

LEPROSY IN CALIFORNIA; DANGER OF INFECTION¹

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Reports on the prevalence of leprosy often do not disclose where the infection was acquired. This is important in connection with control measures if the case is found in an area in which transmission to the public is likely to occur. With new interest being taken in this disease by health authorities in the United States, it is desirable to know the danger of spread in different areas. This seemed especially important for California where many cases have been reported. Among 475 cases reported up to 1940, probably not more than 14 had been infected in the State (1). The present investigation was undertaken to obtain more comprehensive and more recent data. California stands almost alone among the States in being geographically situated for receiving infection from two general sources. The proximity to Mexico, which has many cases, has resulted in the entrance of a very considerable number of cases from that country. The State is the most convenient port of entry for Hawaii, Japan, and other Pacific islands, as well as China, which has resulted in the importation of a smaller but considerable number of cases. These undoubtedly included active cases and probably a larger number in the incubation stage.

At the time California became a part of the United States (1850), the natives, excluding Indians, were designated as Hispano-Californians (Mexicans) and constituted a large part of the population. A number of native Hawaiians came to the State soon after discovery of gold (1848), and at about the same time Chinese began to come in large numbers. Doubtlessly, both immigrations brought leprosy with them. The first readily available reference to the disease in California is a report by the jail physician of San Francisco in 1877, who mentioned treatment of 3 cases of "leprosis." A little later the State health officer of the day, Dr. H. S. Orme, in an annual report (2) included the following statistical data on lepers in San Francisco from 1871 to 1890, based on California State Board of Health reports from 1886 to 1894:

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Year of admission:	Cases	Year of admission:	Cases	Year of admission:	Cases	
1871	1	1878	13	1885	7	
1872	1	1879	14	1886	6	
1873	1	1880	10	1887	3	
1874	6	1881	2	1888	3	
1875	9	1882	12	1889	12	
1876	3	1883	11	1890	5	
1877	0	1884	9		—	
					Total ¹	128

¹ Of this total, 115 were Mongolians, 12 whites and 1 mixed; 120 were males and 8 females.

Birthplaces were recorded as follows:

China	114	England	1	Japan	1
Honolulu	1	Sweden	1	Germany	1
United States	3	France	1	Mexico	1

These figures show an overwhelming predominance of Chinese and an extraordinary excess of males. Nearly everywhere the number of male victims is much larger than females, the ratio generally being about 2:1. The very great excess shown in California in those early years doubtlessly resulted from confining Chinese immigration largely to males. Dr. Orme also wrote "Long ago the people of California recognized the danger of planting leprosy on this coast through Chinese immigration, and for more than 15 years legislation gave abundant authority for its exclusion and repression. Section 2952 of the Political Code reads: 'It shall not be lawful for lepers or persons afflicted with leprosy, or elephantiasis, to live in ordinary intercourse with the population of this State; but all persons shall be compelled to inhabit such lazarettos, or leper's quarters, as may be assigned to them by the Board of Supervisors of the city or county in which they shall be domiciled or settled; and the Boards of Supervisors are vested with power and are required to make all necessary provisions for the separation, detention, and care of lepers or persons affected with leprosy, or elephantiasis, settled or domiciled in their respective cities or counties.'

"In 1883," Dr. Orme continued, "the Board of Supervisors of San Francisco supplemented the above act by an order which forbids positively the landing of lepers from any ship, their transfer to another vessel, and their harboring by any person outside the lazaretto." There is nothing to indicate that the cases referred to by Dr. Orme gave rise to any new infections.

It has long been known that California furnishes a large proportion of the cases of leprosy reported in the United States

and, according to Hopkins and Faget (3), the State with 207 cases ranks third in the number of cases sent to the National Leprosarium at Carville, La., being exceeded only by Louisiana with 596 cases and Texas with 214 for the period 1921-44. Until this study, there seems to have been no special attempt to determine how many, if any, of the cases reported for California were infected there. Comparatively recently, when most health authorities began the adoption of new and more intelligently directed policies in dealing with this disease, it became important to know where leprosy is communicated from the sick to the well, in addition to where it is found. Florida, Louisiana, and Texas have long been recognized as areas in which leprosy spreads enough to be a public health problem and in recent years there has been a tendency to group California with these States as an "endemic" area. With the object only of ascertaining the status of the State as an area in which this disease was transmitted, this study was made. When data on any case indicated that in all probability the infection had been acquired elsewhere than in California, no further attention was given to it. This course was adopted because there was no intention of making a complete study, but only of the cases that could reasonably be regarded as having been infected in this State.

When this investigation began in California in 1947, the State Health Department was engaged in a general statistical study of leprosy in California which was to be prepared for publication. The data for that study were generously placed at my disposal and found of much value. The figures were for the period 1906-1947, and covered a total of approximately 500 cases reported in the State.

