

Leprosy (Hansen’s Disease)

Leprosy is a Class C Disease and is reportable to the state within five business days.

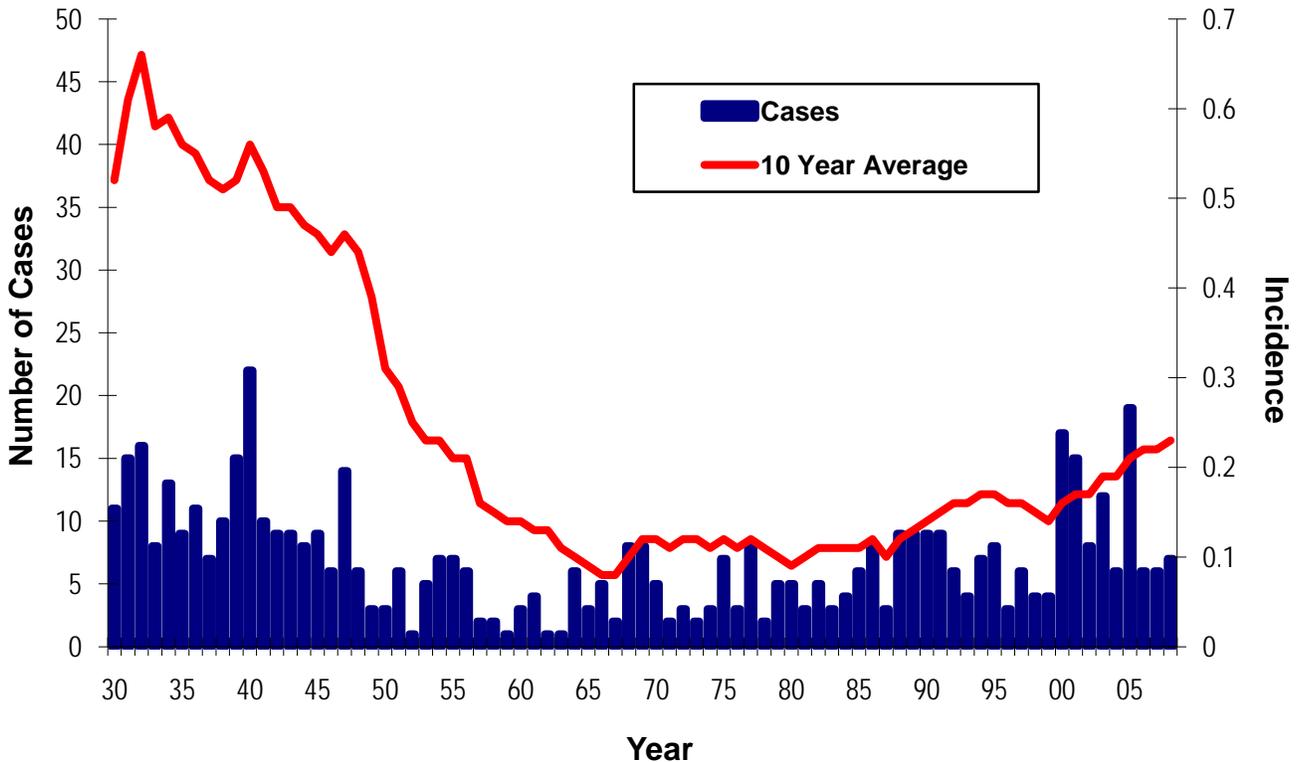
Leprosy was well established in Louisiana prior to the arrival of the Acadians. In the late 1700s, the migration of Acadians from Nova Scotia to Louisiana seems to have imported a few cases of leprosy. It is only by the late 1880s that the numbers were high enough to cause the Louisiana State Board of Health to found a leprosy hospital at Carville near Baton Rouge. By 1921, the hospital was taken over by the U.S. Government.

Incidence rates (new case registrations) of leprosy increased to the 1880s (4.5/100,000) to reach a high of 12 per 100,000 in the late 1920s. These high rates were observed in South Louisiana (often named “French” Louisiana and New Orleans). North Louisiana was relatively spared with rates rarely exceeding 1.0 per 100,000.

