

Pulmonary Tuberculosis Resulting from Extra-Familial Contacts*

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IN recent years, numerous epidemiological studies have shown that tuberculosis not infrequently occurs in several members of a family. The disease may attack as many as four generations. The frequency with which multiple cases have occurred within a given household has tended to obscure the importance of contacts outside the immediate household.

In mass surveys there is not the opportunity for individualization of cases that is necessary to discover extra-familial sources of infection. Rural communities with low death rates from pulmonary tuberculosis have afforded excellent opportunities for demonstrating the importance of extra-familial contact in the spread of tuberculosis in the community. Downes has shown that extra-familial contact has played an important part in the spread of tuberculosis in a rural community.¹

The Massachusetts Department of Public Health recently conducted a 5 year survey on the control of tuberculosis in Berkshire County in Western Massachusetts. This county was considered to be representative of a rural community in New England and has next to the lowest death rate from

pulmonary tuberculosis of any county in the state. It was during these studies that our attention was focused on the importance of extra-familial contact in the spread of tuberculosis in the community. Figure 1 is a graphic representation of the spread of tuberculosis among several families as a result of extra-familial contact. The solution of this situation required a considerable period of time and a careful evaluation of certain obscuring factors. For this reason, the circumstances and clinical facts will be described in some detail.

In March, 1935, and August, 1936, two cases of pulmonary tuberculosis were reported in a small community of approximately 4,000 persons. Both cases were high school girls, aged 18 and 16 respectively. They were the only young persons in their respective homes. Members of family "A" were examined and were found to have no evidence of tuberculosis. Family "B" refused examination at the time but were examined subsequently and found to be entirely negative for tuberculosis. There was no history of tuberculosis in either of the families as far back as they could recall. Both households used raw milk from tuberculin tested herds. The milk supply was obtained from different dairies. The two girls were not "chums" but did attend the same high school.

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EXTRA-FAMILIAL SPREAD OF TUBERCULOSIS IN A RURAL COMMUNITY

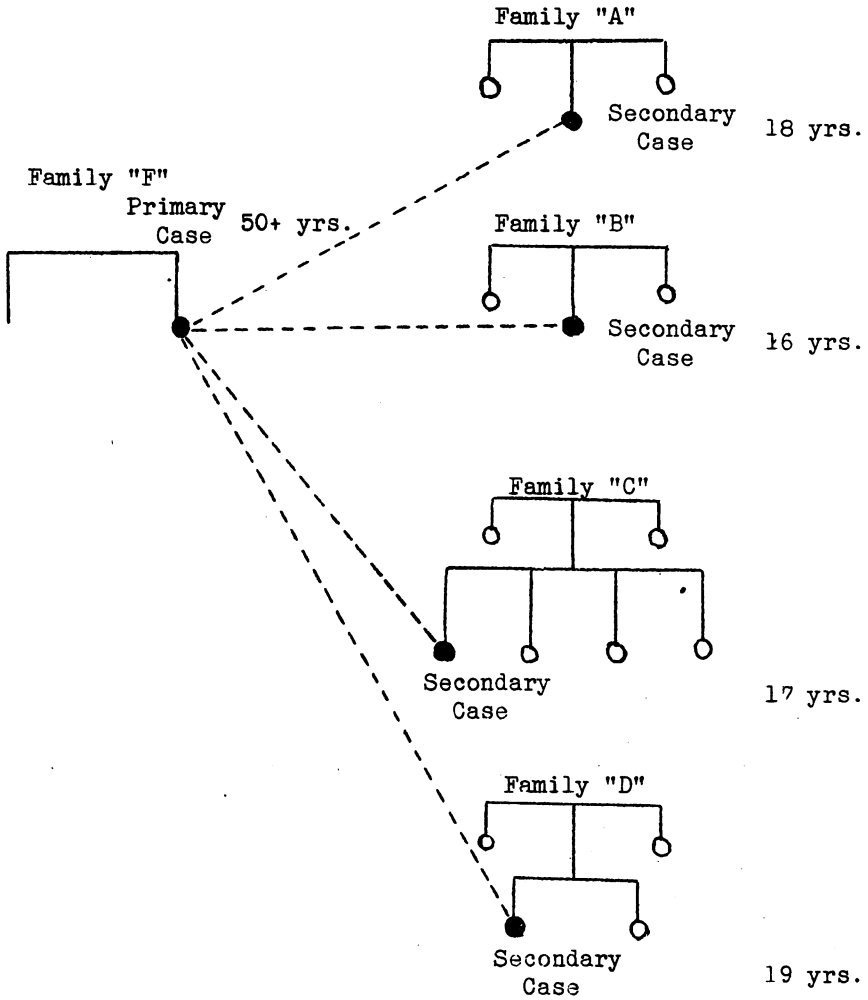


FIGURE 1
PROTOCOL

	<i>Date of Onset Approx.</i>	<i>Age of Onset (Years)</i>	<i>Present Status of Case</i>	<i>Year H. S.</i>	<i>Sputum</i>	<i>Family</i>	<i>Choir</i>
C. K.	March, 1935	18	Dead	1934-1935	Positive	"A"	1934-35
M. W.	August, 1936	16	Arrested	1934-1936	Negative	"B"	1935-36
S. W.	April, 1937	17	In San.	1933-1937	Positive	"C"	1935-36-37
M. H.	December, 1937	19	Dead	1933-1937	Positive	"D"	1934-37
Mrs. D.	Unknown	50+	In San.	-	Positive	"F"	1933-36

A check with the school physician gave all of the teachers a clean bill of health, with the possible exception of

one. The latter had suffered from pulmonary tuberculosis two years prior, but was discharged from the sanatorium

as an arrested case. Further investigations in the community caused some doubt in the mind of the investigator regarding the teacher's physical condition, because several of the pupils complained to their parents that this teacher coughed during her classes.