The tracing of source and place of infection in communicable diseases usually is carried out by ascertaining the place and the time of exposure, giving consideration to the incubation period. Perhaps the best illustration of this is to be found in tracing the source of venereal disease in a control program. Another example is smallpox. Look for the infecting smallpox patient among the victim's contacts 12 to 14 days previous to onset. If his contacts can be traced, the infecting patient should be found.

It is the widely accepted view that leprosy is usually acquired in the early years of life. Determining the source and the place of infection in leprosy is, therefore, often difficult and frequently impossible, chiefly for two reasons: First, the manifestations in the infecting patient may be obscure and the diagnosis in the

new patient uncertain for long periods, even many years; secondly, the incubation period is long and varying and may average from 8 to 10 years. However, some authorities feel that it may be prolonged to 25 years or longer. In this study, if the patient had lived in Hawaii, or the Philippines, or a similar recognized area of high leprosy prevalence, this was regarded as the place where the disease probably was acquired. A few years' residence in either of these Pacific Island groups was considered sufficient to attribute the infection to that area. If the patient had been born in Mexico, and had spent the early years of life in that country, Mexico was considered the probable place of infection even if a longer period later in life had been spent in California.

The following procedures have been utilized in this study. Patients admitted from California to the National Leprosarium at Carville, La., and who remained there, were interviewed in May 1947. Among 74 such cases 7 could be assigned to California as the place of infection. The records of the California State Department of Health were studied in July and August 1947. They were so complete that not much difficulty was encountered in allocating cases to a place of probable infection. The State records included most of the patients who had been interviewed at Carville in May 1947.

In recent years, the attitude of California health authorities in general has been very enlightened and progressive with respect to the public health management of the disease. While patients regarded as possible (or probable) sources of infection have been sent to the National Leprosarium at Carville, La., very little compulsion has been employed. Patients judged not to be a menace to those about them often have been allowed to remain at home, in local hospitals, or under the care of local physicians. Patients of Mexican origin who preferred to return to their native land were permitted to and informal arrangements for receiving the deportees were even facilitated by the State or local authorities with Mexican authorities.

CASE STUDIES

The family groups with leprosy (excluding marital) appeared to present the clearest evidence of infection within the State. Three of these are of special interest as the cases charged to the State never had been outside California:

(1) K family: A mother, born in Japan, came to the United States when 14 years old and developed leprosy 15 years later. At the time of diagnosis she was classified as an active case of leprosy. Her husband,

also born in Japan and the father of her 6 sons, was rated as an old inactive case, but the evidence in his case is not conclusive. The sons who contracted the disease were their third, age 12, the fifth, age 9, and the sixth, age 8.

(2) S family: The first case in this family was the father who died of leprosy in 1928 and never had been out of the State. Ten years later a son, age 17, was infected. He also had never been out of California.

(3) F family: The father in this family had military service in the Philippine Islands (1899-1900) and had developed leprosy after his return, dying in 1912. His two sons, one born in 1901 and the other in 1902, developed the disease, one at age 16 and the other at 17. Both had lived at home with the father until 18 months before his death. A daughter is said to have escaped infection.

Another familial case centers about Mrs. M. P., age 40, who was found to have advanced leprosy in 1932. She was born and probably infected in Mexico. She died of pneumonia apparently while hospitalized for leprosy. A short time later a daughter, I. P., age 6, who had never lived out of California, was discovered to have early leprosy.

ADULT INFECTIONS

Almost as clear examples of adult infection within the State are at least two patients who had lived only in California, except for limited periods in areas where the disease never has been known to be transmitted:

A young adult male (G. P.) who had been out of California only for 3 years while serving as a sailor in Alaska and Alaskan waters; a woman (M. B.), age 48, whose only residence outside California was 7 years spent in Utah. Neither Alaska nor Utah is considered as a probable area of leprosy transmission.

Marital infections.—In the three instances in which husband and wife were reported to have leprosy, the marital partner first to present evidence of the disease was regarded, perhaps somewhat arbitrarily, as the source of infection for the mate. In one family it was not possible to reach any reasonably clear conclusion on this point. In all of the marital infections, the evidence is not so convincing since both partners had been born outside California. If the view of infection of one from the other had not been adopted, it would have been necessary to assume the coincidence that both partners had been infected abroad. Three marital infections in so small a total is a much larger number than is to be expected and throws doubt on some, or all of them.

The K. family: both partners previously mentioned were

born in Japan and spent their early years there. It was impossible to be certain that either one was infected in California, but the probability appears to point in that direction. The alternative is to consider that both were infected in Japan.

The S. family: Mrs. M. S. was born in Mexico and came to California at the age of 28. Nine years after coming to the State she was found to have well-advanced leprosy of the lepromatous type. Her husband, S. S., age 49, was born in Mexico. He spent the first 5 years of his life in Mexico and the remaining 44 years in California. The disease appeared about 1 year before the diagnosis of the maculo-anesthetic form was made; that is, 43 years after coming to the United States.

The R. family: Mr. J. R., age 49, was born in Mexico. He came to California at the age of 31 and was reported as having leprosy 18 years later. The disease was classified as "mixed" of long duration. His wife Jo. R., age 41, was born in Mexico and had lived in California 14 years. Her case was recorded as "macular leprosy, early."

