

A STUDY OF THE EFFECTIVENESS OF CERTAIN ADMINISTRATIVE PROCEDURES IN TUBERCULOSIS CONTROL¹

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THE necessity of measurement of the effectiveness of public health procedures can scarcely be questioned even though precise and complete evaluation offers many difficulties. Measurement is of especial importance in the field of tuberculosis control. A declining mortality and a possibly declining prevalence of infectious cases or the reverse situation in the individual community may change the need for certain procedures. To be most effective a program for control of the disease must be adapted to the changing needs within the given locality. Also, the fact that a considerable proportion of the public health budget is used for the prevention of tuberculosis presents a definite challenge to the administrator to see that the money appropriated is wisely expended.

To ascertain the effectiveness of a given procedure in the tuberculosis program it is necessary (1) to define the objective or objectives of the procedure in as precise terms as possible and (2) to test the accomplishment of the objective by comparison with the results of other procedures having the same objective or by comparison with suitable controls. This study is an attempt to show how some of the values of administrative procedures within a given community may be tested. Various methods of case finding, the isolation of the positive sputum case, and the results of change in policy regarding the education of the patient in respect to tuberculosis may be appraised through the analysis of records which should be available to the administrator for his constant use.

¹ From the Milbank Memorial Fund.

Acknowledgments are made to the Cattaraugus County Department of Health and to the New York City Department of Health for access to the records and especially to Dr. John H. Korns, director of the Bureau of Tuberculosis, Cattaraugus County Department of Health, whose interest and cooperation have facilitated the study.

CASE FINDING

Case finding is a fundamental procedure in the control of tuberculosis no matter what type of community is considered. Its primary objective is to discover the unknown foci of infection and those cases which may become foci of infection. There are the more usual methods of finding cases, such as case reporting by the practicing physicians, diagnostic clinic examination of persons with suspicious symptoms, and examination of family contacts. There are also supplementary ways of case finding, such as tuberculin testing and X-raying of school children and other population groups. It is advisable to test these methods to see which are most effective in attaining the objective in a given community.

Data showing the results of the various ways of case finding utilized in Cattaraugus County may be used to illustrate most strikingly the effectiveness of these methods in this particular community. Figure 1 shows for the period 1928-1932 the proportion of persons

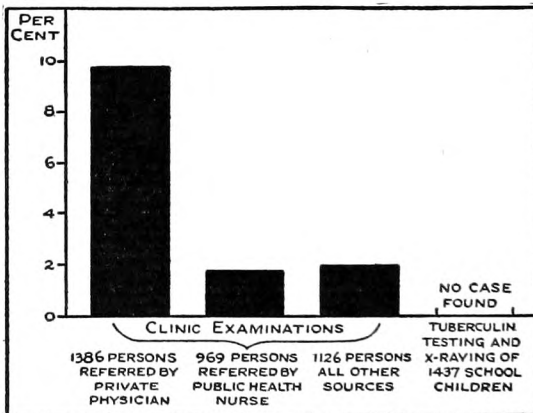


Fig. 1. A comparison of the proportion of persons found to have adult pulmonary tuberculosis through the various referring agencies of the diagnostic clinic and the tuberculin testing of school children in Cattaraugus County, New York, 1928-1932.

persons found to have adult pulmonary tuberculosis in the clinic groups referred by practicing physician, public health nurse, and "all other sources" compared with the result of finding such cases by means of tuberculin testing and X-raying a random sample of the school children. No new cases of adult pulmonary tuberculosis were discovered among the 1,437 children surveyed in the schools. From 2 to approximately 10 per cent of persons referred to the diagnostic clinic had adult pulmonary tuberculosis. It is plainly

evident that the diagnostic clinic has served more effectively in the discovery of cases which may be spreaders of the disease than the method of surveying school children of all ages.

This analysis was made early in 1933 and as a consequence Dr. Korns, director of the Bureau of Tuberculosis in Cattaraugus County, has attempted to make the case-finding program more effective by requiring careful selection of persons referred from miscellaneous sources (designated as "all other" on the chart) and by substituting the X-raying of a limited age group (high school juniors and seniors) for the more general survey of school children of all ages.² Two cases of active adult pulmonary tuberculosis, both in the minimal stage, were discovered among 1,112 high school juniors and seniors X-rayed during the year 1935. There can be little doubt of the wisdom of discarding case finding among the entire school population in this particular area and substituting for it the examination of a selected group, high school juniors and seniors, since at these ages the incidence of active disease is known to be relatively high.

