ORIGINAL ARTICLES

FATE OF CHILDREN BORN OF LEPROUS PARENTS IN THE GROOT-CHATILLON LEPROSY ASYLUM

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In the Government leprosy asylum "Groot-Chatillon," in Surinam, a leprous man and a leprous woman may live together in case a legal marriage can be contracted. The children born of these marriages are removed from the institution before they reach the age of 1 year, generally at the age of 6 to 9 months. For the greater part, they are brought up by relatives of their parents, or of other patients. In the minority of cases they are brought up in nonleprous families or in an orphanage.

Fertility of leprous women.—At present there are 29 women isolated in the asylum. The total number of years which they have spent there between the ages of 15 and 40 is 267, an average of 9.2 years per patient. In this time they have given birth to no less than 71 children. At this rate, had all of these women spent the whole period of fertility (twenty-five years) in the asylum, they would have given birth on the average to six to seven (6.6) children each. The coefficient of the fertility of these women at Groot-Chatillon is therefore 6.6; that of the native women isolated at Groot-Chatillon is 7.3; that of the nonleprous native women in Surinan is 6.3.

ANALYSIS OF BIRTHS AND DEATHS

In the year 1896 the cases of leprosy segregated in the infirmary "Batavia" were removed to Groot-Chatillon. As the archives of "Batavia" have been lost, and as we cannot for our purpose use the data of the Registrar's Office before 1896, we must confine ourselves to the study of the fate of the children born from leprous women in the asylum from 1896 till 1928, a period of thirty-two years.

The number of births during this period, exclusive of 9 registered as stillbirths, was 105. Of these the fate of 6 is unknown. Of the 99 who have been traced, 65 are alive and 34 have died.

The children born at Groot-Chatillon, generally speaking, are healthy. The good attendance of the mothers during pregnancy, the quiet life without heavy occupations, and the more than sufficient nourishment doubtless contribute to this. After birth the treatment of those born is without doubt better, and after the evacuation from Groot-Chatillon certainly not worse, than the treatment of the children generally in Surinam. Nevertheless, one-third are known to have died.

The ages at death were as follows: 0 to 3 months, 13; 4 to 6 months, 6; 7 to 12 months, 4; 1 to 2 years, 3; 2 to 3 years, 1; 12 years, 1; 16 years, 1; 17 years, 1; 18 years, 2; 26 years, 1; age unknown, 1. Thus, of 33 whose ages at death are known, 23 (69.6 per cent) died within the first year and 27 (81.8 per cent) before the end of the third year. None of these had developed leprosy. Of the 6 older children 2 are known to have developed the disease. Little or nothing is known of the causes of death of these children; no postmortems were done.

It is remarkable that more than half of the leprous mothers have not lost a single child, and among these we find the mothers with the largest number of children. On the other hand, 20 per cent of the remaining leprous mothers lost all their children, whereas from the other 80 per cent the number of the survivors over the first year and that of the deceased during this period is equal. This rather points to the fact that it is probably not alone the leprosy in the mothers which causes the mortality; attention must also be given either to the general type of the disease in them or to other diseases as distinct from leprosy.

Type of leprosy in the mothers.—Data concerning the type, period, duration, progress, complications, etc., of the leprosy of the mothers have been examined. No particular differences between those who had lost many children and those who had lost few could be demonstrated.

Complicating diseases in the mothers.—Clinical examination of these women, who generally are very leprous, did not exclude with any certainty that they were suffering or had suffered from any other disease. On the other hand, serum reactions gave important results in relation to the deaths of children. The data on eighteen women are given in Table 1.

Eight of these mothers, whose serum reactions were entirely negative (ignoring certain positive Kahn tests), had a total of 33 children, of whom 5 died, a mortality of 15 per cent. Two of these