Certain data on the 23 cases important to the present inquiry are shown in the following tabulation:

TABLE 1.—*Leprosy infection in Californians who never left the State, probably acquired in California.*

Year reported	Initials	Sex	Location	Source of infection
1919	T. F.	Male	Stockton	Father
1919	W. F.	Male	Stockton	Father
1925	H. S.	Male	Walnut Grove	Unknown
1932	I. P.	Female	Tulare County	Mother
1938	J. S.	Male	Walnut Grove	Father
1941	A. K.	Male	Sacramento	Mother
1941	W. K.	Male	Sacramento	Mother
1941	K. K.	Male	Sacramento	Mother

TABLE 2.—*Leprosy infection in persons never out of State except to areas where disease is not known to be communicated.*

Year	Initials	Sex	Location	Birthplace	Residence	Number of years outside State
1921	G. P.	Male	San Leandro	California	Alaska	3
1943	M. B.	Female	Angels Camp	California	Utah	7

TABLE 3.—*Cases where marital partner is probable source of infection.*

Year reported	Initials	Sex	Location	Birthplace	Probable source of infection
1929	Y. K.	Female	Sacramento	Japan	Husband
1939	S. S.	Male	Carlsbad	Mexico	Wife
1941	J. R.	Female	Mount Shasta	Mexico	Husband

TABLE 4.—*Cases believed to indicate infection in the State.*

Year	Initials	Sex	Location	Birthplace	Residence outside the State
1926	M. L.	Female	Decoto	(1)	(1)
1930	E. L.	Male	Los Angeles	California	None.
1931	J. S.	Male	Los Angeles area	California	Mexico, 1 day (7 years prior to onset).
1935	C. R.	Male	Hanford	California	None.
1935	R. S.	Male	San Francisco	California	(1)
1939	A. M.	Male	San Francisco	California	Pennsylvania, Oregon, Montana, Vancouver 5 years.
1943	A. S.	Male	(1)	California	Mexico before age 9.
1945	D. M.	Male	Oakland	Spain	Spain first year of life.
1946	R. M.	Female	Fresno	Arizona	Arizona first year of life.
1947	E. H.	Female	Los Angeles area	Ohio	Ohio for first 50 years

(1) Not known.

In comparing the incidence of intrastate infected cases with the total number that were reported for periods for which data are available, the figures are as follows:

Period	Total cases reported	Probably infected in State
1913-1916.....	43	0
1917-1921.....	112	3
1922-1926.....	100	2
1927-1931.....	102	3
1932-1936.....	68	3
1937-1941.....	54	7
1942-1946.....	49	4

The period 1937-1941 includes the three children in one family. One case of within-State infection was omitted from this table as it was reported in 1947.

The figures show a tendency of total reported cases to be falling in recent years. The largest number for any one year was 28 in 1921. Intrastate infections do not vary much for the period under consideration.

CLASSIFICATIONS OF AREAS OF INFECTIVITY

The prevalence of leprosy in the United States by classifying areas is as follows:

- (1) *Highly endemic*.—All or the great majority of cases being infected in the State—Louisiana and Florida.
- (2) *Markedly endemic*.—A large proportion of the cases being infected in the State—Texas.
- (3) *Mildly endemic*.—A very small proportion of all cases being infected in the State—Minnesota.
- (4) *Feebly endemic*.—Only occasional cases occurred at long intervals—South Carolina.

In such a grouping California would fall in the class of mildly endemic along with Minnesota. Minnesota has had 7 cases of local origin among a total of 100 or more, while in California the figures are approximately 23 among about 500—a rather suggestive similarity between the two States.

When the data are examined from the point of view of locality in the State where infection occurred, it is found that

eight of the cases came from a comparatively small area near the middle of the State as follows:

Sacramento—4 cases in one family—mother, 3 children
Walnut Grove—2 cases in one family—father, 1 child
Stockton—2 cases in one family—2 brothers

These are from an area with a radius of about 30 miles. Of the 8 cases, 6 were children in families with a leprous parent.

The experience of California seems to agree to a considerable extent with that of Minnesota where the number of cases acquiring the disease in the State was far outnumbered by imported cases. There is one important difference between the two States. In California, leprosy continues to be introduced with the importation of patients or persons in the incubation period from Mexico and the Pacific area, while in Minnesota, an end to the admission of new cases came about the beginning of the 20th century.

SUMMARY

An investigation having a very limited objective, shows the following: That 23 persons in the present century have acquired leprosy in California. Of these, seven never had been out of the State. About these seven there can be no doubt as to the place of infection. The remainder are less positively attributed to infection in the State but this is believed to be established beyond reasonable doubt.

The majority of all cases are due to infection in Mexico, China, and the Pacific Islands.

California is to be regarded as an area in which the likelihood of transmission of leprosy is small, except for children born of parents, one or both of whom have the disease.

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