Incidence

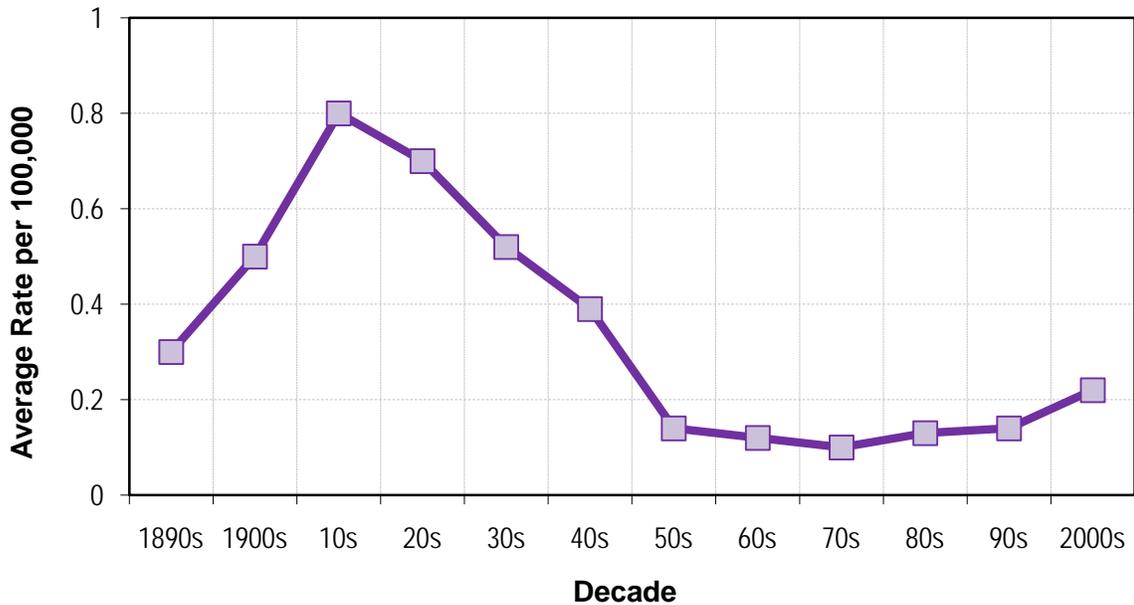
Incidence rates for leprosy from 1880 to 1930 ranged from 5 to 10 per 100,000 in “French Louisiana”. Trends from 1930 to 2008 are presented in Figures 1A and 1B.

Figure 1A: Leprosy cases and 10 year average incidence rates - Louisiana, 1930-2008



From the 1930s to the 1960s the number of new cases and incidence decreased progressively from about 0.5 per 100,000 to 0.2 per 100,000. Case numbers then remained stable to around 5 to 10 new cases per year for an incidence of approximately 0.1. In the 1990s, the number of cases increased to 10 to 20 per year for an incidence increasing to 0.2 to 0.4 per 100,000.

Figure 1B: Leprosy incidence rates by 10 year periods – Louisiana, 1890s-2000s



Incidence by Sex

There has been a slight excess of leprosy among males from the earliest report (see Table 1) however the preponderance of males has increased since the 1990s. This type of shift is not usually expected and may reflect a shift in exposure patterns.

Table 1: Trend in sex ratio of leprosy cases by decades - Louisiana, 1930s-2000s

| Sex Ratio | | | | |
|---------------------------|------------|------------|------------|---------------------|
| Period | Sum | Males | Females | Ratio Males:Females |
| I=Prior to 1930s | 343 | 212 | 131 | 1.6:1 |
| 30s | 115 | 65 | 50 | 1.3:1 |
| 40s | 96 | 48 | 48 | 1.0:1 |
| 50s | 40 | 18 | 22 | 0.8:1 |
| 60s | 41 | 23 | 18 | 1.3:1 |
| 70s | 38 | 20 | 18 | 1.1:1 |
| 80s | 55 | 34 | 21 | 1.6:1 |
| II=1930s to 1980s | 385 | 208 | 177 | 1.2:1 |
| 90s | 60 | 44 | 16 | 2.8:1 |
| 00s | 96 | 69 | 27 | 2.6:1 |
| III=1990s to 2000s | 156 | 113 | 43 | 2.6:1 |

The difference in distribution by sex between period I and II is barely significant (OR=1.38, CI 1.01-1.87) while the difference between period II and III is very high and very significant (OR=0.45, CI 0.29-0.68).

