

MEASURING THE EFFECTIVENESS OF A TUBERCULOSIS PROGRAM¹

by JEAN DOWNES

WHEN an area has attained a reasonable standard in terms of activities and services rendered in its program for tuberculosis control, for future planning it is highly desirable to make an internal evaluation of the program's effectiveness. The usual "appraisal form" method cannot be used to measure the effectiveness of tuberculosis work since it is a "yardstick" which relies upon a quantitative statement of the means of executing a program rather than a criterion of the end results.

There are two definite and clear-cut aims in the tuberculosis program toward the accomplishment of which all activities are directed. They are (1) an appreciable reduction in the mortality from tuberculosis, and (2) a decrease in the number of cases of active disease or foci of infection. Both are capable of objective measurement. Data drawn from Cattaraugus County, New York, for the period 1923-1934 will be used to illustrate the practical knowledge which may be derived from a study of progress in the accomplishment of these two purposes of the tuberculosis program.

Cattaraugus County is a rural area embracing thirty-three towns or townships. In twenty-one of these towns the population is composed of 16,228 persons living on farms or in very small villages; in ten of the towns there are some farm families but the population of 22,165 is predominately gathered in villages ranging in size from 1,000 to approximately 3,000 persons. Two towns, which have a population of 10,000 and 23,000 respectively, comprise the two urban areas in the County.

¹ From the Milbank Memorial Fund. Acknowledgments are made to the Cattaraugus County Department of Health, especially to Dr. John H. Korn, director of the Bureau of Tuberculosis, for access to the data used in this study.

Since tuberculosis is a disease transmitted chiefly from person to person through contact, even a small concentration of population would increase the chances of acquiring tuberculosis. There-

Table 1. Average annual incidence of active cases of tuberculosis in 1923-1926 contrasted with the period 1931-1934 for four localities in Cattaraugus County, New York.

LOCALITY	AVERAGE ANNUAL INCIDENCE OF ACTIVE CASES (PER 10,000)		PER CENT CHANGE
	1923-1926	1931-1934	
Olean	12.0	6.7	-44.2
Salamanca	10.7	9.9	- 7.5
10 Village towns	12.4	5.8	-53.2
20 Rural towns ¹	10.1	4.3	-57.4

¹ One of the twenty-one rural towns has been excluded since it contains the County Home. Because of insufficient information, it was impossible to allocate to previous residence the very few cases and deaths from tuberculosis which occurred at the County Home during the early period, 1923-1926.

Throughout the twelve-year period under consideration (1923-1934), case-finding and case reporting have been emphasized with such success that even in the rural areas of the County at any given moment of time it is believed that at least 75 per cent of the active cases are known to the Department of Health. Consequently, the new active cases of clinical disease reported or discovered year by year for all these areas may be used for a comparison of the incidence of tuberculosis at various time periods. The mortality may be used in a like manner.

Table 1 and Figure 1 show the average annual incidence of active tuberculosis (all forms) for the two periods 1923-1926 and 1931-1934 for each of the two cities, the village, and the rural towns. In the earlier period (1923-1926) the level of the rate of incidence was similar for all of the areas. It varied from 10 in the farm towns to 12 per 10,000 in the village towns. This was not true of the later period because the incidence has declined unequally in the various areas.

fore, it seems advisable to show the incidence of disease and mortality separately for each of the population groups, farm, village, and urban, in order to see where the problem of control is greatest. Also, it is of interest to know whether or not the program of tuberculosis control has been equally effective in all of these groups.

All of the areas, with the exception of Salamanca, show a similar decline in the incidence of active tuberculosis when the period 1931-1934 is compared with the earlier period. The greatest decrease in the occurrence

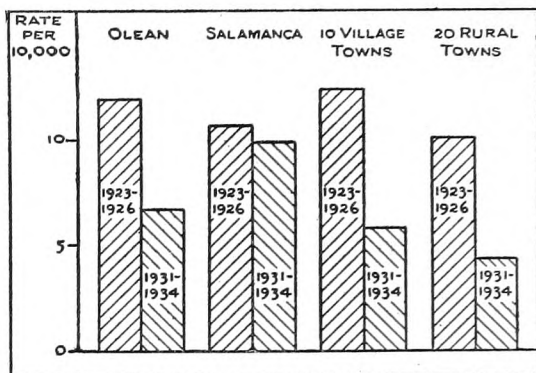


Fig. 1. Average annual incidence of active cases of tuberculosis during the period 1923-1926 compared with that in 1931-1934 for each of the four areas of Cattaraugus County.

