

Epidemiological Features

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DURING the late summer of 1954, an outbreak of illness subsequently identified as St. Louis encephalitis occurred in the Lower Rio Grande Valley of Texas.

The existence of a viral encephalitis in epidemic form was first suspected by the local health authorities in the latter part of August, when an unusually large number of cases of poliomyelitis were reported from Hidalgo County. It was noted that a large proportion of the cases were in adults. In view of this unusual seasonal incidence, together with the atypical age distribution, a disease entity other than poliomyelitis was suspected.

On August 24 a request for epidemiological aid was submitted to the Communicable Disease Center of the Public Health Service by the Texas State Department of Health. A CDC team consisting of epidemiologists, entomologists, and a statistician was sent to the scene of the epidemic to aid in the investigation. Records on 373 cases, 10 of them fatal, were obtained from Hidalgo and adjoining counties.

Hidalgo County is in the Lower Rio Grande Valley of Texas (see map, p. 511). The economy of the area is based upon agriculture carried on in the irrigated, highly fertile, southern part of the county bordering the Rio Grande

River. Citrus, cotton, and truck produce are the primary crops. Canning and oil and gas production are also important industries. The northern part of the county is sparsely settled ranch country and contains only a small portion of the population.

The residents of the area may be divided into two major ethnic groups, namely, Latin-American and Anglo-American. The Latin-Americans are of Mexican and Spanish descent, while the term Anglo-American applies to the remainder of the population with the exception of small Negroid and Asiatic components. The Latin-Americans are largely unskilled and semiskilled laborers, often employed only during periods of agricultural labor demand. In many instances their housing is inadequate and crowded, and sanitation is poor. The two groups generally live in separate sections of the urban communities.

There are also a number of Mexican nationals, engaged primarily in agricultural labor, living in the valley. These include the *braceros*, laborers who enter the country under Government supervision, and many "wetbacks" who have entered the country illegally in search of higher wages. The *braceros* live in closely supervised camps and remain in this country only for a specified period as dictated by agricultural need and labor contract provisions. The "wetbacks" often are semipermanent residents of the area, their periods of tenure being limited only by detection and deportation by the border patrol. They live in whatever housing they can find, usually under extremely primitive and crowded conditions.

The population of the county, according to the 1950 decennial census, was 160,446; 57 per-

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cent urban, 23 percent rural nonfarm, and 20 percent rural farm. Local sources state that the population was approximately 69 percent Latin-American, 30 percent Anglo-American, and less than 0.4 percent Negro. The population increased 51.3 percent from 1940 to 1950. The 1954 population of Hidalgo County was estimated to be 193,369.

Meteorological Data

During the period April 8-14, 1954, heavy rains averaging 10 inches fell over a large area within the county, exceeding by 6 inches the maximum rainfall recorded for the same month during the period 1940 through 1953. Because of poor drainage in this area, the water persisted for quite some time and provided excellent mosquito breeding conditions. The mosquito population, however, was kept down by vector control operations. Precipitation in June, July, August, and September was within normal limits.

Temperatures during the spring were normal, averaging about 75° F. June was the hottest month on record for the period 1940-54; the average temperature was 87.8° F. From July through September the temperatures were within the normal range.

Investigation Methods

The investigation was a joint operation of the Hidalgo County Health Unit, the Texas State Department of Health, and the Public Health Service. On August 27, shortly after the arrival of the epidemiological team, a preliminary appraisal of the epidemic situation was accomplished through a telephone survey to local physicians. This definitely established the existence of an unusual prevalence of a disease resembling virus encephalitis. After this preliminary survey, forms for systematic collection of clinical and epidemiological data were prepared. A meeting was then held with the representatives of the local medical society for the purpose of obtaining cooperation in the prompt and accurate reporting of cases. Physicians were also encouraged to submit a list of patients that they had previously seen and suspected of having had encephalitis, and to obtain blood

specimens from all new patients during the acute phase of the illness. Investigators visited these physicians periodically in order to collect data on new cases. They also visited local hospitals and patients at home during convalescence to obtain more complete epidemiological data.