Incidence by Age Group

Since it appears that there were some shifts in the incidence pattern by sex and age group, the data was analyzed for 3 different periods: 1930 to 1959, 1960 to 1989 and 1990 to 2008. (Figures 2A, 2B and 2C)

Figure 2A: Average annual incidence rate of leprosy by sex and age group Louisiana, 1930-1959

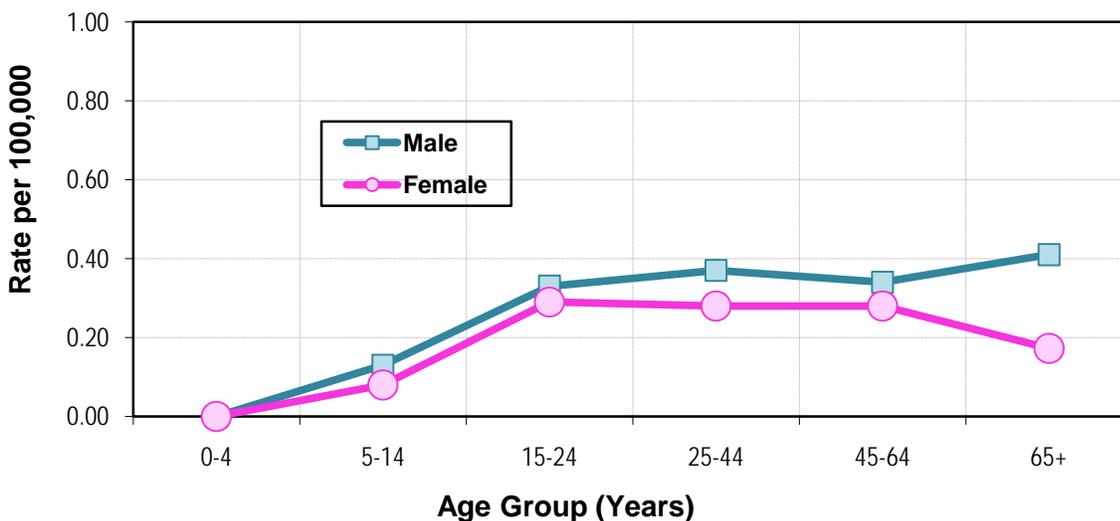


Figure 2B: Average annual incidence rate of leprosy by sex and age group
Louisiana, 1960-1989