of active tuberculosis (57 per cent) was noted for the farm population; 53 per cent was noted for the ten village towns; and a decline of 44 per cent was evident for the City of Olean. On the other hand, Salamanca has shown no evidence of a change in the frequency of occurrence of

active disease. The differences in the incidence rates in the two periods for the three areas (Olean, farm, and village) are statistically significant as they greatly exceed any amount that might result from chance variation.²

In Table 2 and Figure 2 the decline in tuberculosis mortality for each of the four areas is strikingly similar to that noted for the incidence of active tuberculosis. However, the level of mortality for the rural towns with rates of 37 and 18 per 100,000 was considerably below that of the other areas in both periods of time. The average annual mortality for the period 1931-1934 contrasted with that for 1923-1926 declined 50 per cent in the twenty rural

² The difference in the annual average rates for Olean is five times its probable error; that for the village is six times its probable error; and that for the rural towns is five times its probable error.

LOCALITY	AVERAGE ANNUAL RATE PER 10,000		
	1923-1926	1931-1934	Differences
Olean	12.0±0.80	6.7±0.59	5.3±0.99
Salamanca	10.7±1.12	9.9±1.08	0.8±1.56
Village towns	12.4±0.81	5.8±0.54	6.6±0.97
Rural towns	10.1±0.86	4.3±0.57	5.8±1.03

towns, 43 per cent in the ten village towns, and 47 per cent in Olean. On the other hand, Salamanca with a decline of approximately 12 per cent shows relatively little change in mortality.

Table 2. Average annual mortality from tuberculosis in 1923-1926 contrasted with mortality in 1931-1934 for four localities in Cattaraugus County, New York.

Locality	Average Annual Mortality (per 100,000 Population)		Per Cent Change
	1923-1926	1931-1934	
Olean	67.4	34.0	-47.4
Salamanca	56.2	49.6	-11.7
10 Village towns	58.9	33.4	-43.3
20 Rural towns ¹	36.8	18.4	-50.0

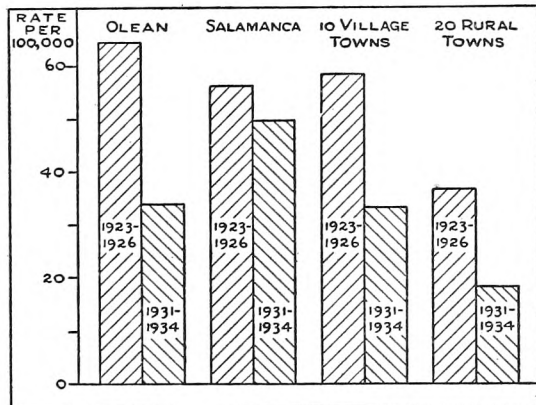
¹ One of the twenty-one rural towns has been excluded since it contains the County Home. Because of insufficient information, it was impossible to allocate to previous residence the very few cases and deaths from tuberculosis which occurred at the County Home during the early period, 1923-1926.

one of the urban areas (Salamanca) the program of tuberculosis control seems to have been ineffective in reducing either the occurrence of the disease or mortality from it.

Since tuberculosis is a disease for which mortality and morbidity are selective both as to age and sex,³ it is important to discover whether or not the decrease in the disease in the different parts of the County has been uniform in the different sex and age groups. Table 3 shows the average annual in-

Both Figure 1 and Figure 2 show that at the present time in Cattaraugus County the control of tuberculosis is a problem for the most part confined to the two urban areas and the village towns. They are relatively small areas geographically with a greater concentration of population than in the wholly rural areas. Also in

Fig. 2. Average annual mortality from tuberculosis during the period 1923-1926 compared with that in 1931-1934 for each of the four areas of Cattaraugus County.



³ Evidence as to the selectivity of the disease both as to age and sex in this particular area was brought out in the following study: Downes, Jean: The Age Incidence of Tuberculosis and Its Significance for the Administrator. Milbank Memorial Fund Quarterly, April, 1935, xiii, No. 2, pp. 152-161.

