Ten-Year Review of Hospital Admissions of Patients with Leprosy

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LEPROSY is not considered a numerically important disease in the United States. There are approximately 2,000 known cases.

At the leprosy clinic of the Public Health Service Hospital in San Francisco 16 new patients were found among 198 family contacts, an attack rate of 80.8 per 1,000 contacts (*1*). In 1966, M. S. Dickerson of the Texas State Department of Health reported in a personal communication that he was finding about two new patients in each 100 contacts examined, an attack rate of about 20 per 1,000. Considering the frequency of such undiagnosed infections plus the freedom of travel which allows persons with undetected disease to enter the country, probably several times 2,000 persons with leprosy live in the United States.

During the 10-year period from July 1, 1955, through June 30, 1965, there were 362 first admissions to the Public Health Service Hospital at Carville, La. Of these, 25 patients were eliminated from the study because of inadequate or unsatisfactory data, four from the first 5-year period and 21 from the second. The purpose of this study was to compare the epidemiologic aspects of the remaining 337 cases.

Fiscal year	*Admissions*
1956	36
1957	30
1958	23
1959	19
1960	32
1961	35
1962	35
1963	34
1964	51
1965	42
Total	337

Characteristics of the Study Group

The number of first admissions per year ranged from 19 in 1959 to 51 in 1964 and averaged 33.7 per year for the 10 years. Among these, approximately twice as many patients were male as female.

The average age at the time of admission for the entire group was 38.2 years: females averaged 38.8 years, and males 37.9 years. The youngest female was 8 years old; the youngest male was 9. The oldest female admitted was 75, and the oldest male was 83 (table 1). Most of the 223 male patients were in the age groups 20–50 years, the largest number being in the 30- to 39-year age group.

Dr. Brubaker is medical officer in charge, Public Health Service Hospital, Carville, La., where the late Dr. Johnwick held the same position from November 1956 until his death in October 1965. Dr. John R. Trautman, formerly chief of the clinical branch of the hospital, collected much of the data from the patients' records.

Distribution by type of leprosy was 244, or 72.3 percent, lepromatous; 44, or 13 percent, dimorphous; 46, or 13.6 percent, tuberculoid; and three, or 1 percent, indeterminate (table 2). Frequency distribution, regardless of sex or type of leprosy, was slightly higher among persons in their 20's than those in their 40's.

Of the 156 patients born in the contiguous United States, the largest number, 81, came from Texas, 23 were born in Louisiana, and 11 were born in Florida. California, Illinois, and Maryland each contributed four patients; Arizona, Mississippi, and North Carolina each contributed three; and Alabama, Georgia, and Kentucky each contributed two. A single patient was born in each of the following States: Arkansas, Connecticut, Indiana, Iowa, Missouri, New Mexico, New York, Ohio, Oklahoma, Oregon, Pennsylvania, South Carolina, Tennessee, and Virginia.

Of the 181 patients born outside the contiguous States, 60 were born in Mexico, 27 in Puerto Rico, 16 in the Philippines, 13 in various other Pacific islands, 12 in Central and South America, 12 in Asia, and 10 in Hawaii. Seven each were originally from Cuba, India or Pakistan, and Europe, six from the Caribbean area, three from Africa, and one from the Near East.

Knowledge of the source of their infection was denied by 78, or 50 percent, of the patients born in the contiguous United States (table 3). Among patients born elsewhere, 50, or 27.6 percent, contracted the disease from another person, and 131, or 72.4 percent, came from an area where leprosy is endemic. Thus, all of the patients born outside the continental United States had a known or assumed contact. The source of their disease was unknown to 23 percent of all patients.

Among the 337 patients were 46 World War II veterans, 13 of whom were born in areas where leprosy is endemic outside the contiguous United States. Of these 13, four came from the Philippine Islands, four came from Puerto Rico, and Colombia, Hawaii, Mexico, Samoa, and Vietnam each contributed one. The remaining 33 veterans were natives of the following 18 States: Texas, seven; Florida, Louisiana, and Maryland, three each; Alabama, Illinois, and North Carolina, two each; and Arkansas, Georgia, Indiana, Kentucky, Mississippi, Missouri, New York, Ohio, Pennsylvania, South Carolina, and Virginia, one each.