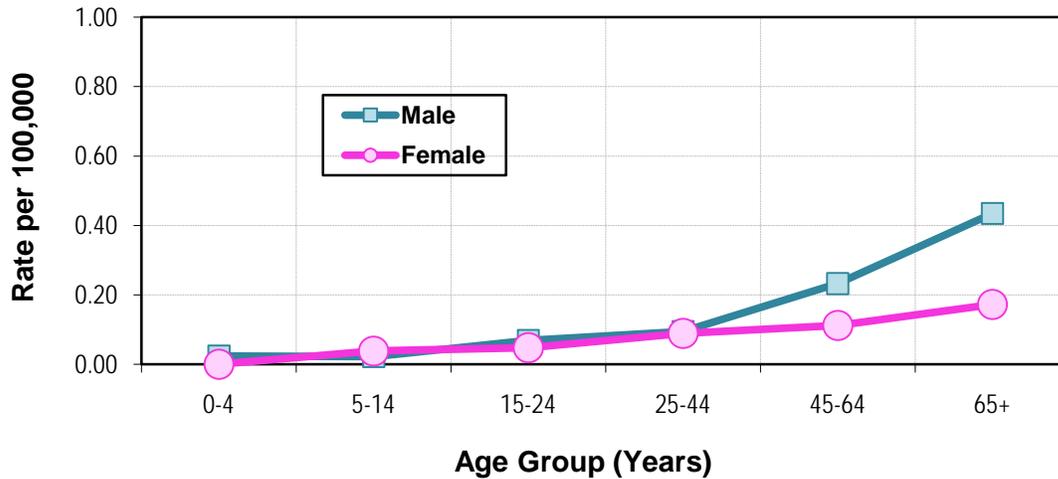
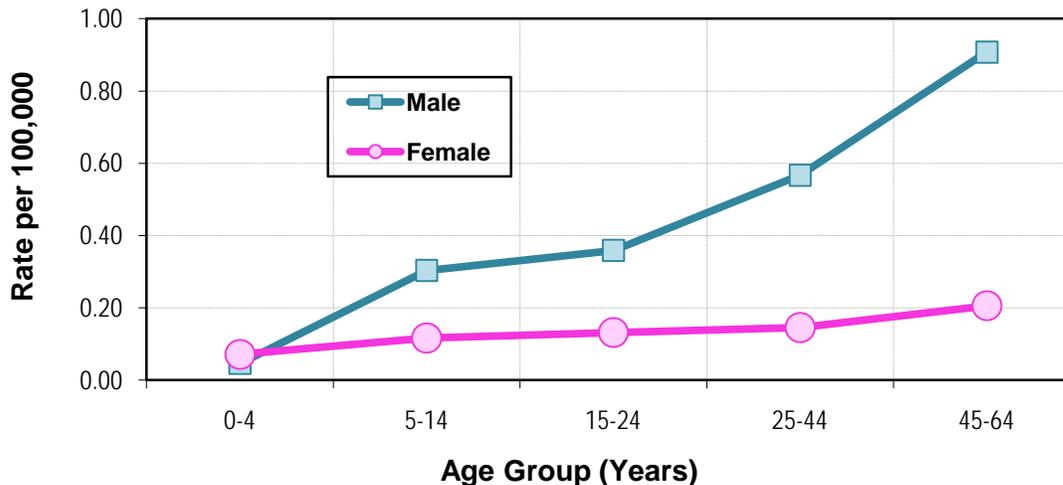


Figure 2C: Average annual incidence rate of leprosy by sex and age group
Louisiana, 1990-2008



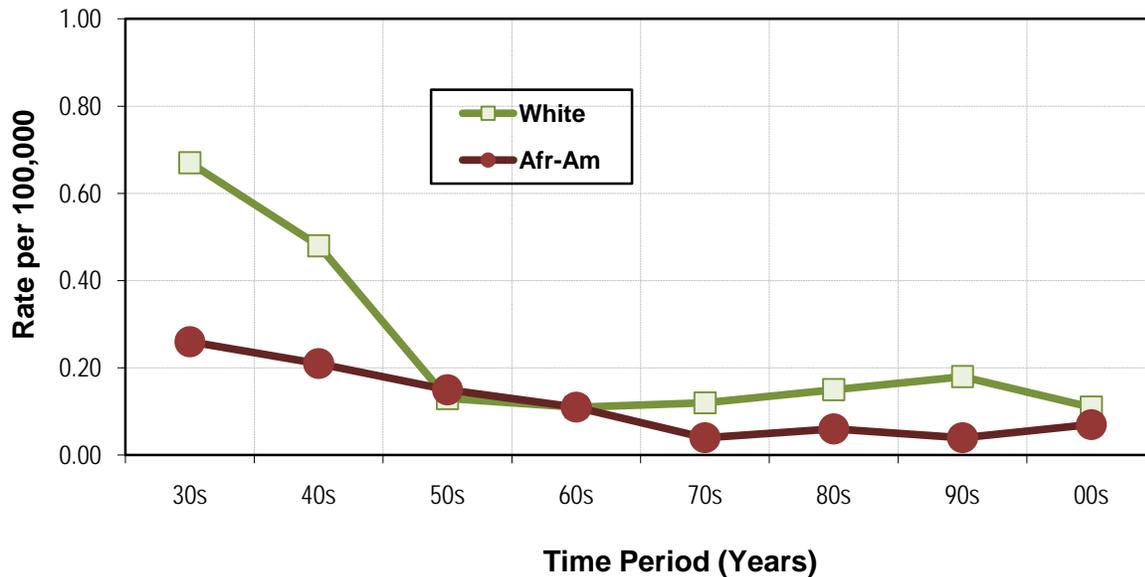
Incidence rates are lower among children and increase with age. That pattern is observed throughout all 3 periods.