Only one hospital in this area was available for treatment of poliomyelitis, and all cases diagnosed as having poliomyelitis were admitted there. Owing to the difficulty of differentiating nonparalytic poliomyelitis from encephalitis clinically, one epidemiologist was assigned to this hospital to study the cases admitted and to review the hospital records. Many of the cases admitted there during this epidemic period were subsequently found to have encephalitis rather than poliomyelitis.

Paired serum samples from 87 patients and single serums from 50 individuals giving a history of no illness were collected for antibody determination. Three autopsies were performed, and brain tissues from two were taken for virus study. All specimens were sent to the bureau of laboratories of the Texas State Department of Health. In addition, brain tissues were sent to the Virus and Rickettsia Section, Communicable Disease Center, for virus isolation.

In a diligent search for potential vectors, the entomologists emphasized collection of adult mosquitoes for virus isolation.

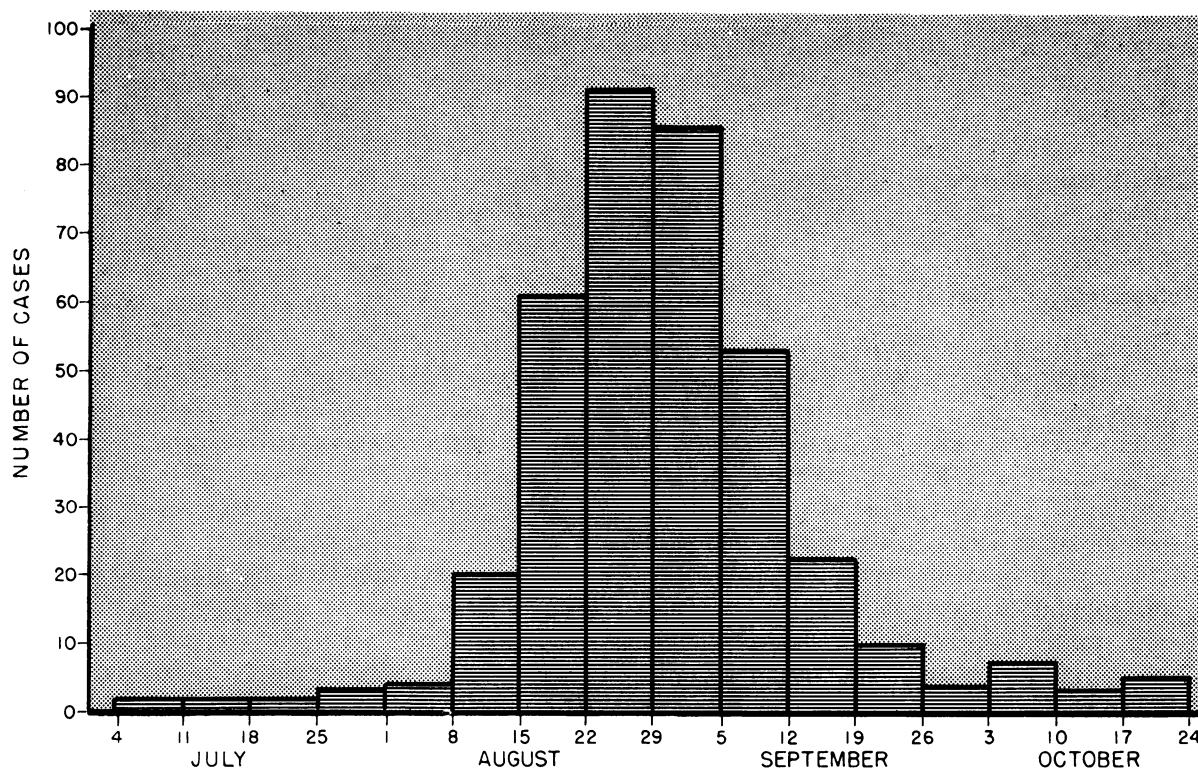
Local veterinarians were also contacted to ascertain whether there were any known outbreaks of disease in animals, and any notifications of unusual disease in animals were investigated by the veterinarian epidemiologist.