Guinto and Binford studied 90 veterans with leprosy diagnosed during the period from 1940 to 1960(*2*). In that group, 12 had signs of leprosy before their military service, 15 had a history of exposure to leprosy before their service, 28 had lived in endemic areas before 1940, and 35 probably had been exposed while in the service. Of the 33 veterans born in the continental

Table 1. First admissions of patients to the Public Health Service Hospital at Carville, La., July 1, 1955–June 30, 1965, by age and sex

Age group (years)	Male	Female	Both sexes
Under 20	16	6	22
20–29	52	30	82
30–39	67	30	97
40–49	39	20	59
50–59	23	15	38
60–69	18	9	27
70 and over	8	4	12
Total	223	114	337

Table 2. Patients admitted to the Public Health Service Hospital at Carville, La., July 1, 1955–June 30, 1965, by type of leprosy and sex

Type of leprosy	Male		Female		Both sexes	
	Number	Percent	Number	Percent	Number	Percent
Lepromatous	164	73. 5	80	70. 0	244	72. 3
Dimorphous	29	12. 9	15	13. 2	44	13. 0
Indeterminate	2	1. 0	1	. 9	3	1. 0
Tuberculoid	28	12. 5	18	15. 8	46	13. 6
Total	223	99. 9	114	99. 9	337	99. 9

United States, 20 served in the Far East, four in Latin America, three in Hawaii, two in the Near East and Southeast Asia, one in Africa, one in Germany, and two in Texas only.

The racial distribution of the 46 veterans admitted during this study period was white 35, Asian six, and Negro five. The racial distribution for all patients admitted during the same period was white 271, Asian 35, and Negro 31.

Symptoms and Delays Preceding Admission

The conditions which prompted the patients to seek medical advice are given in table 4. Because of the subjectivity of the patients' descriptions of their initial symptoms and the interpretations by the physicians, as well as the variabilities among the individual physicians' descriptions of the signs evident during their examinations, only 205 cases were used in tabulating these signs and symptoms. The other 132 cases were found unsuitable because of inadequate data.

"Numbness," which can be interpreted to mean anesthesia or paresthesia, was reported in 102 of 205 patients. Because leprosy of either a local or disseminated type is primarily a disease of the skin, nerves, and mucous membranes, early invasion of the nerve endings usually will produce a localized area of anesthesia within the initial lesion. Other manifestations of either

Table 3. Known exposure to leprosy of 337 patients admitted to the Public Health Service Hospital at Carville, La., July 1, 1955–June 30, 1965, by birthplace

Exposure	Born in contiguous United States		Born outside contiguous States		Total	
	Number	Percent	Number	Percent	Number	Percent
Only endemic area outside the United States	37	23.7	131	72.4	168	49.9
Another patient	41	26.3	50	27.6	91	27.0
Unknown	78	50.0	0	--------	78	23.1
Total	156	100.0	181	100.0	337	100.0

Table 4. Symptoms and lesions in 205 patients first admitted to the Public Health Service Hospital at Carville, La., July 1, 1955–June 30, 1965, by sex

Symptoms and lesions	Males		Females		Both sexes	
	Number	Percent	Number	Percent	Number	Percent
Presenting symptoms	117	85.4	60	88.2	[1] 177	86.3
Numbness	67	48.9	35	51.5	102	49.8
Nasal congestion	25	18.2	9	13.2	34	16.6
Pain or tenderness	14	10.2	7	10.3	21	10.2
Cramps	1	.7	1	1.5	2	1.0
Weakness	4	2.9	0	--------	4	2.0
Pruritus	7	5.1	7	10.3	14	6.8
Hoarseness	1	.7	0	0	1	.5
Fever	6	4.4	1	1.5	7	3.4
Burning	0	--------	1	1.5	1	.5
No symptoms	20	14.6	8	11.8	28	13.7
Presenting lesions	135	98.5	67	98.5	202	98.5
Macules	47	34.3	24	35.3	71	34.6
Papules and nodules	31	22.6	13	19.1	44	21.5
Plaques	15	10.9	6	8.8	21	10.2
Vesicles and bullae	3	2.2	0	--------	3	1.5
Ulcers	2	1.5	2	2.9	4	2.0
Erythema nodosum leprosum	7	5.1	3	4.4	10	4.9
Miscellaneous	30	21.9	19	27.9	49	23.9
No lesions	2	1.5	1	1.5	3	1.5

[1] 168 patients had 1 symptom and 9 patients had more than 1 symptom.

motor or sensory nerve involvement or both are pain, tenderness, pruritus, weakness, and burning. When the number of patients complaining of numbness is added to those with other neurological signs or symptoms, 142, or 69.3 percent, initially had manifestations attributable to peripheral nerve involvement. Twenty-eight patients, or 13.7 percent, had no symptoms.