The incidence pattern by sex and age group has changed over time. In the first period, there was very little difference between males and females until old age. In the second period, by age 45, males start to show higher incidence than females. Finally in recent times, male incidence is much higher than females, much earlier in life. Male children in the age group of 5 to 14 years, already show higher incidence than female children.

Incidence by Race / Ethnic Group

Throughout the time periods listed in Figure 3, Whites were a majority of cases (77.0%) followed by African-Americans (19.6%). Other groups are rarely represented: Hispanic, 1.6%; Asian /Pacific Islander, 1.6%; Other, 0.2%. There has been not much change in the distribution of cases throughout these time periods, from 73% to 77% for Whites without any significant changes.

Figure 3: Incidence of cases by race - Louisiana, 1930s-2000s

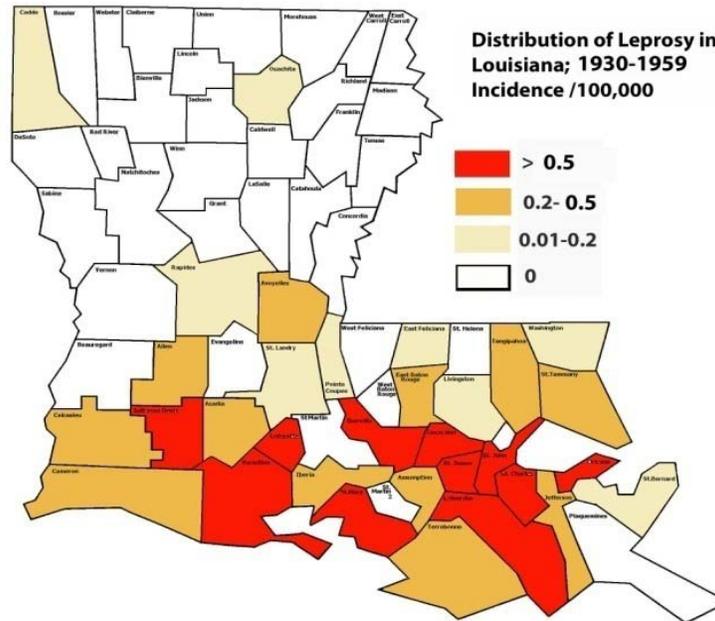


The incidence among Whites has been much higher than that of African-Americans. Incidence has been decreasing in both groups. However, there still remains a gap between both groups.

Geographical Distribution

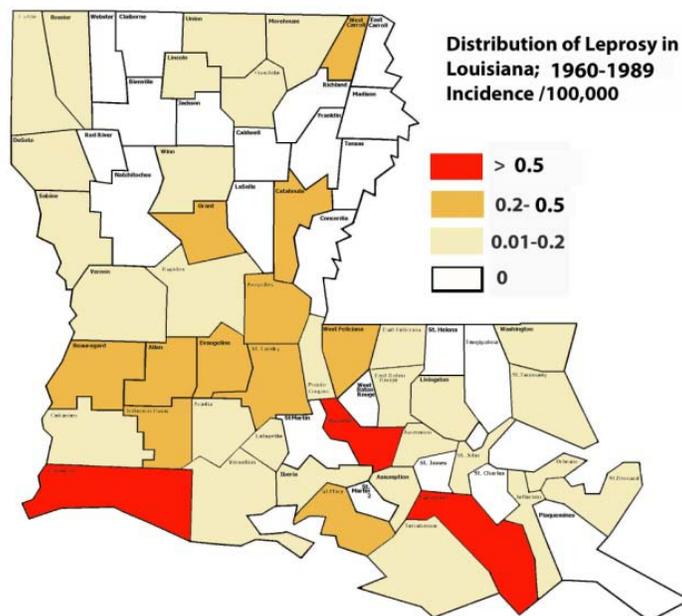
Leprosy occurred mainly in South Louisiana (“French Louisiana”) in the years between 1930 to 1959. The highest incidence rates were observed in a narrow band of parishes from Orleans Parish in the east to Calcasieu Parish in the west. The highest incidences (0.5 /100,000) were observed in the “Cajun” parishes. In north Louisiana cases were restricted to a few larger cities (Shreveport, Monroe and Alexandria). (Figure 4)