TABLE 1.—*Serum reactions of eighteen leprous mothers.*

Case No.	Age	Years in asylum	Children		Reaction			
			Born	Died [a]	Wassermann	Sachs-Georgi	Meinicke	Kahn
1	32	13	7	0	—	—	—	—
2	33	16	7	0	—	—	—	—
3	21	11	3	1	—	—	—	—
4	39	7	2	0	—	—	—	—
5	35	13	1	0	—	—	—	—
6	31	15	4	1	—	—	—	—(+)
7	35	13	6	1	(+)	—	—	+
8	51	26	7	3	—	—	—	—
9	31	13	2	0	—	—	—	+
10	26	7	5	3	+	+++	+++	—
11	47	17	2	1	(+)	++	+++	—
12	26	6	1	1	+	++	+++	—
13	30	4	1	0	—	+++	+++	+
14	31	11	3	3	+	+++	+++	+
15	38	14	8	6	+	+++	+++	(+)
16	35	1	1	0	+	+++	+++	(+)
17	60	28	4	0	+	+	+++	++
18	38	?	2	0	+	+	+++	(+)

[a] Two of the deaths recorded above occurred after the first year; the serum reactions of both mothers were negative.

died after the first year of life, the mortality for that period being only 9 per cent.

The other 10 mothers, whose serum reactions were positive (including 1 with only a weakly positive Wassermann reaction), also had a total of 33 children, of whom 15 died, a mortality of 45 per cent. All of these deaths occurred in the first year.

The differences in the chances of life of children born of leprous mothers are, therefore, parallel with the results of the serological examination of the mother's blood. The mortality of the children of mothers with negative blood is proportionally small, and that of children born from mothers with positive blood is large.

The same results were obtained in an analysis of the death rates of children of 18 arbitrarily selected nonleprous mothers. Of these 11 were negative to the three serum reactions (Wassermann, Sachs-Georgi, and Meinicke); they had had 46 children with 8 deaths, or 17 per cent. The other 7 mothers, positive by these tests, had had 34 children, with 19 deaths, or 56 per cent.

Syphilis, and perhaps also frambœsia, will in many cases be the only cause of the positive reactions; but the possibility remains, or

at least must not be excluded, that other diseases (for example, leprosy) may be held responsible for the result of these reactions.

From the above data the following conclusions may be drawn:

1. The chances of life of the children are independent of the type of leprosy existing in the mother for, so far as known, the positive reactions are at least not caused by leprosy. This would then be in accordance with the opinion of Rodriguez (1) who, after experimenting at Culion, writes: "Leprosy in the patients does not give rise *per se* to an increased incidence of congenital debility in the offspring."

2. On the average, at Groot-Chatillon the chances of mortality among children born of leprous mothers is greatest in those whose mothers give positive serological reactions.

Before arriving at a definite conclusion these preliminary results should, by way of precaution, be further tested with the results of similar experiments.

LEPROSY IN GROOT-CHATILLON CHILDREN

Of the 105 children born at Groot-Chatillon between 1896 and 1928, information is available as to the fate of all except four. This is shown graphically in Fig. 1, in which those still living are indicated by unterminated lines, those who have died are designated by terminal dots, and those who developed leprosy are shown by heavy lines which start at the time the disease appeared.

A total of 69 children (out of 101 whose histories are known) survived the first year. Eighteen of these developed leprosy—26 per cent. In Table 2 this outcome is compared with the figures reported from other institutions.

TABLE 2.—*Children surviving the first year of life who have developed leprosy, in percentages.*

	Observation period	Contracted leprosy
	Years	*Per cent*
Groot-Chatillon	32	26
Culion (Deeney)	10	10
Culion (Gomez et al.)	15	[a] 14
Culion (Rodriguez)	18	[b] 17
Molokai (Hasseltine)	15	1
Almora (Jackson)	30	[c] —

[a] And 19 per cent suspected.
[b] And 17 per cent suspected.
[c] One case.