Periods of delay noted in relation to presenting signs and symptoms are striking and significant (table 5). Three intervals of delay are observed in relation to the first manifestations of leprosy and admission to the Public Health Service Hospital at Carville. The first interval is the time from which the patient became aware of his first sign or symptom consistent with leprosy until he consulted a physician. The second interval is the period after medical advice had been sought but before the diagnosis of leprosy was established. The third delay is from establishment of a diagnosis to the day the patient was admitted to the hospital.

In the first interval 260, or 77.1 percent, of the patients among the 337 first admissions sought advice from a physician within a period of 12 months. Among the patients who delayed longer were 30 who went 24 months before seeking medical advice; 13 waited 36 months. One patient delayed 360 months after the onset of symptoms before seeing a physician.

The second interval is especially striking because of the length of time before the diagnosis was established. Diagnoses of 232, or 68.8 percent, of the patients' illnesses were made within 12 months. Diagnosis of the conditions in 43 patients was delayed for periods of 1 to 2 years and in 15 patients for longer than 85 months. In one case the diagnosis of leprosy was not made for 25 years.

The third interval is significant only to those patients who required hospitalization because of complications of the disease and because of the concern for the patients' contacts. Within 12 months after diagnosis 283, or 84 percent, of the patients were admitted to Carville. The longest single delay was 324 months, and several individual delays exceeded 200 months. The total average delay for patients admitted to Carville was 51.3 months from the first manifestation of leprosy to hospitalization. However, the median delay in each interval was 12 months or less.

Discussion

All persons with leprosy in the United States are not, and need not be, admitted to the Public Health Service Hospital at Carville. This study represents information only on patients admitted to the hospital and therefore is not necessarily representative of the incidence of leprosy in the United States. Nonetheless, a study of a decade of first admissions to this hospital reflects a measure of the prevailing problem of leprosy in the United States.

Compared with the estimated worldwide prevalence of 10,786,000 cases of leprosy in 1966 (*3*), the number of cases in the United States

Table 5. Intervals between manifestations of illness, diagnosis of leprosy, and admission to the Public Health Service Hospital at Carville, La., July 1, 1955–June 30, 1965, by number and percent of patients

Months of delay	Interval 1 [1]		Interval 2 [2]		Interval 3 [3]	
	Number	Percent	Number	Percent	Number	Percent
12 or less	260	77.1	232	68.8	283	84.0
13–24	30	8.9	43	12.7	9	2.6
25–36	13	3.8	12	3.6	5	1.5
37–48	7	2.1	12	3.6	7	2.1
49–60	5	1.5	16	4.7	2	.6
61–72	6	1.8	4	1.2	2	.6
73–84	4	1.2	3	.9	3	.9
85 or more	12	3.6	15	4.5	26	7.7
Mean (in months)	14.5		17.4		19.4	

[1] From first sign or symptom to first visit to physician.
[2] From first visit to physician to diagnosis.
[3] From diagnosis to admission to hospital.

is small. However, the number of patients admitted to the Public Health Service Hospital at Carville and estimated living in the continental United States has not decreased over the past several years.

Studies by Leiker of West New Guinea (*4*) Wade and Ledowsky of Nauru (*5*), and Scott and co-workers (*6*) demonstrate an epidemiologic basis for determining the experience of a community recently exposed to leprosy compared with a community where the disease has been manifest for many years. Leiker's study in particular demonstrates the relationship between the introduction of leprosy into a community without previous experience with leprosy compared with the introduction of the disease into a nonleprous community which has had experience with other mycobacterial diseases, such as tuberculosis. The usual type of epidemic—as in the United States and elsewhere where leprosy and tuberculosis co-exist—would manifest itself by slow spread, with foci of infections occurring in families and communities, a high type index

$$\left(\frac{\text{Lepromatous}}{\text{Total cases}} \times 100 = \text{type index}\right)$$

and a relatively higher incidence in children and young adults. Known contacts were often those of the lepromatous patient with whom there had been prolonged intimate contact in the house and often in the family.

In an epidemic pattern of leprosy in a population previously unchallenged by mycobacteria, the disease usually spreads rapidly. Cases are found throughout most houses rather than in a focal location, and the type index is low, with the tuberculoid type dominating. Adults seem to be as susceptible as children. Most persons with secondary cases would not have had contact with a lepromatous patient, and even persons who have would not necessarily have been in prolonged intimate contact (*4*).

Also, the data of this report show that the type index of the patients admitted to this hospital, 72.3 percent, is high. The patients in this study were older on the average than those studied either by Leiker or Wade and Ledowsky. At Carville, as globally, the ratio of male to female patients is about 2:1.