Data drawn from the tuberculosis clinics of the Bellevue-Yorkville Health Center in New York City for the year 1931 are available for a comparison of case finding in various clinic groups and are shown in Figure 2. There were two distinct clinics at Bellevue-Yorkville: one a consultation clinic which admitted for examination and diagnosis only persons referred by private physicians; the other a district clinic which admitted persons referred by public health and visiting nurses, social agencies, and other agencies. The upper part of Figure 2 shows that the most highly selected group for case finding was that composed of persons referred by private physicians to the consultation clinic where 17 per cent of 1,729 persons was found to have pulmonary tuberculosis contrasted

² The clinic group referred by public health nurses is made up almost entirely of first examination of family contacts among whom the yield in cases will not be great at a limited time period. It was not considered necessary to limit this group but rather to extend it by securing examination of all family contacts.

with slightly less than 5 per cent among persons referred to the district clinic.

When persons examined in the district clinic are classed accord-

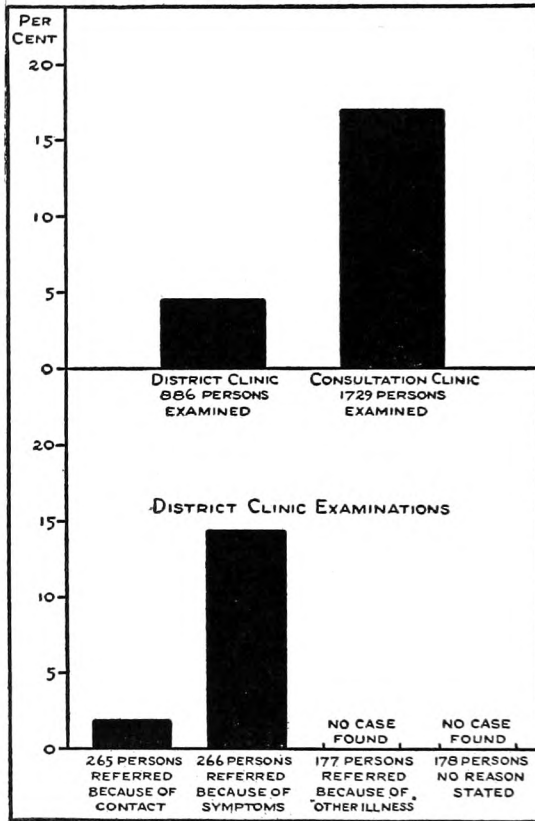


Fig. 2. A comparison of the proportion of persons found to have adult pulmonary tuberculosis through examinations made in the district clinic and the consultation clinic in the Bellevue-Yorkville district of New York City, 1931.

all contacts in different types of families in New Haven was made by Dr. H. R. Edwards, then director of the Bureau of Tuberculosis, and Miss Unzicker, supervisor of tuberculosis in the Visiting Nurses'

³ Under "symptoms of tuberculosis" the following complaints were classed: fatigue or worn-out feeling, loss of weight, cough with or without sputum, dyspnea, hemorrhage, fever, night sweats, and cold of unusual duration (two weeks or longer). The following complaints were classed as "other illness": pain in back, side, or abdomen; grippe; acute cold; indigestion; and dizziness.

ing to the reason for being referred, as shown in the lower part of the chart, it is evident that active pulmonary tuberculosis was found only among those who were contacts to cases or were examined because of symptoms suggestive of tuberculosis.³ These two groups are important for case finding and include only 60 per cent of the 886 persons examined. Thus by more careful selection of patients 40 per cent of those attending clinic could safely have been excluded from examination for tuberculosis.

An analysis of the cost of case finding among

Association.⁴ The families were divided into three groups: (1) those in which the index case was pulmonary tuberculosis, (2) families in which the index case was a child with a positive tuberculin, and (3) those in which the index case was one of tuberculous meningitis. The authors considered that pulmonary tuberculosis of the adult type was the significant finding in each group and concluded that from the standpoint of the dollar invested there was justification for placing emphasis upon case finding among family contacts in groups (1) and (3) but that families in which the index case is a positive reactor to tuberculin do not warrant intensive study or search for tuberculosis cases.

These examples drawn from Cattaraugus County, Bellevue-Yorkville, and New Haven illustrate the importance of the evaluation of the results of various procedures for case finding utilized in individual communities.

ISOLATION OF THE POSITIVE SPUTUM CASE AS A MEANS
OF PREVENTING THE SPREAD OF INFECTION

More and more emphasis is being placed on sanatorium care for the infectious case of tuberculosis not only for purposes of cure but also for the prevention of the spread of infection among persons in the home and in the community. The extent to which this latter objective has been attained is capable of some measurement in an area such as Cattaraugus County. Families in which the primary or index case with a positive sputum was reported or diagnosed within a recent period of time may be compared with a similar group of families drawn from an earlier period. In these two groups only families in which there were persons under 20 years of age may be considered.