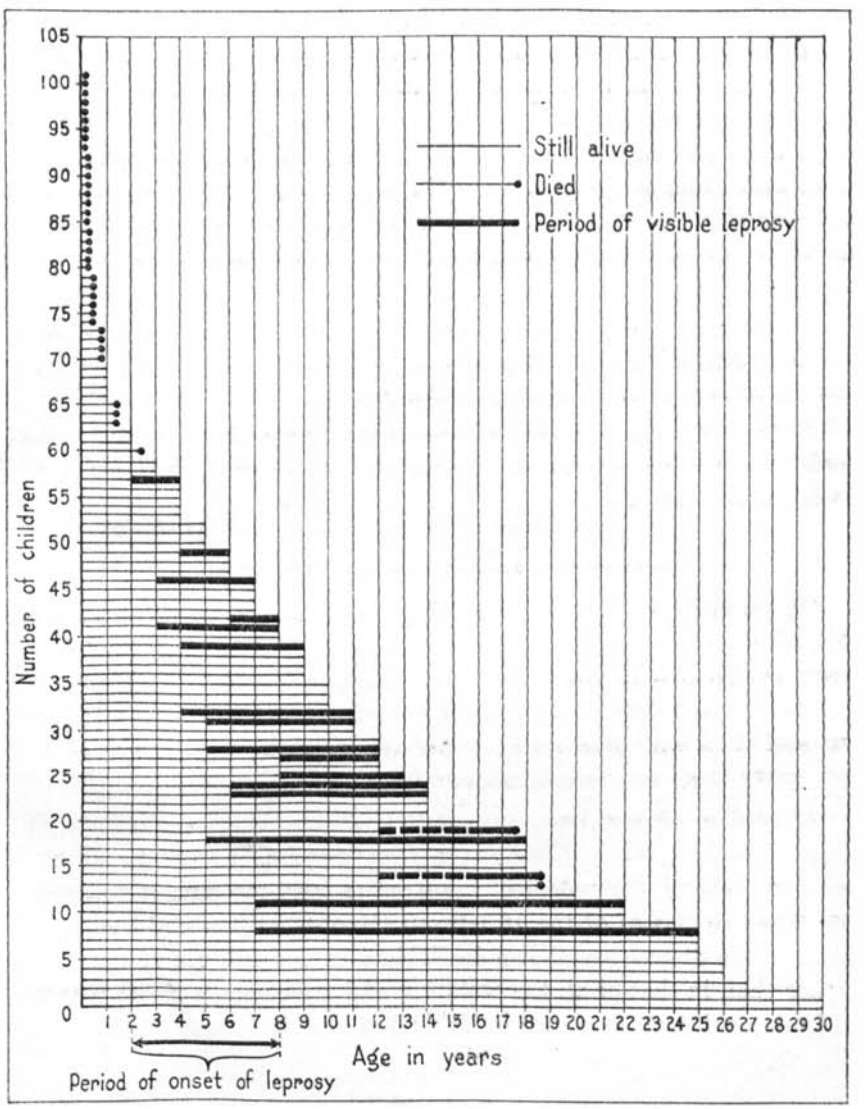

FIG. 1. The fate of the children born at the Groot-Chatillon Leprosy Asylum, 1896-1928

Each horizontal line represents one child, the length of the line indicating the age. A terminal dot indicates death. Thickened lines represent the occurrence of definite leprosy. Broken lines indicate uncertainty of the time of onset.

It is to be realized that these data can be compared with each other only with great reservation. In the first place, the circumstances are different. At Groot-Chatillon the children are removed on the average after nine months; at Culion some of the children during this period were brought up in an orphanage; in Molokai and Almora the children are removed from the parents immediately after birth and brought up in a nursery, where any communication with infected cases is excluded. In the second place, the difference in the duration of the observation period should be taken into account. This is of great importance, as leprosy begins in these children at a later age.

The beginning of leprosy in the children born at Groot-Chatillon has never been noticed before the end of the second year, and never after they reached the age of eight years. This is seen in fig. 1. The frequency rates increase, up to the age of 6 years (Table 3).

Table 3.—*First appearance of leprosy in Groot-Chatillon children.*

Year of life	Total number of children	Children becoming leprous	
		Number	Per cent
First	69	0	0.0
Second	62	1	1.6
Third	58	2	3.4
Fourth	50	3	6.0
Fifth	44	3	7.0
Sixth	39	3	7.7
Seventh	33	2	6.1
Eighth	31	2	6.5
Ninth	28	0	0.0

The age classes of the 18 leprous Groot-Chatillon children at the onset of the disease are shown in Table 4 in percentages of the group rather than in that of all the children, and are compared with a group of Culion children, as shown in Table 3 of Rodriguez' article (1). The grouping of age classes is striking.

