faeces can often be felt on abdominal palpation. The condition is really a very severe dyschezia due to bad bowel habits, sometimes originating from defaecation fears due to pain of an anal abrasion or fissure. Absence of enuresis should exclude any psychological factor.

On the other hand, a true case of Hirschsprung's disease may be overlooked in infancy when it presents all the features of lower intestinal obstruction. The most likely disorder with which it is apt to be confused in the immediate neonatal period is meconium ileus, the infantile variety of fibrocystic disease.

The only common blood disease which may lead the doctor astray is leukaemia, since it may first appear in various obscure ways—as a case of serious anaemia, agranulocytosis, purpura, generalized adenitis—or give rise to bone pains from subperiosteal deposits and be mistaken for rheumatism.

Only two neurological difficulties will be discussed. Todd's paralysis after an epileptic fit may persist for quite an appreciable time and cause anxiety in respect of some organic lesion of the central nervous system. "Otitic" or "toxic" hydrocephalus is a mysterious complaint which has quite often been confused with a brain tumour. No one could be blamed for subjecting a child to ventriculography and even more drastic measures when headache and vomiting with papilloedema are so striking. It is true there may be no localizing signs, but these are not invariably present with a centrally placed neoplasm. There seems to be no way of avoiding this mistake.

Finally, Still's disease may be puzzling when it arises with little or no arthritis, and merely with an irregular undulating fever, a rash, and a neutrophil leucocytosis. The possible diagnoses will then be legion. Alternatively, pericarditis may be present at the onset and rheumatic fever would then seem to be the correct diagnosis. It is perhaps not generally known that rheumatoid arthritis in childhood may first attack one joint alone. The fever, leucocytosis, and toxic state of the child will naturally lead to fear of a pyogenic arthritis, and the doctor in charge feels impelled to explore the joint for pus. The subject of Still's disease should not be left without referring to polyarteritis nodosa, which runs a very similar course.

Overpopular Diagnoses

Bronchiectasis is certainly diagnosed too readily. If there is a persistent productive cough, steps should always be taken to exclude a chronic sinus infection or segmental pulmonary collapse. Glandular fever is the other popular diagnosis which is consistently made on insufficient evidence. If adenitis is confined to the cervical region, tonsillar sepsis is a much more likely cause. Recently we have also been told that a glandular-like fever with eosinophilia but a negative Paul-Bunnell reaction may in fact be toxoplasmosis, an infection which is apparently commoner than we thought.

Finally, I would like to issue two warnings. One is against calling a child hysterical until all other possible causes have been excluded. Serious diseases can begin in this way. Meningitis, for instance, in children may produce most curious temperamental changes. Once I was very nearly misled in a case of subacute bacterial endocarditis. It arose in an excitable rheumatic girl of 12 years who was suddenly struck dumb on seeing her mother after an interval of three weeks. Apart from an old mitral lesion there was nothing else to discover. I was sorely tempted to consider the whole affair an hysterical outburst, but somehow refrained from this. There soon followed a right-sided hemiplegia which proved fatal, and the loss of speech was due to a small embolus in Broca's area.

It is easy to place too little significance on clinical features, but one can err in the opposite direction. Children have been confined to bed for months on end for a continued mild pyrexia—a "ninety-niner" it could be called—with no symptoms, no signs, no leucocytosis, a normal sedimentation rate, and all investigations negative. Surely the

advice here is to throw the thermometer out of the window and allow the child to get up.

So ends what I have to say. My remarks have probably been of little value. Growing children rarely profit by the mistakes of others; they have to make their own experiences. I wonder if adults are any better, even those who belong to our profession.

Congreve was indeed wise when he wrote, "Error lives ere reason can be born."

A "FOLLOW-UP" CHEST X-RAY SURVEY IN THE RHONDDA FACH

I. PULMONARY TUBERCULOSIS

BY

A. L. COCHRANE, M.B., B.Ch., D.P.H.

Member of the Scientific Staff, Pneumoconiosis Research Unit of the Medical Research Council, Llandough Hospital, near Cardiff

IN COLLABORATION WITH

J. GLYN COX, M.R.C.S., L.R.C.P.

Consultant in Chest Diseases, Pontypridd and Rhondda District

AND

T. FRANCIS JARMAN, M.D.

Medical Director, Mass Radiography Service, Welsh Regional Hospital Board

Techniques for evaluating the effect of various therapies on groups of individuals have recently been much studied and most effectively applied both in the tuberculosis and in other fields. This report attempts the more difficult task of evaluating the effect of preventive medicine on a community.

In 1950-1, as the first step in a long-term investigation of the aetiology of progressive massive fibrosis (the more serious form of coal-workers' pneumoconiosis), 89.0% of the inhabitants of the Rhondda Fach over the age of 15 were x-rayed (Cochrane *et al.*, 1952). In addition, owing to the ready co-operation of the Welsh Regional Hospital Board, we were able to offer immediate admission to hospital to all "active" cases. In this way the inhabitants of the valley may be said to have received "radical" therapy for tuberculosis.

