered with adhesive plaster. The results were read 48 to 72 hours later by one of us (G. A. W.) to ensure uniformity. Findings were regarded as positive when there was an area of oedema with surrounding erythema at least 5 mm. in diameter at the site of application of the jelly. In subjects who failed to give a positive response a further test (intradermal) with 1 mg. of old tuberculin, 1/100 dilution, was undertaken. Here the standards of interpretation were those adopted by Aronson (1933) and the Prophit Survey Report. Each child had a miniature (35 mm.) film taken, interpreted by one of us (S. K.), and if any abnormality was detected this was followed by a large chest film. All children showing abnormalities on the large skiagram had a full clinical investigation carried out by one of us (B. M.).

TABLE I

	No.
Total school population	6,532 (100%)
Permission received for investigation	5,805 (88.7%)
School population mass x-rayed and tuberculin-tested	5,552 (95.6%)
Defaulters	253

The entire schoolchild population of the Calder Valley area were invited to participate in this survey and 85% were investigated (Table I); this represents 95.6% of the children who expressed their willingness to co-operate in this inquiry. In an area with a total population of 57,454, about 20% of which is grouped in small rural communities of 50 to 1,000, this response must be regarded as extremely satisfactory.

Results

The results following tuberculin-testing according to age groups and without differentiation of sex are shown in Table II and Fig. 1.

1. The sex incidence of positive reactors is shown in Fig. 2.

Reactor Rate and Location of Schools in the Calder Valley Area.—The 49 schools in this public health area were subdivided into three groups—urban, rural, or mixed (urban and rural) schools, depending on their geographical distribution in the district. On analysis no significant difference in the tuberculin reactor rate was to be noted in children of corresponding ages attending any one of the above three groups of schools.

Reactor Rate and Location of Scholars' Homes.—An inquiry was then made into the geographical distribution of the home of each schoolchild. The scholar's place of residence was classified into one of three types of homes—urban, rural, or mixed. Here again no significant difference

FIG. 1.—Results following tuberculin testing.

TABLE II

Age	1 Jelly- Positive	2 Mantoux- Positive	3 Tuberculin- Positive (1+2)	4 Tuberculin- Negative	5 No Mantoux Done. Jelly- Negative	6 Positive Reactors $\frac{3}{3+4+5}$
5	110	15	125	466	44	19.68
6	114	20	134	438	24	22.48
7	127	28	155	390	27	27.09
8	129	37	166	312	33	32.48
9	142	44	186	266	14	39.9
10	192	38	230	268	14	44.92
11	182	29	211	245	24	43.95
12	214	35	249	259	26	46.62
13	245	56	301	217	24	55.53
14	221	41	262	165	19	58.74
15	100	7	107	46	5	67.72
16	48	7	55	11	1	
17	23	4	27	2	0	
18	4	0	4	0	0

FIG. 2.—Analysis of tuberculin levels in males and females.

was observed in the reactor rate in children of corresponding ages living in a home in an urban, a rural, or a mixed area.

Value of 1/100 Mantoux Test.—An attempt was made to assess the value and limitations of the second tuberculin test (Mantoux 1/100) in determining the magnitude of any further

group of reactors who failed to show a positive response to tuberculin jelly. As is shown in column 5 of Table II, a small number of children in each age group who were negative to a jelly patch test failed to attend for the subsequent intradermal injection of 1/100 old tuberculin. The total number of Mantoux reactors in column 2 of Table II was therefore adjusted by computing the proportion of expected Mantoux reactors among each age group of jelly-negative children who failed to attend for their intradermal test, and adding these to the number of previously determined Mantoux reactors (see column 2, Table II).

The proportion of children who reacted to the Mantoux test after failing to respond to tuberculin jelly varied from 3% to 11.4% (Table III).

TABLE III

Age	Adjusted Total Mantoux Reactors	Total Children	% Jelly Negative but Mantoux Positive
5	19	635	3.0
6	24	596	4.0
7	34	572	5.9
8	46	511	9.0
9	48	466	10.3
10	41	512	8.0
11	33	480	7.0
12	39	534	7.3
13	62	542	11.4
14	45	446	10.0

Radiological Findings

The results of the radiological examination are shown in Table IV. One of the most striking findings was in the

TABLE IV

	No.	Per 100,000
Total children x-rayed	5,552	
Active primary pulmonary tuberculosis*	9	162
Pleural thickening	4	72
Probable bronchiectasis with/without atelectasis	14	252
Pulmonary or hilar calcification	18	324
Abnormalities of cardiac mass	2	—
Congenital bony anomalies	3	—

*Includes grossly enlarged hilar glands, epituberculosis, or lobar collapse due to glandular pressure on a bronchus.

group of 14 children with radiological evidence of probable bronchiectasis, 11 of whom had either a complete absence of symptoms or symptoms of so trivial a nature as to be regarded as insignificant by the parents.