During the period 1931 to October, 1935, there was a total of forty-one families in which the primary case had a positive sputum and in which there were family members under age 20. The rate of

⁴ Edwards, H. R. and Unzicker, Grace: A Cost Analysis of Clearing Tuberculosis Family Contacts. The Milbank Memorial Fund *Quarterly*, October, 1934, xii, No. 4, pp. 306-316.

tuberculous infection among persons 0-19 in these forty-one families may be compared with the rate at similar ages in a group of fifty-one families drawn from the period 1923-1930 in which the primary case had a positive sputum. The fifty-one families are believed to constitute a representative sample of the total families in which a case of infectious disease was reported or discovered during the period 1923-1930.⁵

Among the forty-one families for the period 1931 to October, 1935, 88 per cent of the contacts under 20 years of age was tuberculin tested contrast-

Table 1. Tuberculous infection rate among persons 0-19 years of age exposed to a positive sputum case in fifty-one families (1923-1930) contrasted with those at similar ages exposed in forty-one families in a more recent period of time (1931-October, 1935).

Family Groups	Total Family Contacts Tuberculin Tested (0-19 Years of Age)	Total Positive to Tuberculin	Rate per 100 Persons
Group I (51 families) (1923-1930)	120	89	74.2 ± 2.63
Group II (41 families) (1931-Oct. 1935)	83	45	54.2 ± 3.69
Difference			20.0 ± 4.56

ed with 70 per cent of persons at similar ages in the fifty-one families drawn from the period 1923-1930.⁶ The infection rate as shown in Table 1 for the fifty-one families (1923-1930) was 74.2 contrasted with a rate of 54.2 per 100 persons under 20 years of age in the forty-one families. If these rates are adjusted for age the difference is even greater, 74.2 compared with 51.6 per 100 persons aged 0-19 years.⁷ The difference in the infection rate for the two groups of families (20.0 ± 4.56) is more than four times its probable error and may be

⁵ The sample was selected in the following manner. All new active cases reported in the County during the years 1923-1930 were classified according to residence, by individual towns or townships for the rural part of the County, and by each of the two urban areas. It was desired to draw from this material a sample of 100 tuberculous families which would be representative of all areas of the County. Names were accordingly drawn at random from the various lists according to the proportion of the total population resident in the various civil units. In fifty-one of these families the primary or index case had a positive sputum and there were children under 20 years of age in the home.

⁶ All persons tested were given the intracutaneous test with 0.1 mgm. of Old Tuberculin.

⁷ Ratio adjusted to the combined population of the two groups of families.

considered as statistically significant since such a difference will arise by chance less often than once in a hundred times.

That this decline in the infection rate is probably associated with an improvement in the extent to which sanatorium care was obtained for the infectious cases and the speed with which they were hospitalized may be shown by a comparison of the two groups of families. In the fifty-one families (1923-1930) 70 per cent of the infectious cases had sanatorium care contrasted with 80 per cent of those in the forty-one families (1931-October, 1935). There was a marked difference in the speed with which sanatorium care was secured for the cases in the two groups. Within one month after diagnosis or reporting, 76 per cent of the total cases having treatment in the forty-one families was in the sanatorium contrasted with 44 per cent in the families drawn from the earlier period; 31 per cent of the infectious cases treated in the fifty-one families remained in the home for more than a year before sanatorium care was secured contrasted with only 9 per cent in the other group.

Whether or not the procedure of isolation of the infectious case in the sanatorium has altered the extent of the spread of infection in the community can hardly be answered precisely from the available data. However, among 1,062 children under 16 years of age not known to have had contact with positive sputum cases and tuberculin tested in the clinics in the County during 1928-1930, 166, or 15.6 per cent, had a positive reaction contrasted with 4 per cent of 753 children tested in the clinics in 1933-1935.⁸ The two groups had a comparable age distribution and it is believed that the difference in these rates offers some evidence that the spread of tuberculous infection in the community is being lessened.

CHANGE IN PERIOD OF TIME WITHIN WHICH CONTACTS ARE EXAMINED

One of the important procedures for the control of tuberculosis is the examination of family contacts to tuberculosis cases. It has two objectives, that of case finding or seeking the source of infection of

⁸ From the Annual Report of the Cattaraugus County Department of Health, 1935.

the first case noted in the family, and supervision in order to prevent the spread of serious disease among the family members. Securing the examination of family contacts is usually considered the responsibility of the public health nurse. However, in Cattaraugus County in recent years the director of the Bureau of Tuberculosis himself has undertaken a definite part of the education of the individual patient with respect to the nature of tuberculosis as an infectious disease. Both in the clinic and in the sanatorium the patient has been made aware of the importance of the prompt examination of the family contacts. It was believed that this would facilitate the work of the public health nurse in the home and it is interesting to see whether or not there has been improvement in the promptness and completeness with which these examinations have been secured in recent years compared with the past.