Anesthesia is the sine qua non of leprosy. This study demonstrated frequent peripheral neurological involvement. If all instances of anesthesia were considered suggestive of leprosy unless proved otherwise, leprosy would be diagnosed earlier. The earliest manifestation of leprosy in the natural history of the disease probably is a small area which may be more subjectively anesthetic than objectively observed. When studied histologically, the lesions might be merely round cell infiltration adjacent to neurovascular bundles in the area of the anesthesia.

If this initial lesion is not found, or if found but not diagnosed by the physician and thereby left untreated, the natural history of the disease will be determined by the response of the host to the invading organism, the *Mycobacterium leprae*. A diminishing degree of response by the host produces a spectrum of clinical and pathological manifestations from the tuberculoid type of lesion, single or few in number, through the dimorphous (borderline) range to lepromatous (or disseminated) disease.

In the later stages of either dimorphous or lepromatous leprosy, a reaction by the patient, probably due to the breakdown of bacterial products, may be the first manifestation of the disease. This reaction may be the eruption of lesions of the skin which differ from those of leprosy per se or erythema nodosum leprosum and other systemic disorders, such as leukocytosis, elevated sedimentation rate, fever, chills, neuritic pain, ocular changes, and general discomfiture and debilitation. Whatever the type of leprosy, therefore, early recognition of the symptoms, diagnosis, and treatment are the most important factors in the prevention and control of the disease, prevention of disability, and early reduction of infectiousness.

The significance of the data on intervals of delay becomes apparent when considered in relation to the effects on both the individual patient and the public health. A consultant to the hospital, R. G. Cochrane, said, in a personal communication in May 1965, that the early recognition and treatment of leprosy portends that it can be cured and disability and disfigurement prevented.

As a public health problem leprosy must be considered from the standpoint of the person

with the disease, his susceptibility, and the opportunity of spread. Most persons are not susceptible to leprosy. Of those who are, many may have an insignificant or self-healing form of leprosy. Persons who are highly susceptible, if the opportunity is adequate, will get leprosy in a more severe form. Early treatment of the patient with leprosy to reduce infectiousness, examination of known and suspected contacts, and prophylactic treatment when indicated are essential in an effective leprosy control program.

Summary

From July 1, 1955, through June 30, 1965, there were 362 first admissions to the Public Health Service Hospital at Carville, La. Of these, 25 persons were eliminated from this study because of inadequate or unsatisfactory data.

Among the 337 patients remaining in the study were approximately twice as many males as females. The average age at the time of admission was 38.2 years. The youngest patient was a girl 8 years old, and the oldest was a man of 83. Of the cases studied, 244, or 72.3 percent, were lepromatous; 44, or 13 percent, were dimorphous; 46, or 13.6 percent, were tuberculoid; and three, or 1 percent, were indeterminate.

Patients born in the continental United States included 81 from Texas, 23 from Louisiana, 11 from Florida, and 41 from 23 other States. Of 181 patients from outside the contiguous States 60 were born in Mexico, 27 in Puerto Rico, 16 in the Philippines, 13 in various Pacific Islands, 12 in Central or South America, 12 in Asia, 10 in Hawaii, seven each in Cuba, India or Pakistan, and Europe, six in the Caribbean area, three in Africa, and one in the Near East.

Half the patients born in the continental United States denied knowledge of the source of their infection. Among the patients born elsewhere, 27.6 percent reported that they had contracted the disease from other patients. Of these, 72.4 percent came from areas where leprosy is endemic. The source of their disease was unknown by 23 percent of the entire study group.

Among the 337 first admissions, 46 patients were veterans, 13 of whom were born outside the United States in areas where leprosy is endemic. Most veterans born in the United States served in the Far East. The racial distribution of the 46 veterans was 35 white, six Asian, and five Negro. The distribution for all patients admitted during the period was 271 white, 35 Asian, and 31 Negro.

More than 50 percent of the patients sought medical advice because they had neurological symptoms denoting anesthesia or paresthesia. Macular lesions, present in 34.6 percent of the patients, were the type most frequently observed.

The average delay was 14.5 months from the onset of a symptom until the patient visited a physician. An average of 17.4 months elapsed from the time a physician was consulted until the diagnosis was established. The period from diagnosis to admission to the Public Health Service Hospital at Carville averaged 19.4 months.

In differential diagnosis prompt consideration of leprosy is imperative to effect early treatment. When it is diagnosed early and treated appropriately, leprosy can be cured, deformity prevented, the source of infection eliminated, and the reservoir reduced.

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