It will be argued by some that the technique would have been more radical if B.C.G. had been given to all those whom we found to be tuberculin-negative at the time of the first survey. This was not done for two reasons: (1) we did not think the evidence in favour of B.C.G. so convincing that it would be unethical not to vaccinate the tuberculin-negative, and (2) we were particularly anxious to measure the "conversion" and "reversion" rates. Tuberculin-negative children under 5 years of age were, however, given B.C.G. if they were "contacts," while older "contacts" were similarly vaccinated if their parents so wished.

In 1953, during the second stage of the investigation, the community was again x-rayed, and we are therefore in a position to measure the changes in the death rate and prevalence rate of tuberculosis and measure the attack rate of infection.

It is, however, impossible to cover all this in detail in one report. The epidemiology of pneumoconiosis,

including a discussion of the relationship between tuberculosis and progressive massive fibrosis—the main object of the scheme—has in general been reserved for a separate publication, and further papers will deal with such subjects as the results of tuberculin-testing and the factors influencing the attack rate of tuberculosis.

General Description and Plan of Work

(1) First Survey

We were conscious that there were some errors inherent in the techniques used at the time of the first survey, so advantage was taken of the second survey to reduce them. Fortunately, however, the errors discovered were small, but they necessitated some slight modifications of the results we published in 1952. In this report, the tables and diagrams incorporate these corrections.

(2) Between the Surveys

All those who were thought to be suffering from active tuberculosis were hospitalized, with two exceptions, at the time of the first survey. As expected, it was not found possible to keep all the infectious cases in hospital. After the first few months there were nearly always 40 known infectious cases in the valley, between the two surveys, who were carefully supervised by the health visitor.

Figs. 1 and 2 show the death rates from pulmonary tuberculosis amongst the men and women in the valley between 1949 and 1953. In Fig. 2 the female death rates are compared with those for the rest of the Rhondda Urban District (population 111,389), which is also predominantly a mining area.

The rates for women show (a) that the tuberculosis mortality in the Rhondda Fach was originally higher than in the rest of the R.U.D.; (b) that at the time of the first survey there was a slight rise (this was possibly due to more accurate notification of cause of death); and (c) that after

FIG. 1.—Crude tuberculosis death rates in the Rhondda Fach.

FIG. 2.—Comparison of tuberculosis death rates among females in the Rhondda Fach with those in the rest of the Rhondda Urban District.

the survey the death rate fell rapidly and was actually zero in 1953. The figures are small (Table I), but encouraging so far as they go. The rates for non-miners are very similar.

The figures for miners and ex-miners are possibly less depressing than they appear. Shortly after the survey started, another research project led to an ever-increasing proportion of miners and ex-miners in this area upon whom a post-mortem examination had been made. In 1953, more than 50% of such men who died had a post-mortem examination. This is very satisfactory from one point of view, but the increasing appearance of tuberculosis in the death certificates is al-

TABLE I.—Deaths from Pulmonary Tuberculosis in the Rhondda Fach, 1949–53

	Estimated Population	1949	1950	1951	1952	1953
		No. %/1000	No. %/1000	No. %/1000	No. %/1000	No. %/1000
Females	13,464	8 5.9	11 8.2	6 4.5	2 1.5	0 0.0
Miners and ex-miners	6,513	7 10.7	5 7.7	7 10.7	9 13.8	8 12.3
Non-miners	6,207	3 4.8	4 6.4	2 3.2	0 0.0	1 1.6

most certainly related to the increasing proportion of necropsies. It must be remembered that only 1% of cases of progressive massive fibrosis (P.M.F.) give a positive sputum in life (Cochrane *et al.*, 1952), while nearly 40% are positive bacteriologically at necropsy (James, 1954). It is not surprising, therefore, that the rates for miners and ex-miners have not shown the same fall as those for the females. However, it seems clear that mortality from tuberculosis among miners and ex-miners will remain a serious problem in South Wales long after it has virtually disappeared amongst the others.

(3) Second Survey

This second survey had three main objectives: (1) to reinforce the effect of the first survey in controlling tuberculous infection in the area; (2) to evaluate the effect of the first survey; and (3) to reduce the errors inherent in some of the techniques used in the first survey.

(4) General Method of Work

Our general approach was very similar to that used during the first survey, but the following changes were introduced: (a) We were, on this occasion, interested in two overlapping populations, the defined 1950–1 population (Population A), of which a nominal roll was made, and the 1953 population (Population B), which was defined by private census just before the survey started. This was found preferable to our previous use of corrected electoral rolls. (b) A records card (Fig. 3) was completed for everyone in the valley, in addition to the M.M.R. cards and P.R.U. industrial histories. They were also used for checking against the two populations, and were later coded and used as a basis for a punch-card analysis.

One point in connexion with the analysis must be stressed. The year of birth was punched in each case, but, as the time interval between the two surveys was 2 years 7 months (2.6 years), it was impossible to carry out an analysis by age at the time of each survey without either overestimating or underestimating the age at the time of the second survey in relation to that at the first survey. We have chosen, in effect, to overestimate the age (by 0.4 years) at the time of the second survey, and allowance for this must be made when interpreting some of the figures and tables.

Details of our methods of work are given in the Appendix.

Results

(1) The Defined Population

The two populations were in general defined as consisting of those of 5 years of age and over who were living in each town at the end of the survey there.

