

STUDIES OF LEPROSY IN THE GERMAN ETHNIC GROUP OF
COLONIA TOVAR, VENEZUELA
V. THE MORBIDITY RATES IN BCG-VACCINATED AND
UNVACCINATED GROUPS DURING FIVE YEARS

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This paper is the fifth report of studies made in the leprosy focus of Colonia Tovar, settled by people of German ethnic stock. One group in this community was vaccinated with BCG, while the other remained unvaccinated. Both groups were exposed to the risk of contagion before and during the period of observation, which covers a period of five years beginning in 1950.

The first two studies of this series (1-3) concerned the epidemiological factors and the immunological findings with the tuberculin and lepromin tests. The next two (4, 5) dealt with the clinical findings and the changes in the immunological reactions after BCG vaccination. The present report is of the occurrence of leprosy in the unvaccinated and vaccinated groups.

MATERIAL

The age and sex distributions of the two groups are shown in Table 1. Both groups were composed of persons who showed no signs of infection

TABLE 1.—*Age and sex distribution of vaccinated and unvaccinated groups.*

Age group	Vaccinated			Unvaccinated		
	Male	Female	Total ^a	Male	Female	Total ^b
0 - 4	66	52	118	32	23	55
5 - 9	54	67	121	31	15	46
10 - 19	103	101	204	61	45	106
20 - 29	36	28	64	46	46	92
30 - 39	24	28	52	35	35	70
40 - 49	6	13	19	39	22	61
50 plus	3	3	6	46	46	92
Totals	292	292	584	290	232	522

^a The 3 infected persons are omitted here.

^b The 25 infected persons are omitted here.

in 1950, a total of 1,106. Of these, 584 were vaccinated and 522 remained as unvaccinated controls. The ages in both groups ranged from less than four to more than 50 years of age.

Both groups were submitted to an initial lepromin test in 1950-1951. The test was repeated in 1954-1955, at the end of the observation period, but the Mitsuda-negative persons were tested annually as previously reported (4, 5).

Repeated examinations for leprosy were made of both groups, and every suspicious case was submitted to bacteriological, histopathological and immunological study to make the diagnosis of leprosy as exact as possible.

The lepromin employed was of the integral type, prepared at the Cabo Blanco leprosarium by the Mitsuda-Hayashi method. The scale used for reading the tests was the one approved by the II Pan-American Conference on Leprosy (Rio de Janeiro 1946). The BCG was prepared by the National Institute of Tuberculosis in Caracas. Two intradermal injections were made, each of 0.1 cc. containing 0.00075 gm. of bacilli.

FINDINGS

The results of the initial lepromin tests made in 1950-1951, before

TABLE 2.—Results of the initial (1950-1951) lepromin tests in the two groups before BCG vaccination, in relation to age.

Age group	Number of persons			Gross results ^a		Degree of positivity ^b		
				Negative	Positive	1+	2+	3+
	Total ^c	Not read	Read	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
<i>Group later vaccinated</i>								
0-4	118	61	57	24 (42.2)	33 (57.8)	27 (11.1)	4 (10.8)	2 (11.1)
5-9	121	28	93	30 (32.3)	63 (67.7)	12 (7.7)	8 (7.9)	9 (11.0)
10-19	204	54	150	42 (28.0)	108 (72.0)	39 (25.0)	23 (22.8)	15 (18.2)
20-29	64	19	45	4 (8.7)	41 (91.3)	39 (25.0)	16 (15.8)	11 (13.4)
30-39	52	8	44	5 (11.5)	39 (88.5)	17 (10.9)	12 (11.9)	18 (22.0)
40-49	19	3	16	6 (37.4)	10 (62.6)	21 (13.5)	9 (8.9)	11 (13.4)
50 plus	6	2	4	0 (—)	4 (100.0)	13 (8.3)	22 (21.8)	10 (12.2)
Totals	584	175	409	111 (22.9)	298 (77.1)	156 (100)	101 (100)	82 (100)
<i>Group not vaccinated</i>								
0-4	55	17	38	4 (10.6)	34 (89.4)	15 (9.6)	11 (10.9)	8 (9.8)
5-9	46	11	35	6 (17.1)	29 (82.9)	52 (21.4)	8 (21.6)	3 (16.7)
10-19	106	26	80	3 (3.7)	77 (96.3)	86 (35.5)	13 (35.2)	9 (50.0)
20-29	92	25	67	1 (1.6)	66 (98.4)	35 (14.4)	5 (13.5)	1 (5.5)
30-39	70	20	50	3 (6.1)	47 (93.9)	30 (12.3)	6 (16.2)	3 (16.7)
40-49	61	20	41	0 (—)	41 (100)	9 (3.7)	1 (2.7)	—
50 plus	92	43	49	4 (8.2)	45 (91.8)	4 (1.6)	—	—
Totals	522	162	360	21 (6.8)	339 (94.2)	243 (100)	37 (100)	18 (100)

^a The percentages in this section pertain to each individual age group, to show the relation of total positivity to age.