Observations

One very surprising feature that emerged from the survey was the high tuberculin reactor rate noted in the early years of school life, and indeed throughout the entire life of the schoolchild in this area. These figures are considerably higher than those of Jones-Davies (1950) in the County of Radnor, Heimann and Paterson (1945) in Bournemouth, Fleming (1943) in Glasgow, and Thompson (1947) in Ealing. Moreover, what is perhaps even more remarkable is the difference between our findings in the Calder Valley area and those of two wholly urban areas in Yorkshire—Hull and Leeds—where similar investigations were conducted (McDowell, personal communication) (Table V and Fig. 3).

TABLE V

Age	Leeds Children	% Positive Reactors	Hull Children	% Positive Reactors	Calder Valley Children	% Positive Reactors
5	314	9.55	280	11.07	635	19.68
6	301	8.97	311	13.18	596	22.48
7	287	18.82	360	17.33	572	27.09
8	289	18.68	319	19.43	511	32.48
9	307	23.45	293	21.5	466	39.9
10	315	25.4	352	32.38	512	44.92
11	306	30.72	291	31.27	480	43.95
12	296	33.78	305	33.77	534	46.62
13	290	37.59	274	36.86	542	55.53
14	296	43.24	327	40.06	446	58.74
15	—	—	—	—	158	67.72

It will be noted that in the Calder Valley public health area the tuberculin reactor rate is between 9 and 19% higher in each age group than in Hull or Leeds. This remarkable finding is dealt with below. Generally one has been led to expect a much higher incidence of reactors in an urban area, where human pulmonary tuberculosis is a greater risk owing to overcrowding and poverty (Bradbury, 1933; D'Arcy Hart and Payling Wright, 1939).

Possibly the explanation of our findings lies in the relatively primitive methods of dairy farming which are prevalent in this area of the West Riding. Herds are often tiny, consisting of as few as 6 to 20 beasts. In many instances most of these small herds are retained by the owner-farmer for a season and then sold privately or on the market. Such cattle, because of their temporary ownership, are termed "flying herds," and anything more than a cursory supervision of the cattle is in these circumstances difficult. Moreover, the owner-farmer bulks his liquid milk into churns and often operates simultaneously as manufacturer, wholesaler, retailer, and transporter of his commodity. As much as 80% of all milk consumed in the Calder Valley area is untreated, only a very small proportion being tuberculin-tested or pasteurized, apart from that now supplied to the schools under the milk-in-schools scheme. Furthermore, we understand (Ministry of Agriculture, personal communication) that about 40% of cows in this area are positive tuberculin reactors. In the two urban regions of Leeds and Hull, however, both medical officers of health inform us that virtually all milk consumed in these towns is either tuberculin-tested or subjected to heat treatment.

In the small population of the Calder Valley area it is impossible to estimate accurately the incidence of bovine infection, and we submit the statistics in Table VI without comment.

FIG. 3.—Comparison of results obtained in the Calder Valley with those of Hull and Leeds.

TABLE VI

	Notified Cases of Primary Abdominal Tuberculosis	Cases per 100,000 of Population
Calder Valley	4	7.02
Leeds	7	1.39
Hull	7	2

An additional point meriting brief consideration is the notified incidence of respiratory tuberculosis (245 per 100,000) in the Calder Valley area as compared with the County Borough of Leeds, where the corresponding morbidity rate is much higher, being 507 per 100,000. Yet despite the difference in the pulmonary tuberculosis notification rates in these two areas we have evidence that the former region has a substantially higher tuberculin reactor rate in each age group.

Furthermore, we have observed a much lower radiological incidence of pulmonary calcification in the Calder Valley (0.324%) than in the Leeds survey (1.05%). We must, therefore, endeavour to reconcile the apparent paradox of a low radiological pulmonary calcification rate and high tuberculin reactor rate in the Calder Valley with the higher pulmonary calcification rate and lower reactor rate of Leeds.