Some points, however, require greater definition. The survey did not take place at a single point in time; it lasted several months. It was therefore decided to consider the population as a composite one. The population of each town was defined as those inhabitants who were alive at the end of the survey in that particular town. The concept "inhabitant" also needed clearer definition. We were chiefly interested in these populations from the point of view of infection, so the time spent at home was the most important factor. We therefore excluded those who were in the armed Forces or who were "working away" unless they came home regularly at week-ends.

DATE OF BIRTH		SEX		POP. Card No.		AB CONTACT		OCC		PK		PMF		Tb		M		S	
1 2		M F		1 2 3 4		O NO YES		1 2 3 4		1 2 3 4		1 2 3 4		1 2 3 4		1 2 3 4		1 2 3 4	
5 6 7 8 9		10 11		12 13 14 15		16 17 18 19		20 21 22 23		24 25 26 27		28 29 30 31		32 33 34 35		36 37 38 39		40 41 42 43	
44 45 46 47 48		49 50 51 52		53 54 55 56		57 58 59 60		61 62 63 64		65 66 67 68		69 70 71 72		73 74 75 76		77 78 79 80		81 82 83 84	
85 86 87 88 89		90 91 92 93		94 95 96 97		98 99 100		101 102 103 104		105 106 107 108		109 110 111 112		113 114 115 116		117 118 119 120		121 122 123 124	

FIG. 3.—The records card designed for use in the follow-up survey.

The Population B is analysed in Fig. 4. In Table II Population A is compared with Population B and also with our previous estimate. The differences between the two estimates of Population A are small (59 in the case of men and 31 in the case of women).

Lewis-Faning (1953) compared the age distribution of our survey population with that of Wales as indicated by the

FIG. 4.—Rhondda Fach. Defined population at time of 1953 survey.

preliminary figures of the 1951 Census, and suggested that either the population of the Rhondda Fach diverged markedly from that of Wales as a whole, or we had not completely enumerated its population.

However, on re-checking our population we were not able to discover any source of error, and, indeed, subsequent publication of the 1951 Census County Report of Glamorgan (Registrar-General, 1954) showed the age distribution of the Rhondda Urban District (of which the Rhondda Fach is a part) to be very similar to that which we published.

(2) Population X-rayed

The same criteria were used as in the previous survey—that is, the population x-rayed consisted of those who were over the age of 5 at the time of the survey, and of whom a technically acceptable radiograph had been obtained by one of the teams or by anyone else within six months of the survey, provided the film was either made available to us or had been read by some recognized authority. The remainder of the population were termed “lapses.” All films were read in duplicate and sputum investigations were carried out on a large scale. The 35-mm. films were read independently by two observers (T. F. J. and Dr. W. E. Miall) and the 14 by 14-in. (35 by 35-cm.) films by two pairs of observers (A. L. C. and Dr. Idris Davies, and Drs. P. J. Chapman and S. Rae).

Tables II and III summarize the percentage x-rayed in the two surveys. The differences are chiefly in the younger age groups, and are probably due to the better definition of the population on the second occasion. All prevalence rates refer to these x-rayed populations.

TABLE II.—Defined and X-rayed Populations 1950-1 and 1953

Age	Population 1950-1 as Measured Then			Population 1950-1 Corrected 1953			Population, 1953		
	%	No. X- rayed	No. in Popu- lation	No. in Popu- lation	No. X- rayed	%	No. in Popu- lation	No. X- rayed	%
Females									
5				1,000	929	92.9	1,072	1,054	98.3
10				1,005	942	93.7	977	960	98.3
15	(95.6)	(758)	(793)	972	903	92.9	990	964	97.4
20	93.0	787	847	887	807	91.0	867	824	95.0
25	94.1	994	1,056	1,041	970	93.2	906	866	95.6
30	92.5	889	961	977	903	92.4	1,047	985	94.1
35	92.2	913	990	982	903	92.0	904	833	92.1
40	91.0	810	890	896	817	91.2	952	856	89.9
45	88.5	785	888	898	779	86.7	852	767	90.0
50	87.5	770	880	885	775	87.6	867	761	87.8
55	86.8	645	743	743	631	84.9	787	684	86.9
60	78.6	503	640	654	509	77.8	690	567	82.2
65	59.2	751	1,269	1,260	750	59.5	1,430	968	67.7
Total	86.4	8,605	9,957	12,200	10,618	87.0	12,341	11,089	89.9
Total (20+)	85.6	7,847	9,164	9,223	7,844	85.0			
				9,164	7,847				
Error				59	3				
Males									
5				975	898	92.1	1,165	1,145	98.3
10				1,010	955	94.6	953	935	98.1
15	95.4	721	756	891	826	92.7	892	870	97.5
20	95.4	760	798	819	768	93.9	748	703	94.0
25	94.0	958	1,019	1,020	958	93.9	940	889	94.6
30	92.9	804	865	870	805	92.4	1,017	958	94.2
35	94.4	828	877	892	840	94.2	829	776	93.6
40	93.2	840	901	906	838	92.5	896	831	92.7
45	93.7	760	811	809	751	92.8	841	776	92.3
50	93.2	700	751	748	704	94.1	771	702	91.1
55	93.2	647	694	684	629	92.0	699	623	89.1
60	90.7	558	615	642	576	89.7	602	539	89.5
65	78.0	916	1,174	1,146	902	78.7	1,195	986	82.5
Total	91.7	8,492	9,261	11,412	10,450	91.6	11,548	10,733	92.9
Total (20+)	91.4	7,771	8,505	8,536	7,771	91.0			
				8,505	7,771				
Error				31	—				

The total age 20 and over was chosen for comparison between the two 1950-1 populations as the 15-19 age group excluded those still at school on the first occasion.