Results

In general, the disease was an acute febrile illness characterized by a relatively abrupt onset, with fever, severe generalized headache, malaise, disorientation, stupor, and signs of meningeal irritation. The course was usually self-limited, with the fever lasting 3 to 7 days, falling by lysis.

During early July physicians began to notice an increase in the number of patients with fever of unknown origin. In retrospect, these cases could have been mild encephalitis and probably represented the beginning of the epi-

Figure 1. Distribution of 363 reported cases by week of onset, Hidalgo County, Tex., 1954.



demic. In August an increasing number of cases were observed, and the outbreak reached its peak during the last week of the month. Figure 1 depicts the epidemic curve of the 363 cases for which date of onset was available. The dates of onset of the other 10 cases were not recorded. It is of interest that most of the cases occurred during the period from the middle of August to the middle of September.

Based on the 317 cases for which data were available and on the estimated 1954 population, the attack rate for Hidalgo County was 163.9 per 100,000. It was felt that many patients with symptoms of mild encephalitis were not seen by physicians and consequently had not been reported. Further, during the early phase of the epidemic many of the cases diagnosed as encephalitis were not reported to the health department. Based on the number obtained by the telephone survey and on the number of cases actually reported, it was estimated that approximately 2.8 times as many cases had occurred as were actually reported, or a total of approximately 1,000 cases.

Of 11 towns in this area with a population

greater than 1,000, the attack rate was highest in Weslaco and lowest in Mercedes (table 1). The cases occurred in widely separated areas and there was no evidence of radial spread from one town to another. Although all age groups were affected, the incidence was highest in individuals over 50 years of age (table 2). The incidence for males was 155.7 per 100,000

Table 1. Number of cases and attack rates for cities with more than 1,000 population, Hidalgo County, Tex., 1954

City	Estimated 1954 population	Number of cases	Rate per 100,000
Weslaco	9,056	39	430.6
San Juan	4,113	12	291.8
Edinburg	14,924	37	247.9
Edcouch	3,525	6	170.2
Alamo	3,636	7	192.5
Elsa	3,831	7	182.7
McAllen	24,185	44	181.9
Pharr	10,473	17	162.3
Mission	12,974	17	131.0
Donna	8,642	7	81.0
Mercedes	12,150	3	24.7

Table 2. Number of cases and attack rates by age and sex for 317 residents of Hidalgo County, Tex., late summer 1954

Age	Estimated 1954 population			Number of cases			Attack rate per 100,000		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
Under 9	27, 268	26, 437	53, 705	37	17	54	135. 7	64. 3	100. 5
10-19	18, 484	17, 593	36, 077	20	21	41	108. 2	119. 4	113. 6
20-29	17, 614	16, 762	34, 376	18	20	38	102. 2	119. 3	110. 5
30-39	13, 182	11, 992	25, 174	17	29	46	129. 0	241. 8	182. 7
40-49	10, 348	9, 050	19, 398	6	20	26	58. 0	221. 0	134. 0
50-59	6, 202	5, 889	12, 091	16	11	27	258. 0	186. 8	223. 3
60-69	3, 960	3, 812	7, 772	13	20	33	328. 3	524. 6	424. 6
70 and over	2, 478	2, 298	4, 776	13	14	27	524. 6	609. 2	565. 3
Unknown				15	10	25			
Total	99, 536	93, 833	193, 369	155	162	317	155. 7	172. 6	163. 9

and for females, 172.6. In the 0- to 9-year age group, the attack rate in males, 135.7, was roughly twice that of 64.3 for females; in the 40- to 49-year age group only 6 cases were reported in males, giving an attack rate of 58 as compared with 221 for females.