For such a comparison, records for the families of all new active cases reported during the period January, 1932, to October 1, 1935, and an additional nineteen families in which an active case was reported in 1931, comprising a total of 118 families, may be contrasted with a sample of eighty-seven families drawn from the period 1923-1930.⁹ Since four and one-half years is the longest possible period of observation for any of the families drawn from the more recent period, the examination of contacts for the sample of eighty-seven families is limited to 4.5 years after the diagnosis of the index case in the family.¹⁰

Table 2 shows the total number of contacts, according to age, in each of the two groups of families and the per cent of contacts examined. The proportion of contacts under 20 years of age examined is approximately the same for both groups of families. However, 57 per cent of the adult contacts 20 years or older was examined in the Group II families (more recent period) contrasted with 33.3

⁹ For method of selection of the sample see footnote 5.

¹⁰ The two groups of families were found to be comparable with respect to the following: the proportion in which the index case was pulmonary or non-pulmonary tuberculosis, the proportion with positive or negative sputum, and the position of the case in the household.

per cent of contacts in the same age group in the families drawn from the earlier period. Some improvement is noted in the proportion of total contacts examined in families in Group II contrasted

Table 2. Per cent of contacts examined in eighty-seven families in which the index case was diagnosed during the period 1923-1930 compared with 118 families in which the index case was diagnosed during the period 1931-October, 1935.

Family Groups	Total Contacts	Contacts Examined	Per Cent Examined
Under 20 Years of Age			
Group I (1923-1930)	203	143	70.4
Group II (1931-Oct. 1935)	182	127	69.8
Over 20 Years of Age			
Group I (1923-1930)	195	65	33.3
Group II (1931-Oct. 1935)	248	141	56.9
All Ages			
Group I (1923-1930)	398	208	52.3
Group II (1931-Oct. 1935)	430	268	62.3

with those in the sample of eighty-seven families, namely, 62 per cent compared with 52.

When the examined contacts are distributed according to the interval of time between the report of the primary or index case in the family, and the first examination of the contacts as shown in Table 3, considerable difference between the Group I and Group II families is noted. Only 48 per cent of the examined contacts in the

Group I families (1923-1930) had the first clinic examination within six months after the index case in the family was known, contrasted with 87 per cent in the Group II families. In the Group I families, approximately 19 per cent of the examined contacts had a first examination two years or more after the index case was known, and for only 3 per cent of contacts examined in the Group II families was the interval of time so long.

Both Tables 2 and 3 show improvement in the examination of family contacts. Not only is there a higher proportion of contacts examined in the families reported in the more recent period but also the contacts are now placed under clinic supervision much more quickly than previously. It is believed that these facts cannot

be interpreted as necessarily an indication of increased effort or supervision, in terms of visits to the family, on the part of the public health nurse. In fact the average number of visits to the home by the public health nurse has shown a decrease when the more recent period is compared with the earlier period. In a sample of families drawn from the period 1923-1930 there was an average of 11.6 visits per year to the home, contrasted with 7.1 visits per year for families in the period 1931-October, 1935.¹¹ It is sufficient to say that it appears that the work of the public health nurse in securing the prompt exam-

Table 3. Interval of time between reporting of a case of tuberculosis and the examination of the family contacts.

Family Groups	Interval of Time Before First Examination			
	Within 6 Months	6 Months to a Year	1-2 Years	2 Years or More
	Contacts Under 20 Years of Age			
Group I (1923-1930)	48.3	20.3	12.6	18.9
Group II (1931-Oct. 1935)	87.4	5.5	3.9	3.1
	Contacts Over 20 Years of Age			
Group I (1923-1930)	50.7	18.5	4.6	26.2
Group II (1931-Oct. 1935)	79.5	5.0	10.6	5.0

ination of family contacts has been accelerated and this improvement is probably due to a number of factors operating in the community over a period of years, not the least of which are the increasing awareness of the practicing physician and of the patient as to the importance of the examination.

The data in this study have been used to show that evaluation of procedures for tuberculosis control within a given community may be of practical advantage to the administrator. Various methods of case finding have been compared; sanatorium care of the positive sputum case as a means of preventing the spread of infection in the

¹¹ The data for nursing visits are based on records covering a period of two years for seventeen families drawn from the period 1923-1930 and records for eighteen families covering a similar period of time drawn from the more recent period 1931-October, 1935. It was desired to have the families comparable with respect to the proportion in which the index case had sanatorium care and the amount of sanatorium care within the two-year period after the index case was known. It is obvious that the presence of the active case in the home will modify the need for nursing visits. Consequently only a small group of families could be used for comparison.

home and in the community has been appraised; both the extent and promptness of examination of family contacts have been tested for improvement. It is not sufficient to test procedures only on the basis of what is believed to be the net effect of all of them. Rather, specific procedures should be tested for effectiveness and those should be eliminated which seem unnecessary in a particular community. Only in this way can a public health program for the control of tuberculosis be evolved which will be both flexible and efficient.