TABLE III.—Summary of Percentages X-rayed in the Two Surveys Over the Age of 5

	Population 1950-1 Corrected 1953			Population 1953		
	No.	No. X-rayed	%	No.	No. X-rayed	%
Males ..	11,412	10,450	91.6	11,548	10,733	92.9
Females ..	12,200	10,618	87.0	12,341	11,089	89.9
Total ..	23,612	21,068	89.2	23,889	21,822	91.3

TABLE IV.—*Females. Prevalence of Tuberculosis in the Rhondda Fach, 1950-1 and 1953*

Age	Survey 1950-1				Survey 1953			
	Pop. X-rayed	No. Infectious %	No. Active Including Infectious %	Quiescent and Active %	Pop. X-rayed	No. Infectious %	No. Active Including Infectious %	Quiescent and Active %
5	929	—	6 6.5	6 6.5	1,054	—	—	7 6.6
10	942	3 3.2	10 10.6	10 10.6	960	4 4.2	4 4.2	10 10.4
15	903	5 5.5	13 14.4	16 17.7	964	4 4.1	7 7.3	18 18.7
20	807	19 23.5	30 37.2	45 55.8	824	1 1.2	14 17.0	36 43.7
25	970	10 10.3	13 13.4	22 22.7	866	5 5.8	18 20.8	41 47.3
30	903	14 15.5	18 19.9	23 25.5	985	7 7.1	12 12.2	17 17.3
35	903	5 5.5	9 10.0	12 13.3	833	5 6.0	8 9.6	15 18.0
40	817	1 1.2	2 2.4	5 6.1	856	1 1.2	4 4.7	11 12.9
45	779	4 5.1	5 6.4	5 6.4	767	—	—	3 3.9
50	775	—	—	—	761	3 3.9	4 5.3	5 6.6
55	631	—	—	1 1.6	684	2 2.9	2 2.9	2 2.9
60	509	—	—	1 2.0	567	1 1.8	3 5.3	3 5.3
65	750	3 4.0	3 4.0	4 5.3	968	1 1.0	1 1.0	2 2.1
Total	10,618	64 6.0	109 10.3	150 14.1	11,089	34 3.1	77 6.9	170 15.3

Fig. 5 shows the percentage of miners, ex-miners, non-miners, and women who were x-rayed during the second survey. Although age appears to be the most important factor influencing the lapse rate, occupation and sex also appear to be important.

FIG. 5.—Percentage x-rayed in the second Rhondda Fach survey.

(3) Prevalence of Tuberculosis

(a) Prevalence of Tuberculous Infection.

The schoolchildren were again "Mantoux"-tested by one of us (T. F. J.), and Fig. 6 summarizes the results. The change appears satisfactory, but the results will be discussed in greater detail in a subsequent paper.

FIG. 6.—Results of tuberculin testing in the Rhondda Fach in 1950-1 and 1953. (In this figure the ages have been adjusted to correct for the error of 0.4 year.)

(b) Prevalence of Tuberculous Disease

The same standards of diagnosis were made as on the previous occasion. Fig. 7 and Table IV show the prevalence of infectious tuberculosis amongst the women at the time of the two surveys. It is clear that there has been a satisfactory fall. So far as miners are concerned, however, a similar decrease is seen only amongst the younger miners

FIG. 7.—Prevalence of infectious pulmonary tuberculosis in Rhondda Fach females.

and ex-miners (Fig. 8); in the higher age groups there has been a definite increase. The results for the non-miners are somewhat difficult to interpret owing to their atypical age distribution (Fig. 9).

Those who had a positive sputum at the time of the first survey have been analysed in terms of their status at the time of the second survey (Table V). This assists us to understand some of the changes that have taken place in the prevalence of pulmonary tuberculosis. The lower mortality rate among females as shown in Fig. 1 would, of course, tend to increase rather than decrease the prevalence of infectious pulmonary tuberculosis. The cause of the fall must therefore be looked for elsewhere. The females have the highest rate of conversion from "positive" to negative sputum, and this may very well be an important factor contributing to the fall in prevalence. The highest sputum conversion rate is found among females in the younger age groups, and the lowest among cases of P.M.F., which corresponds with general clinical experience in the area. Although these overall conversion rates are relatively high, the number of cases that remained positive after treatment certainly suggests that there is still room for great clinical advances. Amongst the males with positive sputum at the time of the first survey there were 12 cases of P.M.F. It is of great interest that only one of them died during the

TABLE V.—*Status in 1953 of the Infectious Cases at the Time of the 1950-1 Survey*

	No. of Infectious Cases 1950-1	Status of the Same Cases in 1953			No. who Left the Area
		No. Dead	No. Sputum Negative	No. Still Sputum Positive	
Males	48	7 14.6	19 39.6	20 41.7	2
Females	64	7 10.9	41 64.1	15 23.4	1

2.6 years between the surveys. This is very different from that found by Kilpatrick *et al.* (1954), who reported that 80% of such patients were dead in 2½ years. The difference may be partly due to the cases seen by Kilpatrick being

FIG. 8.—Prevalence of infectious pulmonary tuberculosis in Rhondda Fach miners and ex-miners.