The school physician made several sputum examinations, all of which were negative for tubercle bacilli. The charge that the teacher was a source of infection for the two girls did not seem justifiable in view of the repeated negative sputum reports and her denial of symptoms. Certainly the burden of proof was upon the person who said there was a causal relationship between the new cases and the teacher.

The situation rested at this stage until April, 1937, when the investigator was requested to see a patient in consultation. The patient was found to have pulmonary tuberculosis. She was a 19 year old girl who had been graduated from the same high school in 1936. Careful inquiry revealed that she had had little or no contact with either of the other girls at school. She had, however, during the time she was in school taken two courses given by the teacher who was under suspicion. A check-up by x-ray in her family revealed no evidence of active tuberculosis in any of the members, nor was there any family history of the disease. Again the evidence pointed to someone in the high school as a potential source of infection for these three girls. The teacher, aware that she was under suspicion and being somewhat embarrassed by the persistent questioning by the school physician, returned to the sanatorium outside the state for a check-up where she had formerly received treatment. A negative report was received by the school physician from the sanatorium.

Thus the situation remained until December, 1937, when a second request for consultation was received. This

time the patient was another high school girl aged 17. She had pulmonary tuberculosis. She, too, had had the same teacher in some of her classes. She knew all three of the girls but denied close friendship with them. Her family was examined by x-ray by a local physician who reported negative findings. Subsequent examination of these films confirmed the original report. At this stage there seemed to be almost overwhelming evidence that these girls had had a common source of infection, and the logical place to search seemed to be in the high school.

Further revisits were made to the families for the purpose of rechecking their contact histories. All families had used raw milk from tuberculin tested herds, but only two of the families took milk from the same dairy. It was during one of the visits to family "C" that a casual remark was made relative to a certain church which opened a new approach to the problem because it was known that family "A" attended the same church. Visits were made to families "B" and "D" and it was discovered that both of them also attended this church.

This was a remarkable coincidence. A rough statistical calculation placed the church under strong suspicion on the basis that in the school population considerably less than one-half of one case would be expected to have occurred by chance among this religious denomination if the source of infection were in the school. Thus attention was directed away from the high school. Inquiries were made regarding attendance of these girls at the church, which revealed that three of them sang in the choir and that all four of them had attended social functions at the church on numerous occasions.

A careful check-up of the reported cases and deaths in the community failed to show any of them to be members of this church.

During the investigations relative to the church membership it was learned quite by accident that the wife of the former minister in this parish had developed pulmonary tuberculosis and had entered a sanatorium in another state within 3 months after leaving this parish, early in 1936. This rumor was checked and found to be authentic. In fact, at the time of her admission to the sanatorium her pulmonary condition was advanced and her sputum was markedly positive. Further inquiry revealed that the minister's wife also sang soprano in the choir and took communion from a common cup before three of the girls who sang in the choir, as well as before the fourth who was not a choir member. Thus a common source of infection was found for these four girls in their fellow church member. On the basis of x-ray, sputum examination, and statistics, the school teacher, an arrested case, was eliminated from suspicion.

DISCUSSION

Aside from determining the true source of infection for these four girls, several other factors of epidemiological significance in the spread of tuberculosis in a community are manifested. It is well known that the commonest age at which death from tuberculosis in women occurs is between the ages of 20 and 25. There is also evidence at the present time to show that the age of highest mortality from tuberculosis is gradually shifting to the older age groups.² In this particular instance the range in age was from 16 to 19 years. All cases were girls, again revealing the importance of sex. We have in their age and sex two factors which have to be considered as contributing toward their susceptibility to pulmonary tuberculosis. A further factor of im-

portance so far as the spread of disease in a community is concerned is that three of these girls had positive sputum at the time the diagnosis was made. Two of them were moderately advanced and two were far advanced at the time of diagnosis. There was a high fatality rate. Two of the girls have already died from the disease, while one remains in a sanatorium, and the fourth has been discharged from a sanatorium as an arrested case.

Although three of these girls sang in the soprano section of the choir, while the fourth did not, there was ample opportunity for contact between the fourth girl and the tuberculous wife of the minister through social functions and the Sunday School. It was ascertained that these contacts were regular, usually once or twice a week, over a period of several years. The question of the use of the common communion cup is a "moot" one. It is reasonable to suppose that droplet infection through the contact at choir practice and social functions might well be sufficient to result in active disease in susceptible individuals such as girls of this age group.

The dosage of infection was probably fairly large if consideration is given to the cumulative effect resulting from frequent exposures at fairly regular intervals.

CONCLUSION

Failure to find a source of infection within a household should not preclude further attempts at finding the source case.

REFERENCES

1. Downes, J. How Tuberculosis Spreads in a Rural Community. *A.J.P.H.*, 26, 1:30, 1936.
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