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A Summary Of Tuberculin Reactor Rates Obtained Through Skin Testing In Maine Schools

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The rise in reactor rate with increasing age suggests that conversion from negative to positive occurs during school attendance, due to increased exposure to non-familial infectious cases.

The study of reactor rates in various age groups of school children is a convenient means of measuring community infection and thus, indirectly, the effectiveness of control measures in force, since changes in infection levels would be expected to be reflected in changes in reactor rates. However, in order to compare results obtained from time to time or place to place and obtain valid figures, uniform methods of testing, reading and recording must be employed.

To assure uniformity of performance a policy statement for tuberculin testing was prepared by the Maine Trudeau Society and accepted by the Maine Tuberculosis Association December 12, 1956.[1]

Since that time tuberculin testing with PPD (purified protein derivative) has been carried out in many schools throughout the State. In the past three years 11,571 tests have been made under the provision of this policy and reported to the Division of Tuberculosis Control in sufficient detail to be summarized for this report.

Testing was done using intermediate strength, freshly diluted PPD 0.0001 mg. per ml. Intradermal injection of 0.1 ml. was the standard dose used, readings were made in 48-72° after injection and recorded as millimeters of induration. All reactions were recorded, those 5 ml. or more in diameter were considered to be positive.

Summary reports by school, town, or school district were prepared by age and sex. No consistent differences were noted from year to year, from one sex to the other, between rural and urban areas, or in different geographic areas in the state. All records were combined in making out this report, retaining only broad divisions by ages. Most children fell into the age groups 5-7, 12-14, and 16-18 years because in most schools testing was concentrated in the entering, eighth, and twelfth grades as recommended in the Policy Statement. Data have been summarized for these age groups and presented in Table I, II, and III.

The reactor rate was found to increase with increasing age from 0.6 to 3.9%. If these rates are plotted on semi-logarithmic scale a nearly straight line progression is obtained indicating that reactivity increases by geometric progression at least through the age groups tested. If such a rate of increase persisted unchanged, 100% reactivity would be reached at approximately 35 years of age. This is known not to be true through random testing of older persons and contacts of known cases. Where the rate of increase begins to slow up cannot be determined from the data at hand.

In Tables II and III the numerical and percentage distribution of reactions by millimeters of induration is given for the three groups. Reactions under 5 mm. in size are of decreasing importance with increasing age although their rate remains almost constant — between 0.35% and 0.45% in all three groups. Such reactions are undoubtedly non-specific and due to a constant factor.

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TABLE I

PPD Testing in Certain Age Groups 1957-1960

Age on Last Birthday in Years	Percent Partici-pation	Total in Age Group	Total Tested & Read	Tested and Read: Millimeters of Induration 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20+	Positive Not Measured	Previous Reactors	Total Tests Completed	Total Positive	Percent Reactors
5- 7	87	6688	5793	5744	3	8	3	2	9	1	1	1	1	10	1	1	2	1						2	3	1	5794	34	0.6
12-14	88	3022	2648	2587	0	7	0	2	6	2	2	4	1	10	2	7	3	0	4					3	8		2648	52	2.0
16-18	77	2376	1827	1750	0	2	4	2	7	1	2	1	3	12	3	7	2	2	5	1	0	3	0	13	7	3	1830	72	3.9
Total	85	12086	10268	10081	3	17	7	6	22	4	5	6	5	32	6	15	7	3	9	1	0	3	0	18	18	4	10272	158	1.5

familial infectious cases. However, it may be chiefly a measure of community infection in the past, with conversion playing only a minor part. The answer to this must await a cohort study of children over a period of years or a conversion rate study with retesting of large numbers of children in succeeding years. Sufficient numbers of retests have not been reported at this time to allow for discussion of conversion rates, and the program is not old enough for a cohort study to be made as yet.

Overall participation in the present study was only fair. Some schools achieved 99-100% while others reached less than 50%. It was best among eighth graders, worst among twelfth graders who often felt too old and independent to cooperate in the program. Absence at the time of testing was the chief factor in reducing participation among the youngest group. Participation was best in communities where education through the press, PTA meetings, and school health preceded the program.

As reactor rates decrease the percentage participation necessary to determine whether or not changes are due to chance alone approaches 100%. For example, a significant change of 0.5% from a rate of 1.0% requires 85% participation among a total of 2000, 99% of 100. Every effort must be made to obtain 99-100% participation in most schools in Maine where classes seldom number more than 100 students.

In the follow-up study of reactors most were found to be contacts of known cases, generally under supervision and non-infectious at the time of the testing program. In very few instances were the sources of infection not identified. These findings indicate that control measures have been effective. If in retesting of cohorts the reactor rate increment is less than that of age groups tested simultaneously this, too, will indicate that control measures have reduced the level of community infection.

According to a report by the Ohio Tuberculosis and Health Association[2] the goal of practical tuberculosis control has been reached when:

1. tuberculin reactor rates have reached
   - 1% in grade school children
   - 2% in high school students
   - 3% in college students
   - 5% in the population under 35
   - 10% in the population 35 to 50
   - 25% in the population over 50
2. tuberculosis death rates are not over 0.5
   (less than 5 deaths in Maine annually)
3. morbidity rates are less than 5 per 100,000 annually
   (less than 50 cases per year in Maine)

In order to know whether or not one of the goals

TABLE II

Distribution of Reactors by Size and Age Group

Age	Size of Reaction in Millimeters					*NM*	*Total*
	1-4	*5-9*	*10-14*	*15-19*	*20+*		
5-7	16	13	15	0	2	4	50
12-14	9	15	22	4	3	8	61
16-18	8	14	26	9	13	10	80
Total	33	42	63	13	18	22	191

TABLE III

Percent Distribution of Reactors by Size and Age Group

Age	*Size of Reactions in Millimeters*					*NM*	*Total*
	1-4	*5-9*	*10-14*	*15-19*	*20+*		
5-7	32%	26%	30%	0%	4%	8%	100%
12-14	15	25	37	6	5	12	100
16-18	10	18	33	11	15	13	100
Total	17	21	33	7	10	12	100

set for "practical" control of tuberculosis has been reached, skin testing in the schools will have to be rapidly increased so that a true picture of infection rates throughout the State can be obtained. It is most important that tests be conducted in uniform manner recorded accurately, and reported to the Division of Tuberculosis Control so that all information can be analyzed and pooled as necessary. Summary forms are available through the six District Health Offices where help is also available in the planning, execution and summation of any testing program.

The writer is indebted to Marguerite C. Dunham, M.D., for making available figures from her studies done in Aroostook County, and to the Maine Tuberculosis and Health Association and its affiliates for much of the data in other parts of the State.

Summary

1. Information has been obtained on 11,571 tuberculin tests in Maine School Children from 1957-1960.
2. 10,272 children tested were in the age groups 5-7, 12-14, and 16-18 years.
3. Reactor rates for these groups were 0.6, 2.0, and 3.9 respectively, showing an almost straight line geometric progression.
4. The significance of these increases must await cohort studies, and short-term retesting to determine conversion rates.
5. There is no significant difference in reactor rates for reactions less than 0.5 mm. of induration for the three age groups.

References

1. Policy Statement on the Tuberculin Test and its use, December 1956. Maine Tuberculosis Association, 2 Bridge Street, Augusta, Maine.
2. Ohio Tuberculosis and Health Association Program Policy Declarations, March 25, 1960.