FIG. 9.—Prevalence of infectious pulmonary tuberculosis in Rhondda Fach non-mining males (owing to small numbers in higher age groups these have been combined to give a smoother curve).

selected on the basis of severity or, more probably, to the effect of antibiotics which have been used in the treatment of our cases, and which appear to prolong life without, unfortunately, causing sputum conversion.

No marked changes could be expected in the total prevalence of all types of tuberculosis, as the main way of leaving the tuberculous population is the extremely slow one of progression from the group with "active" tuberculosis to that with "quiescent" disease, and finally to the group which has "arrested" disease. The small change in total prevalence that has occurred amongst females is shown in Fig. 10. It should, however, be stressed that, although the reduction in total prevalence of all types of pulmonary tuberculosis is small, the qualitative changes within this "tuberculous" population represent a very real improvement in the tuberculosis situation in the valley. A very important factor in causing changes in prevalence is, of course, the "attack rate" of new cases, which is considered below.

FIG. 10.—Prevalence of pulmonary tuberculosis in Rhondda Fach females.

(4) Attack Rate of Pulmonary Tuberculosis

This index measures the rate of appearance of shadows considered clinically to be tuberculous amongst those whose x-ray films were previously considered to be free of tuber-

culosis. Cases of definite simple pneumoconiosis (Categories 2 and 3) which developed early signs of progressive massive fibrosis are not included in this paper. They will be dealt with in a subsequent paper. The accuracy of such measurements depends mainly on the extent to which the original population has been followed up, and our results in this respect can conveniently be considered here.

Those who were x-rayed during the first survey fell into three groups at the time of the second survey: (1) those who had died in the interval, (2) those who had left the defined area, and (3) the survivors. The last-named could be further subdivided into those x-rayed again at the time of the second survey and those who refused.

The extent of the follow-up is shown in Table VI. It will be seen that 95% of the "surviving" men and women were x-rayed. This is shown diagrammatically in Fig. 11 for the women.

In order to calculate the attack rate on those whose x-ray films were considered normal as regards tuberculosis at the time of the first survey, those with active and quiescent

TABLE VI.—Summary Results of the "Follow-up" of Those X-rayed in 1950-1

	X-rayed 1950-1 (1)	No. Dead (2)	% of (1) (3)	No. Left Area (4)	% of (1) (5)	No. Remain- ing (6)	% of (1) (7)	No. Re- X-rayed (8)	% of (6) (9)
Females ..	10,618	168	1.6	650	6.1	9,800	92.3	9,315	95.1
Non-mining males ..	4,310	47	1.1	515	11.9	3,748	87.0	3,612	96.4
Miners and ex-miners ..	6,140	308	5.0	330	5.4	5,502	89.6	5,200	94.5
Total ..	21,068	523	2.5	1,495	7.1	19,050	90.4	18,127	95.2

FIG. 11.—Follow-up of females x-rayed in 1951.

lesions were excluded from the population of those x-rayed in 1950-1. When pulmonary tuberculosis was diagnosed during the second survey on 35-mm. film, and the records showed that the person concerned had been x-rayed and the x-ray considered normal on the previous survey, the two films were projected simultaneously and scrutinized by three readers. The technique was time-consuming but very satisfactory.

Fig. 12 shows the radiological attack rate of tuberculosis amongst women, non-miners, and miners and ex-miners whose films were read as "normal" for pneumoconiosis and tuberculosis at the first survey.

It is proposed to devote a later paper to a discussion of the attack rate of tuberculosis and the factors influencing it. We can, however, make the following points conveniently at this stage.

(1) We have clearly not succeeded in preventing the appearance of new tuberculous lesions, and owing to the

absence of any previous direct measurement of the attack rate in that area we cannot claim to have reduced it.

(2) Our figures in general confirm the pioneer measurements of attack rate made by Springett (1951), which are still the only ones available, as shown in Table VII. Superficially, too, it would appear that our attack rates are very

FIG. 12.—Annual radiological attack rate of tuberculosis in the Rhondda Fach.

similar to his in magnitude, suggesting that the first survey had little or no effect on the attack rate. It must, however, be remembered that Springett's data are not entirely comparable with ours. His measurements inevitably excluded those who, after a normal film, developed symptoms later and were

diagnosed at clinics or hospitals (Springett, 1951), which would lead, as he points out, to his attack rates being underestimates. In addition, Springett (personal communication, 1954) did not include in his series cases of uncomplicated primary type tuberculosis or pleurisy. This again would make his figures a considerable underestimate in relation to ours, which include both types. In Table VII