We think that there is some circumstantial evidence to suggest that the high reactor rate in the Calder Valley is largely due to the high percentage of infected and untreated milk which is consumed by the child population in their homes, etc., and outside the milk-in-schools scheme. These conclusions are similar to those of Coutts (1947), who was also impressed by the high reactor rate in children in the rural areas of Cambridgeshire as compared with that of children in the town of Cambridge, where only treated milk was consumed.

Conclusions

In the Calder Valley public health area 58.74% of children are tuberculin reactors by the age of 14. No significant difference in the reactor rate was noted between the sexes, or among children attending urban, rural, or mixed schools, or those residing in homes geographically situated in urban, rural, or mixed areas. It is suggested that this high incidence may be due to bovine infection from the consumption of untreated milk.

In the five-year to seven-year age groups the Mantoux 1/100 intradermal test succeeded in revealing only a further 3% to 6% of reactors. Among the older age groups (8-14 years) 7% to 11.4% of children negative to tuberculin jelly gave positive reactions with 1/100 old tuberculin.

Radiological evidence of active primary or pulmonary tuberculosis was noted in 0.16% of children in the Calder Valley.

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Medical Memoranda

A Case of Prostatic Abscess

The rupture of a prostatic abscess into the rectum has been regarded as a dread complication which should be prevented by surgical intervention. This view is often expressed in surgical textbooks (Wakeley and Hunter, 1943; Attwater, 1948; Bailey and Love, 1948; Romanis and Mitchiner, 1948; Riches, 1950), and it also appears in textbooks of venereology (Marshall, 1944; McLachlan, 1947; Willcox, 1950).

On the other hand, venereologists who have had experience of this admittedly rare contingency have noted (Burke, 1940) that the patient whose prostatic abscess points and is allowed to open into the rectum does extremely well and usually makes an uninterrupted recovery: proctitis, either gonococcal or non-specific, may be a sequel, but with penicillin and the sulphonamides this is now prevented or rapidly cured.

Because of these divergent views the following case report may be of interest.

CASE REPORT

The patient, a bachelor aged 44, attended the special treatment centre at St. Bartholomew's Hospital because of a urethral discharge. He had been treating this at home for seven months by irrigations with potassium permanganate solution.

In the last few weeks he had experienced gradually increasing frequency of micturition, burning on micturition, and pain on defaecation. Just before his attendance he was passing urine eight to ten times each night.

Examination showed a thin, ill, and apprehensive patient. His temperature was 99.4° F. (37.4° C.), pulse 100. He had a purulent urethral discharge, smears from which showed many leucocytes and mixed organisms. No gonococci were grown on urethral culture. Examination of a wet film of the urethral discharge in saline showed no trichomonads. Blood Wassermann and Kahn reactions as well as the complement-fixation test for gonorrhoea were negative. Rectal examination showed a large, boggy, tender mass protruding into the rectum. On micturition the urinary stream was narrowed; both glasses of urine were hazy, with much debris in the first. A diagnosis of prostatic abscess was made.

As the patient refused admission to hospital he was started on out-patient treatment with procaine penicillin, 600,000 units being given daily by intramuscular injection: in addition 5 g. of "sulphatriad" was given daily by mouth. He was instructed to rest at home in bed. By the second day his temperature was normal and remained so. By the third day he felt easier, the frequency had decreased, and defaecation was painless. Rectal examination showed the prostate to be less tender but larger than before. His urinary stream was still narrowed, and both glasses of urine contained pus, the second being completely opaque.

The patient was persuaded to enter hospital. The procaine penicillin was continued in the same daily dosage, and supplementary crystalline penicillin, 250,000 units daily, was administered by intramuscular injection. Sulphatriad was continued, 1 g. being given four-hourly.

On the patient's sixth day in hospital rectal examination showed the abscess to be larger, soft in the centre, and pointing into the rectum. The stream on micturition had narrowed further, but the urine was now clear.

On the seventh day surgical drainage was considered in order to prevent rupture of the abscess into the rectum; but the same day the patient passed "about a cupful" of pus when going to stool, showing that rupture had occurred.

Rectal examination the following day showed the prostate to be smaller and firmer, particularly the left lobe; pus was