Figure 4: Distribution of Leprosy - Louisiana, 1930-1959



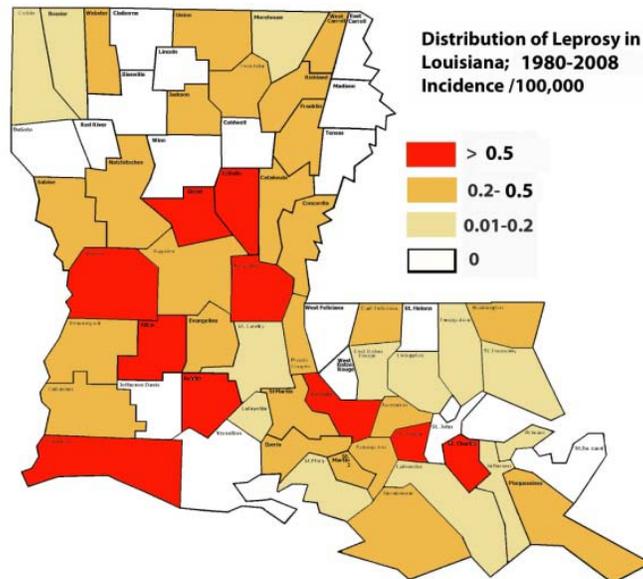
Between 1960 to 1989, there was a sharp decrease in incidence in the “Cajun” parishes where most incidences had decreased to 0.2 to 0.5 per 100,000 population. Meanwhile, the northern parishes saw moderate and widespread increase in incidence (0.02 to 0.2 /100,000 population). (Figure 5)

Figure 5: Distribution of Leprosy - Louisiana, 1960-1989



In recent years (1990 to 2008) there has been a radical change in geographical distribution. Leprosy is on the increase throughout the state, in the Cajun parishes, and particularly in North Louisiana. Several authors had noticed this trend towards leprosy cases in northern Louisiana where it was rarely observed before. (Figure 6)

Figure 6: Distribution of Leprosy - Louisiana, 1990-2008



Origin of Cases

The majority of cases are U.S. born (from 2000 to 2008: 94% were born in the U.S.).

Table 2: Country of origin of leprosy cases - Louisiana 2000-2008

| Country of Birth | Total | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 |
|------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| United States | 90 | 15 | 15 | 6 | 10 | 6 | 19 | 6 | 6 | 7 |
| Brazil | 1 | | | 1 | | | | | | |
| India | 1 | | | 1 | | | | | | |
| Taiwan | 1 | | | | 1 | | | | | |
| Vietnam | 1 | | | | 1 | | | | | |
| Western Samoa | 2 | 2 | | | | | | | | |
| Total | 6 | 2 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 |

Only one of these cases was diagnosed before entry into the United States; all others were diagnosed after entry.

Clinical Classification

The majority of cases are multi-bacillary. From the years 2000 to 2008, the types B, BL or LL represent 70% of all cases.