TABLE VII.—Annual Radiological Attack Rates of Tuberculosis per Thousand

Source of Data	Females		Males without Pneumoconiosis	
	Age 15-24	Age 25-34	Age 15-24	Age 25-34
Rhondda Fach surveys 1950-1 and 1953	2.8	0.7	4.7	1.0
Springett (1951). London	3.5	2.0	3.0	2.0
The same Rhondda Fach data but excluding uncomplicated primary type tuberculosis, pleurisy, and those who were diagnosed between surveys on account of symptoms	0.6	0.7	0.4	1.0

a crude attempt has been made to allow for these differences by excluding from our series (a) cases of uncomplicated primary type tuberculosis and pleurisy, and (b) those who went to the clinic between the surveys on account of symptoms. Such an approach, it must be stressed, is very crude, as the factors influencing people to go to the clinic in the Rhondda Fach after the first survey were probably very different from those influencing Civil Servants in London. The comparison does, however, suggest that the attack rate in the Rhondda Fach between the surveys was less than that of Civil Servants in London in 1946-9.

(3) The way in which the appearance of new cases is confined to the younger age groups suggests the possibility of selective follow-up when a community has already been carefully surveyed. In a community where there is no progressive massive fibrosis it would be very reasonable to restrict the follow-up to those under the age of 35. The one female "new" case over this age was a diabetic. It would, of course, be necessary to have a careful follow-up of all male minimal quiescent lesions as well.

Discussion

From the point of view of epidemiology in general, our most important finding is a purely technical one. We have shown that it is technically possible to follow up a population of 25,000 people with a relatively low lapse rate. We believe this to be of considerable importance in the field of experimental preventive medicine.

As regards the epidemiology of tuberculosis, the most important finding is the confirmation of Springett's work that the radiological attack rate of tuberculosis in the two

sexes has a very similar age distribution in spite of the marked differences between the sexes in the relationship of tuberculosis mortality to age. This suggests, as Springett pointed out, that the higher tuberculosis mortality now being experienced by males in the higher age groups is mainly caused by the breakdown of lesions acquired in early adult life.

From the point of view of practical tuberculosis control, our results are less striking than we had hoped but less depressing than we had feared. There was a marked fall in tuberculosis mortality amongst women and non-miners; there was a considerable reduction in the prevalence of infectious cases, particularly among the younger people, and there was probably a reduction in the attack rate of tuberculosis.

The effects of such community surveys have recently been reviewed (Cochrane, 1954). There is no other survey with which a detailed comparison can be made. Olsen (1953) showed that the mortality rate was halved but that there was relatively little change in the notification rate after an extensive survey in Bornholm. The greater fall in mortality achieved in the Rhondda Fach is probably due to the availability of antibiotics after the first survey (the first Bornholm survey was completed in 1940). No details are given of changes in attack rate or prevalence rate, so no further comparison is possible with Bornholm. It is, however, of interest that there is nothing to suggest that a greater effect was achieved in Bornholm, where B.C.G. was given on a large scale in addition to hospital treatment. Davies (1946) and Davies *et al.* (1948) reported very much more striking results. In one instance no new cases were found during six years after x-raying a community of 367 and only one new case in the three years following a community survey of 6,000 people. The differences between their results and ours are possibly due to a very much lower initial prevalence in the communities they x-rayed, but unfortunately there is little evidence available on this point.

There are some points in relation to the results which deserve more detailed discussion:

(1) Of the 112 infectious cases known to us at the time of the first survey, all but two had had treatment and many had had surgical treatment. In 1953 14 were dead and 35 were still sputum-positive. This is a rude reminder that the therapeutic battle is only half won.

(2) If, as now seems probable, the tuberculous lesion in the male has a relatively long period of latency before cavitating and becoming infectious, the problem, as Springett pointed out, is a serious one, as the numbers are large and the period of observation long. Progressive massive fibrosis, probably pathologically and certainly administratively, presents this problem in its most serious form. These lesions are very slowly progressive over long periods of time, but may at any time become very infectious. Chemotherapy has undoubtedly improved their prognosis *qua vita*, but sputum conversion is only rarely achieved, and is even more rarely permanent. This group is undoubtedly the most serious obstacle to the elimination of tuberculosis from the valley.

(3) The speed at which the tuberculosis mortality rate fell in the valley, while the overall prevalence was scarcely altered, indicates that the mortality rate by itself is not an adequate index of prevalence. In addition, as mortality approaches zero it becomes less and less sensitive as an epidemiological index. This underlines the need for a new index. It is improbable that notification rates, however complete they are made by "intimation" or other means, and however much the inter- and intra-observer error is reduced among chest physicians, will ever be really satisfactory. In the discussion of new indices, too little attention has been paid to deciding which epidemiological index one wishes to estimate. If mortality indices are unsatisfactory, the only alternatives are attack rates, and no one would suggest it as a satisfactory routine measure.

Prevalence rates are not such a valuable measurement from the point of view of preventive medicine as attack rates, because changes in them are often rather difficult to interpret, since they vary directly with the attack rate and

inversely with the case fatality rate; but when the case fatality rate is low—as it soon will be in tuberculosis—they are much more satisfactory. They will, in any case, measure the administrative and social load on the community. Prevalence, unlike the attack rate, can, theoretically, be measured relatively accurately by x-raying a random sample of the community, and the way is thus open for obtaining a satisfactory index for various parts of the country. Whether this is a practical possibility can, of course, be decided only by actual experience.