LOCALITY	1923-1926		1931-1934		PER CENT CHANGE	
	Male	Female	Male	Female	Male	Female
INCIDENCE OF ACTIVE CASES (PER 10,000)						
Olean	11.1	12.9	8.4	5.0	-24.3	-61.2
Salamanca	9.6	11.9	8.3	11.6	-13.5	-2.5
10 Village towns	11.2	13.6	6.3	5.3	-43.8	-61.0
20 Rural towns	7.4	12.9	3.9	4.8	-47.3	-62.8
MORTALITY RATE (PER 100,000)						
Olean	66.2	63.2	36.5	31.6	-44.9	-50.0
Salamanca	60.8	51.6	36.2	63.3	-40.5	+22.7
10 Village towns	62.6	55.0	43.1	23.0	-31.2	-58.2
20 Rural towns	34.0	39.7	12.9	24.2	-62.1	-39.0

Table 3. A comparison of the change in the average annual incidence of active cases and the mortality from tuberculosis among males and females in the period 1923-1926 and 1931-1934 in different localities in Cattaraugus County, New York.

cidence of active cases and mortality by sex for each of the four areas in 1923-1926 contrasted with the period 1931-1934. The per cent change in incidence has been decidedly greater among females than among males in all of the areas except Salamanca for which little or no change was recorded. The incidence rate among females was from 61 to 63 per cent lower in the more recent period contrasted with the early period. On the other hand, the incidence among males (excluding Salamanca) showed a decline of from 24 to 47 per cent.

In the twenty rural towns the decline in mortality was less among females than among males but in Olean and the ten village towns the mortality among females declined from 50 to 58 per cent in the two time periods compared. These are somewhat greater declines than those noted among the males. The female mortality rate in Salamanca has increased 23 per cent and the male rate decreased 41 per cent.

Figure 3 shows graphically the per cent change in the average annual incidence of active cases at various ages for the period 1931-1934 compared with 1923-1926 for each of the four areas. In general, the greatest decline in the incidence of active tuberculosis

has taken place in the age groups under 25. These are the ages which should reflect most readily the effect of preventive work in tuberculosis. It is of interest to note that Salamanca shows an increase in the incidence of active disease at these ages. No particular significance can be attached to the actual amount of these increases but the fact of no decrease in active disease at these ages is indicative of deficiency in tuberculosis control in this particular community.

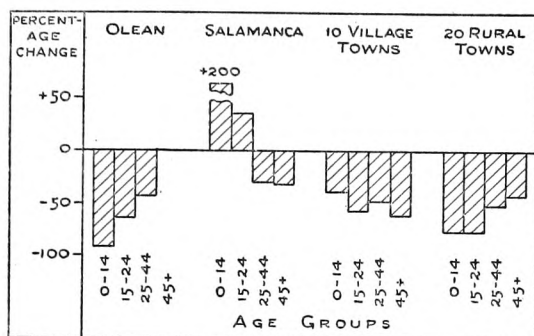


Fig. 3. Percentage change in the average annual incidence of active tuberculosis in 1931-1934 contrasted with 1923-1926 at different ages in each of the four areas of Cattaraugus County.

For future planning these findings would indicate that the tuberculosis problem in this rural County is now confined largely to the two urban areas and the village towns even though appreciable reductions have taken place in both case incidence and mortality in two of the areas. Emphasis should be placed upon case-finding and preventive work among adult males and a special effort should be made to reduce the incidence of active cases among persons over 25 years of age.

In the one urban area, Salamanca, which shows no effect of the intensive anti-tuberculosis work, there is need for careful study as to causes and perhaps an entire reorganization of the program of services. It may require a concentration of effort to enlist better cooperation on the part of the family physicians, or perhaps better supervision and reorganization of the services of the public health nurse. Just as public health personnel and equipment are marshalled to control a typhoid epidemic, so should the tuberculosis program in any department of health be organized with sufficient elasticity to enable the best efforts of the department to be directed to the "sore spots" or points of greatest need.

In conclusion it seems appropriate to point out that the ordinary appraisal of services and activities would not reveal the true situation in Cattaraugus County. For example, in Table 4 is shown the ratio of new active cases to deaths in the two periods (1923-1926 and 1931-1934) for each of the four areas in Cattaraugus County. It is interesting to note that Salamanca ranks equally well with the other areas in both periods and attains the

Locality	Ratio of New Active Cases to Deaths from Tuberculosis	
	1923-1926	1931-1934
Olean	1.9	2.0
Salamanca	1.9	2.0
10 Village towns	2.1	1.7
20 Rural towns	2.7	2.4

Table 4. Ratio of new active cases to deaths from tuberculosis in four areas in Cattaraugus County for the period 1923-1926 contrasted with that of 1931-1934.

standard set by the "appraisal form" in case-finding in rural areas—yet there has been no progress in that particular area in attaining the objectives for which the tuberculosis program is planned.