The rate for the Anglo-American population was more than three times that for the Latin-American (table 3). It is quite possible that some of the cases included in the Latin-American group were actually Mexican nationals. This, if true, would tend to strengthen the observed difference. On the other hand, it is quite certain that reporting was less accurate among the Latin-Americans than among the Anglo-Americans, and this would tend to diminish the observed difference in the incidence. The attack rate for the *braceros*, based on a very rough population estimate, appeared about midway between the two racial groups. It may also be stated that *braceros* were covered by compulsory medical insurance and generally were hospitalized. This resulted in more accurate reporting than might have been expected in this group.

The rural-urban distribution of the reported cases in Hidalgo County showed a higher attack rate in the urban population than in the rural (table 4).

For entomological studies, approximately 2,000 adult mosquitoes were collected by light traps, hand collections in shelters, and biting collections. Representative samples of larvae were collected from temporary and permanent water. It was found that *Psorophora confinnis* was predominant in the temporary water habi-

tats. However, in artificial containers around premises, *Culex quinquefasciatus* was found breeding in significant numbers. This species was predominant among mosquitoes collected in shelters; it formed a large percentage of those obtained from biting collections, and about 14 percent of the mosquitoes collected by light traps. *P. confinnis* was the preponderant species among those caught by the latter method.

The virus of St. Louis encephalitis was isolated from brain tissues of one fatal case of encephalitis as well as from two pools of *C. quinquefasciatus* mosquitoes. A fourfold or greater rise of complement-fixing antibodies for St. Louis encephalitis was demonstrated on 43.7 percent of the patients. Seventy percent of the individuals who presumably were exposed but had no clinical illness also had complement-fixing antibodies for this disease.

No detailed studies on possible reservoirs of infection were made in animals during this epi-

Table 3. Number of cases and attack rates by ethnic group, Hidalgo County, Tex., 1954

Ethnic group	Estimated 1954 population	Number of cases	Rate per 100,000
Anglo-American	59, 944	191	318. 4
Latin-American	133, 424	126	94. 4
<i>Bracero</i>	¹ 12, 000	23	191. 7
Other		1	
Unknown		2	

¹ Estimated number of *braceros* in the county during the outbreak.

Table 4. Number of cases and attack rates by rural-urban classification, Hidalgo County, Tex., 1954

Classification	Estimated 1954 population	Number of cases	Rate per 100,000
Urban residents.....	110,800	191	178.7
Rural residents.....	96,569	114	110.2
Unknown.....		31	

dem. However, preliminary investigation showed no known epizootics occurring concurrently with the epidemic or during the spring and summer.