^b The percentages in this section pertain to each degree-of-positivity group, hence the 100 per cent totals.

^c These totals do not include infected persons in either group.

BCG vaccination, are shown in Table 2, in which the division of the two groups by ages is continued.

It will be noted that there was a difference in the two groups as regards the number of Mitsuda-negative persons. In the group that was left unvaccinated there were only 24 negatives, while among those who later were vaccinated a total of 111 were negative. Therefore this group, prior to vaccination, had a far greater number than the other of persons who supposedly were more susceptible to infection because of the lack of the resistance evidenced by lepromin positivity. The difference is also evident when one compares the degrees of positivity in the two groups. In the group that were vaccinated the 1+ reactors predominated over those showing 2+ and 3+ reactions, while in the one that remained unvaccinated the contrary was the case.

TABLE 3.—Results of the final (1954-1955) lepromin tests in the vaccinated and unvaccinated groups, in relation to age.

Age group	Number of persons			Gross results ^a		Degree of positivity ^b		
				Negative	Positive	1+	2+	3+
	Total	Not read	Read	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
<i>Vaccinated group</i>								
0-4	118	7	111	14 (12.7)	97 (87.3)	24 (18.5)	39 (17.2)	34 (20.1)
5-9	121	8	113	3 (2.7)	110 (97.3)	31 (23.8)	36 (15.8)	43 (25.4)
10-19	204	14	190	4 (2.2)	186 (97.8)	45 (34.7)	83 (36.6)	58 (34.3)
20-29	64	3	61	2 (3.3)	59 (96.7)	10 (7.7)	36 (15.9)	13 (7.7)
30-39	52	1	51	0 (—)	51 (100)	15 (11.5)	19 (8.4)	17 (10.1)
40-49	19	1	18	0 (—)	18 (100)	3 (2.3)	11 (4.8)	4 (2.4)
50 plus	6	1	5	0 (—)	5 (100)	2 (1.5)	3 (1.3)	—
Totals	584	35	549	23 (4.2)	526 (95.8)	130 (100)	227 (100)	169 (100)
<i>Unvaccinated group</i>								
0-4	55	16	39	8 (20.5)	31 (79.5)	18 (16.8)	7 (4.7)	6 (6.7)
5-9	46	11	35	8 (22.8)	27 (77.2)	10 (9.3)	13 (8.7)	4 (4.4)
10-19	106	25	81	9 (11.1)	72 (88.9)	26 (24.4)	24 (16.0)	22 (24.4)
20-29	92	24	68	0 (—)	68 (100)	24 (22.5)	29 (19.0)	15 (16.7)
30-39	70	13	57	4 (7)	53 (93.0)	7 (6.3)	27 (18.0)	19 (21.1)
40-49	61	14	47	1 (2.2)	46 (97.8)	10 (9.3)	22 (14.7)	14 (15.6)
50 plus	92	39	53	3 (5.8)	50 (94.2)	12 (11.2)	28 (18.7)	10 (11.1)
Totals	522	142	380	33 (8.7)	347 (91.3)	107 (100)	150 (100)	90 (100)

^a The percentages in this section pertain to each individual age group, to show the relation of total positivity to age.

^b The percentages in this section pertain to each degree-of-positivity group, hence the 100 per cent totals.

The situation is very different with respect to the results of the final lepromin tests, shown in Table 3. In the vaccinated group there was an increase in the number of strong (2+ and 3+) reactors, at the expense

of those that were originally negative or only weakly reactive. In the control group there was also an increase in the degree of Mitsuda-positiveness, but much less than in the vaccinated group. It should be taken into consideration, however, that among the controls there were 142 persons whose lepromin reactions are unknown, against only 35 among the vaccinated persons.

The incidence of leprosy morbidity in the two groups is shown in Table 4. There the persons who were found to have contracted the disease in its several forms are tabulated according to the year in which the diagnosis was made, and in relation to the results of the initial lepromin tests made when they were without signs of the infection. The persons "not read" at that time are not taken into account in this table, because no case of leprosy has been found among them.

TABLE 4.—Cases of leprosy arising in the vaccinated and unvaccinated groups, in relation to the results of the initial lepromin tests, by year in which the diagnosis was made.^a

Year	Lepromatous				Indeterminate				Tuberculoid				Dimorphous				Total			
	—	1+	2+	3+	—	1+	2+	3+	—	1+	2+	3+	—	1+	2+	3+	—	1+	2+	3+
<i>Vaccinated group</i>																				
1951	—	—	—	—	—	—	—	—	2	—	—	—	—	—	—	—	2	—	—	—
1952	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	1	—	—	—
1953	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1954	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1955	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Totals	0				0				3				0				3			
<i>Unvaccinated group</i>																				
1951	—	—	—	—	—	1	—	—	1	—	—	1	—	—	—	—	1	1	—	1
1952	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	—	—	—
1953	1	1	—	—	—	1	—	—	1	—	1	—	—	1	—	—	2	3	1	—
1954	2	—	—	—	3	—	1	1	—	1	1	1	2	—	—	—	7	1	2	2
1955	—	—	—	—	—	1	—	—	—	—	1	—	—	—	—	—	—	1	1	—
Totals	6				8				8				3				25			

^a No case of leprosy has been found among the total of 177 persons whose final lepromin reactions were not read.