(4) The relation between the effort put into the Rhondda Fach surveys and the results obtained should give other workers some idea of the effort required to eliminate tuberculosis from the country.

Summary

Part of the second stage of a field experiment in the Rhondda Fach to investigate the effect of reducing tuberculous infectivity upon the rate of appearance of progressive massive fibrosis in miners is described.

The valley was re-surveyed in the summer of 1953. On this occasion we succeeded in x-raying 91.3% of the new population over the age of 5, and 95% of those who had been previously x-rayed and who were still resident in the valley. The prevalence of infectious tuberculosis as compared with the figures at the time of the first survey (1950-1) shows a marked fall amongst the women and a lesser fall amongst the younger men. There has been a slight increase amongst the older miners and ex-miners.

The tuberculosis mortality for women and non-miners has fallen sharply between the two surveys. The same trend is not shown for miners and ex-miners.

In spite of ample hospital accommodation, 35 (amongst whom were 10 cases of progressive massive fibrosis) of the 112 cases which were infectious in 1951 were still infectious in 1953, and 46 new cases of tuberculosis developed in the valley between the two surveys.

APPENDIX

A. General Method of Work

As a result of our previous experience, we relied mainly on home-visiting as a means of persuading people to be x-rayed. Only one broadcast appeal was made, and there was little publicity in the Press. The actual x-raying was done between April 7 and July 31, 1953. In spite of the holidays which inevitably interfered with the survey, this was found preferable to the previous winter survey.

The staff was considerably enlarged in comparison with the previous survey. The Welsh Regional Hospital Board supplied two M.M.R. teams for most of the duration of the survey, and the Medical Research Council's P.R.U. team was assisted by two teams who were being trained for work with the National Coal Board. The x-raying was done at five main centres in the valley, at each of which there were (1) a mobile 35-mm. unit, x-raying the schoolchildren; (2) a "fixed" 35-mm. and a "fixed" 14 by 14 in. (35 by 35 cm.) unit in the centre of the town, x-raying women, non-miners, and ex-miners; and (3) a mobile 14 by 14 in. unit at the pithead x-raying miners. Slight modifications were introduced at each centre to suit local conditions. At the main centre, x-raying was continuous from 10 a.m. until 10 p.m., for women, children, ex-miners, and non-miners. On several occasions the mobile x-ray van (35-mm. film) was taken into the streets, but the results were less spectacular than expected.

We were, on this occasion, interested in two overlapping populations: (1) the "defined" population, of 1950-1 (Population A), and (2) the new population of those living in the same geographical area in 1953 (Population B). For Population A, a typewritten nominal list was prepared from our previous records in street number order, including name, initials, address, and previous x-ray number for those x-rayed in the first survey. Population B was obtained by a

private census which antedated the survey by about two weeks. The technique proved highly satisfactory—much superior to our previous technique with electoral rolls.

A card was designed (Fig. 3) giving details of both surveys. These cards were completed at the three centres for everyone x-rayed, in addition to the usual M.M.R. cards and P.R.U. industrial histories. These cards were then sent from all four x-raying units to a central bureau, where they were sorted by streets and then checked first against Population B and then against Population A lists. Owing to the details available about each person, a very accurate check was possible. In the case of any doubt the person was visited. This served as a check on the accuracy of both Populations A and B. Those not marked as x-rayed on Population B were visited and, when possible, persuaded to be x-rayed. This proved a very much more difficult task than on the previous survey. This was possibly due to the lack of propaganda, but that was not our impression. Subsequently, Population A was checked against Population B, and the addresses of all those not marked as x-rayed or as refusals on the second survey were visited to discover whether the person was dead, had left the area, or whether there had been a mistake on one or other of the populations. Later, Population B was checked against Population A to discover, in the case of those members of Population B not x-rayed during the second survey, whether they were in Population A, and, if not, where they were living at the time of the previous survey. All this involved a great deal of home-visiting, but led to a great increase in accuracy in the definition of both populations.

The punching of the material on Hollerith cards and the subsequent analysis were carried out under the supervision of Mr. R. G. Carpenter, of the Pneumoconiosis Research Unit.

B. Radiographic Technique

The P.R.U. work was done under the supervision of Mr. W. G. Clarke. The P.R.U. mobile van was re-equipped with a Siemens four-valve unit with an output of 125 kV and 500 mA. The tube-cassette stand was specially designed for use in a van and ensured that the tube was always correctly centred to the film. Exposures were controlled by the "ionomat," the new automatic exposure control which incorporates an ionization chamber to measure the x-radiation reaching the film. The processing of the films in the van was done using the N.R.D. automatic processing unit. Electrical power was supplied by a mobile diesel generator of large capacity, 32 kVA. This also supplied power for the heating of the tents and a second mobile van which was used for film reading. This unit operated at the pithead.

A second unit, a Victor KX8, which had been installed in the van for the first survey, was assembled in the various halls and chapels and was used for the examination of ex-miners. Large film retakes, requested by the M.M.R. unit, were also taken on this unit. Power was supplied for this unit by a generator with the same output as that supplying the van.