CAUSE OF THE LEPROUS INFECTION

A question of importance is why some of these Groot-Chatillon children have developed leprosy. Besides a certain risk that every child of the population of Surinam runs of contracting leprosy, there are special, very particular circumstances affecting the children born at Groot-Chatillon. These are (a) their birth from leprous parents,

TABLE 4.—*Age distribution at time of onset of leprosy in children of the Groot-Chatillon Asylum and a group at the Culion Leper Colony.*

Age	Number of cases		Percentage	
	Groot-Chatillon	Culion	Groot-Chatillon	Culion
0 - 1 year	0	1	0.0	9.1
1 - 2 years	0	0	0.0	0.0
2 - 3 years	1	0	5.6	0.0
3 - 4 years	2	2	11.0	18.2
4 - 5 years	3	2	16.7	18.2
5 - 6 years	3	1	16.7	9.1
6 - 7 years	3	2	16.7	18.2
7 - 8 years	2	1	11.0	9.1
8 - 9 years	2	0	11.0	0.0
9 - 10 years	0	0	0.0	0.0
10 - 11 years	0	0	0.0	0.0
11 - 12 years	0	0	0.0	0.0
12 - 13 years	0	0	0.0	0.0
Unknown	2	2	11.0	18.2
Totals	18	11	100	100

(b) their stay in the settlement until a certain age, (c) repeated visits to their leprous parents at a later age, and (d) their growing up in the same surroundings from which the parents or other patients have come, it being a fact that most of the children are adopted by relatives, either of the parents or of other patients.

The circumstances mentioned under the first three headings concern all children who are born at Groot-Chatillon. That under (d) is variable and has a very different bearing upon the matter. It is, therefore, of much interest to attempt to determine whether the outbreak of leprosy in some of these children has any relation to the environment in which they have lived. The data gathered are given in Table 5.

TABLE 5.—*Relation of leprosy in Groot-Chatillon children to environment in which they have lived.*

Leprosy in environment	Children becoming leprous		Children (over 8) remaining healthy	
	Number	Per cent	Number	Per cent
Absent	2	11	21	50
Suspected	1	6	..	..
Present	3	17	..	..
Uncertain	12	66	17	44
Totals	18	100	38	94

The result of this examination seems to show that the presence or absence of leprosy in the environment in which these children are growing up is of some importance with respect to whether or not they develop the disease. However, it must be remarked that the families in which leprosy is prevalent can with some certainty be excluded. They are generally well-to-do people, so that the children brought up under such favorable conditions are better able to resist infection acquired before evacuation from the settlement. It remains striking, however, that 56 per cent of the children who remained healthy, and only 11 per cent of those who became leprous, were brought up in leprosy-free surroundings, and that none of the children who remained healthy (on the contrary, 17 per cent of those who became leprous) were brought up in infected surroundings.

On the other hand, the result of this examination proves that not only the surroundings in which the children are brought up after their removal may be held responsible for the later appearance of leprosy. There must still be other factors. One, of course, thinks first of the fact of their birth from leprous mothers. In this connection, the nature and the stage of the disease in the mothers will be of much importance.

In that direction, the difference in age at which the disease begins is shown; on the one side, of children who developed the disease in leprosy-free surroundings and on the other side, of those from leprosy-infected surroundings.

The circumstances of the environment of only five children who developed the disease are known with certainty. All were removed from the asylum at between 8 and 11 months of age. Two lived thereafter in leprosy-free surroundings and three in leprosy-infected surroundings. The first two developed definite symptoms in their second and third years, respectively. The ages of the other three at onset were 5, 7, and 8 years. Probably the first two were infected during their stay in the asylum. The other three were possibly infected or reinfected after their removal from the settlement.

Further details of these cases are as follows:

Case 1.—F. D., removed after eight months to leprosy-free surroundings. Symptoms in the second year. Mother very much infected; active symptoms; lepra maculo-tuberosa (cutaneous type).

Case 2.—A. G., removed after nine months to leprosy-free surroundings. Symptoms in the third year. Mother similar to preced-

ing case. A brother being brought up in nonleprous surroundings is healthy.

Case 3.—An. G., removed at nine months to infected environment. Symptoms at 7 years of age. Mother has active leprosy. Three older brothers and sisters, all healthy, are growing up in surroundings that cannot with certainty be said to be nonleprous.