Discussion

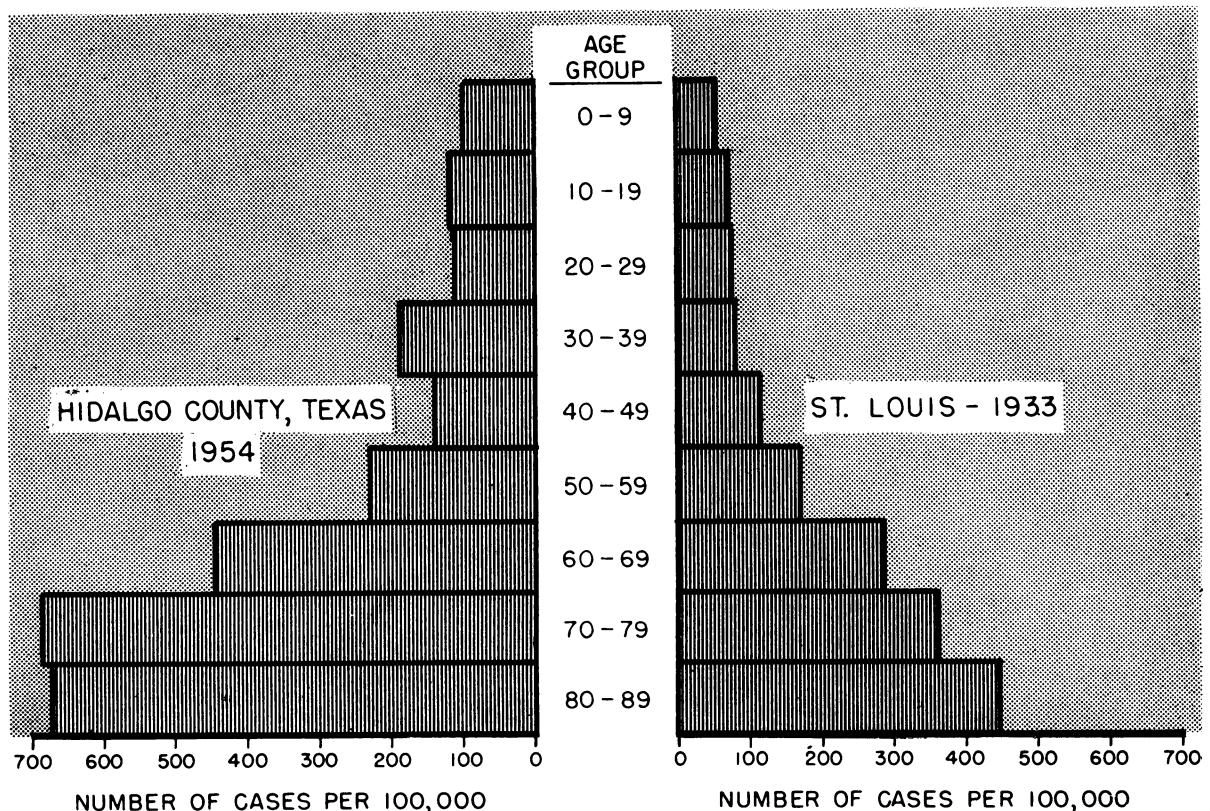
Based on the epidemiological picture and the laboratory findings, the epidemic appeared to be St. Louis encephalitis.

The disease was first encountered in epidemic form in Paris, Ill., in 1932. At that time it was

regarded as Von Economo's disease (1). During the following summer a similar epidemic occurred in and around St. Louis, with smaller foci in Kansas City, St. Joseph, and Columbia, Mo., and to some extent in the States of Illinois and Kentucky. A total of 1,095 cases were reported in the city and county of St. Louis. This epidemic was thoroughly investigated, and the virus of St. Louis encephalitis was isolated by inoculation of infected human brain tissue into monkeys (2). In 1937 an epidemic occurred in the St. Louis area, with 518 cases reported (3). Since then small outbreaks and sporadic cases have been reported from various areas, particularly in California and Kansas. And subsequent to this study there were important outbreaks in the lower Ohio Valley in 1955 and in the Texas Panhandle and the Louisville, Ky., areas in 1956.

The epidemiological features and the clinical picture of the present outbreak resemble, in many respects, those of the 1933 St. Louis outbreak. The seasonal incidence, with most of the

Figure 2. Comparison of attack rates by age, Hidalgo County outbreak and St. Louis outbreak of encephalitis.



cases occurring during the late summer and early fall, and the age distribution, with the majority of the cases occurring in the older age groups, were strikingly similar. The attack rate for Hidalgo County, however, was higher than that in the St. Louis outbreak, with 163.9 per 100,000 as compared with 99 per 100,000. In comparing the age distribution with that of the St. Louis outbreak in 1933 (fig. 2), it is evident that the two curves are almost identical except that the attack rate in Hidalgo County was greater in each age decade than that in the St. Louis outbreak. In both places, however, the rate increased abruptly after the age of 50.

Further, in the St. Louis epidemic the attack rate was higher in those living in the suburbs of the city. In Hidalgo County a higher rate was observed in the urban population. It should be pointed out, however, that the urban areas of Hidalgo County are more similar to the suburban St. Louis County than to the highly metropolitan city of St. Louis. Also, the areas in Hidalgo County do not lend themselves to a sharp rural-urban distinction, since farm animals, pit privies, and other typically rural characteristics, such as irrigation ditches, weed-covered areas, and standing bodies of water, are often encountered within the city limits. The reporting might also have been more accurate within the cities.