The distribution of cases by gender shows a slight preponderance of multi-bacillary cases (lepromatous and borderline) among males (77% L for males vs. 68% L for females, 6% B for males vs. 4% B for females) while the opposite is true for pauci-bacillary (indeterminate and tuberculoid) cases (1% I for males vs. 3% for females, 16% T for males vs. 24% for females), the difference being significant ($\chi^2=12.7$, $p=0.05$). (Table 3)

Table 3: Clinical classification of leprosy cases - Louisiana, 2000-2008

| HD Class | Total | % |
|--------------------|-------|---------------|
| I | 8 | 10.5% |
| TT | 4 | 5.3% |
| BT | 10 | 13.2% |
| B | 1 | 1.3% |
| BL | 19 | 25.0% |
| LL | 34 | 44.7% |
| Subtotal | 76 | 100.0% |
| Unspecified | 20 | |
| Total | 96 | |

The distribution of cases by age group shows some difference by gender. Among males the proportion Multi-bacillary/Pauci-bacillary is fairly constant (from 85%-15% to 90%-10%). Among females, the proportion Multi-bacillary/Pauci-bacillary decreases with age (from 68%-32% to 56%-44%) with the exception of the 15 to 44 age group where the majority are multi-bacillary (96%). (Figures 7 and 8)

Figure 7: Distribution by bacteriological type within age group - males - Louisiana, 2000-2008

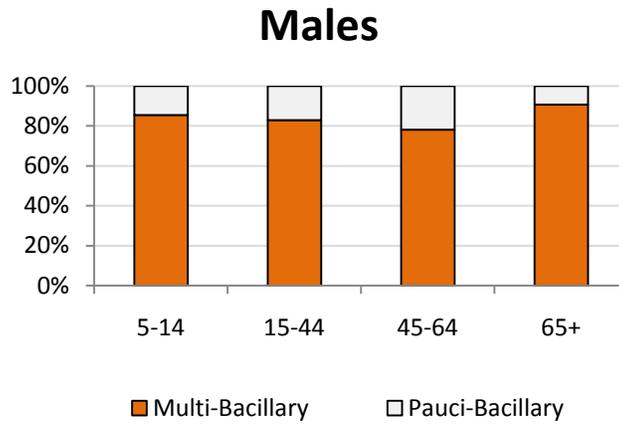
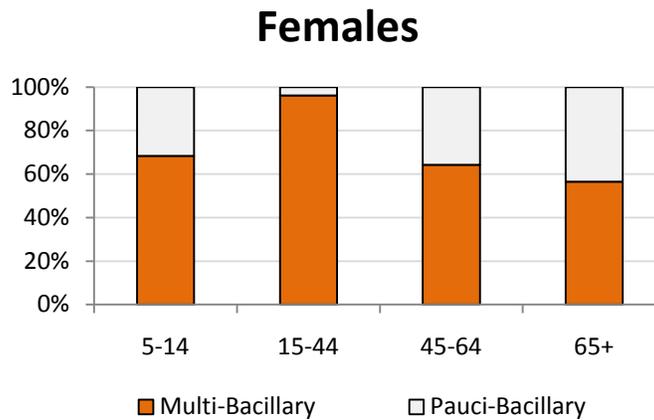


Figure 8: Distribution by bacteriological type within age group - females - Louisiana, 2000-2008