The first striking feature of this table is that only 3 cases of leprosy developed among 584 persons in the vaccinated group—all from among those who were originally negative to lepromin—whereas there were 25 cases among the 522 persons of the unvaccinated group. Of these 25, no less than 12 came from the 21 negatives (57.2% of them), while the 13 cases among the 339 positives constitute only 3.8 per cent of that lot. It is of interest that the 6 cases among the 156 weak (1+) reactors and the 7 cases among the 186 stronger (2+ and 3+) reactors represent precisely

the same percentage. Also of interest is the fact that in the vaccinated group cases occurred only in the first two years of the period, whereas in the control group a large majority (18 of the 25) were found in the third and fourth years.

DISCUSSION

We consider the two groups studied to be practically comparable. There were differences as regards the numbers of persons in the different age groups, but they are not very important, especially in the younger groups. They were exposed before and during the period of observation to the same risks of contagion from contact with infectious cases.

The difference in morbidity shown in Table 4 may be reduced to morbidity coefficients (cases per thousand) as follows: In the vaccinated group, with 3 cases out of 587 persons, the coefficient is 5.11. In the other group, with 25 cases among 547 persons, the coefficient is 45.70. The difference between these coefficients, 40.59, could occur by chance only once in 200,000 similar experiments carried out with groups of 567 persons from the same comprehensive system. This means that the reduction of the morbidity coefficient in the vaccinated group can, with all certainty, be attributed to the effect of the BCG vaccination.

Besides the great difference in the morbidity coefficients, there is also a very clear contrast between the two groups as regards the type of leprosy found, which again is evidence of the protective action of BCG in the vaccinated persons. The 3 cases of infection found in that group were of the tuberculoid type, strongly positive to lepromin, and their lesions disappeared in a very short time. On the other hand, there were 9 infectious cases (lepromatous and dimorphous) in the unvaccinated group, besides 6 of the indeterminate group which could change into the infectious form as their Mitsuda reactions were negative or only weakly positive.

BCG vaccination has thus been shown to have a decided preventive effect against leprosy, not only because it was effective in bringing about a radical reduction in the morbidity rate, but also because no infectious forms of the disease were found in the vaccinated group. In addition to this, we have the notable difference between the two groups as regards the number of closed cases (tuberculoid and indeterminate).

SUMMARY

This report deals with the incidence of leprosy morbidity in the two groups of contacts in Colonia Tovar which have been under observation for five years, of which one (584 persons) was vaccinated with BCG while the other (522 persons) served as a control. All the persons in these groups lived in close contact with infectious forms of the disease.

Records were kept of all persons in the two groups starting with 1950, when none as yet showed any evidence of infection. These records included results of clinical examinations and lepromin tests made in 1950-1951. Both groups were again tested with lepromin at the end of the period of

observation, in 1954-1955. The examination made of all persons with suspicious lesions included bacteriological, histopathological and immunological studies to make the diagnosis of leprosy and the classification of the forms of the disease as accurate as possible.

Three infected persons have been found in the vaccinated group, and 25 in the control group, which gives morbidity coefficients of 5.11 for the former and 45.70 for the latter. The probability that such a difference, 40.59, could be produced by chance is only one in 200,000 similar experiments with 567 persons from the same comprehensive system. The great reduction in the morbidity coefficient can thus be attributed, with all certainty, to the effect of BCG vaccination.

RESUMEN

En esta experiencia se refiere al estudio de la morbilidad por lepra en dos grupos de contactos, uno de ellos vacunado con BCG y no vacunado el otro. Todos viven en un foco leprógeno en estrecho contacto con formas infectantes de la enfermedad. Todas eran personas sanas para 1950. El grupo vacunado con BCG está compuesto en total por 584 personas y por 522 el grupo testigo.

Para las personas componentes de ambos grupos se llevó un record a partir de 1950. En dicho record se registró los exámenes clínicos, además prueba lepromínica en 1950-1951. Una nueva lepromino-reacción se les hizo a los dos grupos al finalizar el período de observación en 1954-1955.

Durante el curso de la experiencia toda persona sospechosa al examen clínico se le practicó estudio bacteriológico, histopatológico e inmunológico con objeto de hacer lo mas exactamente posible la diagnosis y la clasificación de cada caso de lepra encontrado.

El número de enfermos hallados en el grupo vacunado fué de 3, y de 25 en el grupo testigo, lo que da un coeficiente de morbilidad por mil de 5.11 y 45.70 respectivamente, con una diferencia de 40.59. Esta diferencia y una aún mayor se observaría debido únicamente al azar sólo una vez en cada 200,000 experimentos similares efectuados con grupos de 553 personas provenientes del mismo universo y como consecuencia la reducción del coeficiente en el grupo vacunado se le puede atribuir con toda seguridad al efecto de la vacunación BCG.

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