Case 4.—Al. S., removed at 9 months to infected environment. Symptoms at 5 years of age. Mother has no active symptoms; lepra nervorum (neural type). Sister of Case 5.

Case 5.—A. S., removed at 11 months to infected environment. Sister of case 4. Three older brothers and sisters of these children are being brought up in leprosy-free surroundings and are healthy.

CONCLUSIONS

1. The fertility of the leprous native women segregated at Groot-Chatillon is not less but rather greater than that of the nonleprous native women in Surinam. The coefficient of fertility is, respectively, 7.3 and 6.3.

2. The total number of deaths among the children born at Groot-Chatillon was, during an observation period of thirty years, 40 per cent, and during an observation period of eighteen years, the same; the mortality in children born at Culion was, during eighteen years, 46 per cent (1).

3. The number of stillbirths is large, as is also the mortality rate in the first year of life. The total rate from 1896 to 1928 was 280 per 1,000 native-born children. From 1924 to 1927 it was 260 per 1,000. These figures are to be compared with a mortality of 150 per 1,000 native-born children in Surinam.

4. This large mortality in children is not to be imputed to greater debility in the children as a consequence of the simple fact of leprosy in the mothers. Affections of the mothers which cause positive serum reactions must be held responsible for the greater mortality among children, though a possibility which must not be excluded is that, under certain circumstances, leprosy may cause these positive reactions.

5. A negative serum reaction, generally speaking, indicates a good prognosis for survival of the children born of these mothers.

6. Of the children born at Groot-Chatillon and surviving the first year of life, 26 per cent became leprous; this percentage is in-

dependent of the duration of the observation period, if fixed at longer than eight years. Of the children born at Culion after ten years, 10 per cent were infected; after fifteen years, 14 per cent were leprous and 16 per cent suspected; after eighteen years, 17 per cent were infected and 24 per cent suspected.

7. The children who became infected were, without any exception, outwardly infected after the end of the second, and before the beginning of the ninth year of life. The frequency of contracting leprosy increased up to the age of 6 years. The experiences at Culion are quite similar.

8. The children born at Groot-Chatillon and infected with leprosy contracted the disease, either from an infection in the asylum, against which they were not sufficiently resistant, or owing to a later infection or reinfection, obtained in the surroundings in which those children were brought up after the evacuation.

9. There are indications that the children who are already definite cases at the age of 3 years were unable to overcome an infection caught in the asylum, and that those who became visibly infected after the beginning of the fifth year of life were infected or reinfected after their evacuation.

10. There are indications that at least 20 per cent of the children who became sufferers from leprosy could not overcome an infection obtained in the asylum, and that at least 60 per cent of the children who contracted the disease were infected or reinfected at a later age.

11. The incubation period of leprosy from children born at Groot-Chatillon, who did not possess or could not maintain a sufficient resistance against an infection caught during the first months of life in the settlement, is about two years.

DISCUSSION

To prevent as far as possible the children born at Groot-Chatillon from becoming leprous at a later age, they should be evacuated directly after birth and be brought up in leprosy-free surroundings. In the new Leprosy Ordinance of 1929-1930, the provision is inserted that the children born at Groot-Chatillon must be separated from their parents directly after birth. In principle, it is to be recommended that members of the family of patients should not be permitted to bring up these children.

It is not less important that the Government in some way or other take care of the bringing up of these children after evacuation;

for instance, with regard to the choice of surroundings in which they are to grow up. There are practical reasons for this, for experience has proved that children born at Groot-Chatillon and who contract leprosy later on are the most expensive cases for the Government, which has to segregate them at a very young age. The natural educators are also suffering from leprosy and are segregated, among other things, during the whole period of their fertility, with as a consequence a large number of children born in the asylum, a number of whom later contract the disease.

Of the sixteen cases born at Groot-Chatillon who are still alive, seven are in an asylum (five children, a woman of 21, and a man of 24 years). The number of nursing years of these two grown-ups is now already twenty-five. The woman has already given birth to three children, two of whom have died and one has leprosy and is also cared for in an asylum. There are known to be cases in Surinam, more than 80 years of age, who were born in asylums and have spent their whole lives there.

REFERENCE

(1) Rodriguez, J. N. Studies on early leprosy in children of lepers. Philippine Jour. Sc. 31 (1926) 128.