M.M.R. units were installed in the same halls and staffed by the mass radiography service of the Welsh Regional Hospital Board, under the administrative direction of Mr. John H. Phillips. These units were responsible for the examination of women, children, and non-miners. The M.M.R. technique was exactly similar to that described for the first survey.

The proximity of the two units introduced the possibility of excessive scatter radiation affecting the staff. This was overcome by the use of lead screens. That this was effective was shown by checks made on dental film worn by the staff and measured by the N.P.L.

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Chest Clinic, the National Coal Board, and the National Union of Mineworkers; and especially to the members of the two teams who gave such devoted service, and to the men, women, and children of the Rhondda Fach, without whose co-operation the scheme would have been impossible.

We express our thanks for the assistance given by the members of the Local Advisory Committee of the Rhondda Fach Scheme, and in particular to the members of its executive subcommittee. The views expressed in the paper are, however, our own and not necessarily those of the members of the Committee.

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AORTIC ANEURYSM DUE TO TUBERCULOUS LYMPHADENITIS

BY

C. G. ROB, M.C., M.Chir., F.R.C.S.

AND

H. H. G. EASTCOTT, M.S., F.R.C.S.

From the Surgical Unit, St. Mary's Hospital, London

The term "mycotic aneurysm" was first used by Osler in 1885 when he described a patient with multiple aneurysms of the aorta secondary to what he termed "malignant mycotic endocarditis." Since then a group of diseases have been named the mycoses, and so the word "mycotic" has been given another meaning in addition to its original one. To-day the accepted definition of a mycotic aneurysm is one due to septic infection in the wall of an artery; it is usually associated with bacterial endocarditis. The mode of formation of a mycotic aneurysm depends upon whether it is of the embolic or of the erosive type. If embolic, an infected embolus lodges in the vessel or in one of its vasa vasorum, and the inflammation, by weakening the arterial wall, causes it to give way with the formation of an aneurysm. If erosive, the inflammation spreads from the aortic valve or from a coarctation to the adjoining aorta, or, much less frequently, it comes from an extravascular source and weakens the vessel wall by spreading from the adventitia inwards.

In this paper we describe a case in which a mycotic aneurysm of the abdominal aorta developed owing to erosion of the aortic wall by tuberculosis of the pre-aortic lymph nodes.

Case Report

The patient was aged 59. Two months before admission to St. Mary's Hospital he noticed a pain in his back; this was a constant ache, worse at night, and was gradually getting more severe. He also suffered from pain in his calves and feet; this was worse when he stood up and relieved by rest in bed. He had occasional attacks of vomiting. Two weeks before admission he noticed a pulsatile swelling in his abdomen which was rapidly enlarging. He consulted Mr. A. Emllyn Williams at the Hampstead General Hospital, who considered that he had an aneurysm of the abdominal aorta and referred him to us for treatment.

He gave a past history of two bouts of pulmonary tuberculosis occurring respectively nine years and two years previously. Nine months before admission he had a cold abscess of the chest wall treated surgically at the Brompton

Hospital. One of his brothers had died of pulmonary tuberculosis and one of his daughters also suffered from this disease.

On admission the scar of the operation on the chest wall was soundly healed and x-ray examination showed no evidence of an active pulmonary lesion. He was seen by Dr. W. D. W. Brooks, who considered that the pulmonary disease was quiescent. Examination of the abdomen revealed a slightly tender mass in the epigastrium situated just above and to the left of the umbilicus; this pulsated in an expansile manner and was considered to be an aneurysm of the aorta. Apart from a mild urinary infection, no other abnormality was detectable on clinical examination. Aortography (performed by Dr. David Sutton) demonstrated an aneurysm of the abdominal aorta between the renal arteries and the aortic bifurcation (Fig. 1).

FIG. 1.—Pre-operative aortogram showing an aneurysm of the abdominal aorta.

At this stage the patient exhibited two unusual features as compared with the usual case of abdominal aortic aneurysm which we treat with a blood-vessel graft. He had an evening temperature of 100° F. (37.8° C.) and the aneurysm was unusually large clinically when compared with the size shown on the aortogram. The pyrexia was at first thought to be due to the urinary infection, but although this infection cleared with treatment the pyrexia persisted. In view of these findings and his previous medical history it was considered possible that he suffered from tuberculosis of the abdominal lymph nodes as well as an aneurysm of the aorta.

At operation a large mass of caseating tuberculous lymph nodes was found to be adherent to the anterior and lateral walls of an aortic aneurysm. At one point the aneurysm was very thin walled and about to rupture. The whole mass and the aneurysm were resected, the inferior mesenteric artery was tied, and continuity was restored by means of a prosthesis of "orlon" cloth. Orlon cloth was used in preference to an arterial homograft because the graft bed consisted in part of tuberculous tissue, and it was felt that this might spread and involve a graft.

The patient made a satisfactory recovery from the operation, and was discharged from hospital to a convalescent home one month later. There he completed a twelve-weeks course of streptomycin and P.A.S.

On examination of the specimen the resected portion of aorta was seen to have a moderate degree of atheroma; many enlarged caseating lymph nodes surrounded a saccular aneurysm. Microscopical examination demonstrated tuberculous granulation tissue with much central caseation abutting on the outer surface of the aorta, replacing the adventitia