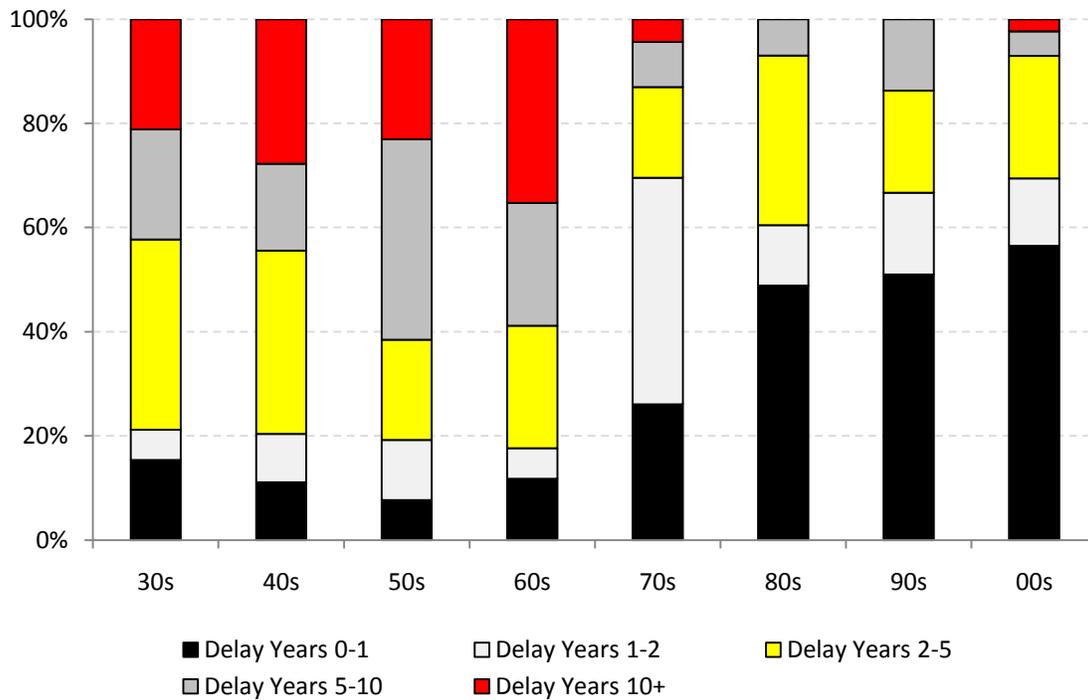


Delay Onset-Diagnosis

From 2000 to 2008, the majority of cases were diagnosed within 1 year of onset (55%). The delay between onset and diagnosis has been steadily reducing throughout the last 80 years. In the 1930s, 40% of cases were diagnosed within 2 to 5 years of onset and 20% more than 10 years after onset. The proportion of cases diagnosed within 1 year was hovering about 10% until the 1970s when it started increasing to be 55% in current times. In the early days, there was no treatment; physicians likely delayed diagnosis because of the consequences to the patient of

social ostracization. Mandatory institutionalization in the United States stopped only in the 1960s and outpatient treatment began. Those factors may have affected the diagnosing trends in Louisiana. (Figure 9)

Figure 9: Trend in delay between onset and diagnosis by decades - Louisiana, 2000-2008



The Armadillo Connection

In the old days, leprosy was a very focal infection. Most cases were clustered in families or small population groups with very few sporadic cases. This pattern has been changing. Currently, the majority of cases had no family history of leprosy and occurred as sporadic cases with no connection to any cluster. The changes in gender, age group and geographic distribution all tend to show that the epidemiologic picture of leprosy is completely different.

In 1975 a leprosy-like infection was found among the nine-banded armadillo *Dasypus novemcinctus*. This was later shown by DNA studies to be identical to human leprosy. Areas with the highest rates of human leprosy were also areas with a high prevalence of leprosy in the armadillo population. Leprosy research on armadillos started in 1968, however, surveys of frozen specimens of armadillos showed that as early as 1961, armadillos were infected (17/182

positive sera) on a wide scale. Numerous surveys have since been carried show that about 4% of armadillos had histo-pathological leprosy lesions and 16% had detectable IgM antibodies.

It appears that the prevalence rate among armadillos remained constant throughout the past years. The infection seems to be concentrated to the low-land coastal areas of Louisiana and Texas; only rare cases were found in higher lands of Texas, Arkansas or Mississippi.

Armadillos are not native to Louisiana. Armadillos slowly expanded their range north from Mexico beginning in the 1880s and have achieved very high densities here. No one really knows what allowed them to extend their range, but people speculate it was the elimination of normal predators as cattle operations increased in Texas. By 1957, armadillos had colonized south Louisiana.

For 32 patients for which armadillo contact was elicited, 15 said that they had contact with armadillos (about 50%). Although the connection between armadillo-leprosy and the changing epidemiology of leprosy in Louisiana is very suggestive, the exact mechanism of transmission is still being debated.