A remarkable feature of this outbreak is the low death rate. Only 10 deaths were attributed to encephalitis, which gives a case fatality of less than 2 percent, while in the St. Louis epidemic the rate was approximately 20 percent.

In the St. Louis outbreak the epidemic began in the rural region of St. Louis County and spread toward and into the city; there was no evidence that the disease had a similar spread in Hidalgo County. Multiple cases in families were uncommon, and there was no evidence that spread was by contact. Further, there was no indication that the disease was spread through a common source medium such as water, milk, or other foods.

Mosquitoes are believed to be important vectors in the transmission of St. Louis encephalitis. Five species of mosquitoes, *Culex tarsalis*, *Culex pipiens*, *C. quinquefasciatus*, *Culex stigmatosoma*, and *Aedes dorsalis* have been found infected with the St. Louis virus in nature (4).

In the laboratory, the virus has been successfully transmitted to animals by *C. quinquefasciatus*, and by 11 other species from 3 genera, *Culex*, *Aedes*, and *Culiseta* (5). In view of the fact that *C. quinquefasciatus* was the predominant species collected in shelters and from biting collections, together with the isolation of the St. Louis virus from two of the pools, the evidence to incriminate this mosquito as the most probable vector in the Hidalgo outbreak is certainly strong.

There was no evidence that more than one virus was associated with the present epidemic, although the occurrence of western equine, eastern equine, and St. Louis encephalitis viruses in the Lower Rio Grande Valley had been previously recognized (6). On epidemiological grounds alone, the Hidalgo outbreak was St. Louis encephalitis. In the 1952 outbreak of encephalitis in California, as in the previous years, western equine was predominant in June and July, while St. Louis encephalitis reached its peak in September (10-12). In Hidalgo County, no cases were reported in June and very few in July; most of the cases occurred in late August and early September. Approximately one-third of the cases of western equine in California were in patients less than 1 year of age, whereas in Hidalgo County most of the patients were in the older age groups. Eastern equine encephalitis may be readily excluded on the basis of greater severity and marked age selection involving children primarily. Serologic evidence and absence of epizootics lend further support to this epidemiological reasoning.

Summary

In an epidemiological study of the encephalitis outbreak occurring during the late summer of 1954 in the Lower Rio Grande Valley, records of 373 reported cases were collected. However, it was estimated that somewhat over 1,000 cases had occurred during the epidemic.

The epidemiological features of the present outbreak resemble, in many respects, those of the 1933 St. Louis epidemic, particularly in regard to the seasonal incidence and the age distribution.

There were only 10 deaths, or a case fatality

of less than 2 percent of the estimated number of cases. Autopsies were performed on 3 of the patients who died, and brain tissue specimens were taken from 2. The virus of St. Louis encephalitis was isolated from 1 of these 2.

Culex quinquefasciatus was the most prevalent species of mosquitoes observed, and the St. Louis virus was isolated from two pools of these mosquitoes.

On the basis of the epidemiological picture, together with the confirmatory laboratory support, it was concluded that the outbreak was due primarily to the St. Louis virus.

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Training Public Health Workers in 1956

More than 17,000 persons received training provided by the Bureau of State Services, Public Health Service, in the fiscal year 1956. Of these, more than 8,000 (46 percent) were from State and local health departments. Almost 4,000 (22 percent) were faculty members and students from universities and students from foreign countries. Nearly 1,500 (8 percent) were in health-related work in industry. Length of training ranged from a 1-hour lecture for university students to 9 months at a university for foreign students. Most of the courses, however, were of 1 to 2 weeks' duration.

The number of courses, as well as trainees, has increased steadily in the past 5 to 10 years. During the fiscal year 1956, the Bureau of State Services offered or participated in courses covering 90 different subjects.

Enrollment for the Communicable Disease Center courses in Atlanta rose from 89 in 1947 to more than 1,190 in 1955. In the Center's field courses, attendance increased from 183 in 1947 to more than 4,600 in 1956.