SPECIAL REPORT 65-1

CDC

COMMUNICABLE DISEASE CENTER

ENCEPHALITIS

SURVEILLANCE

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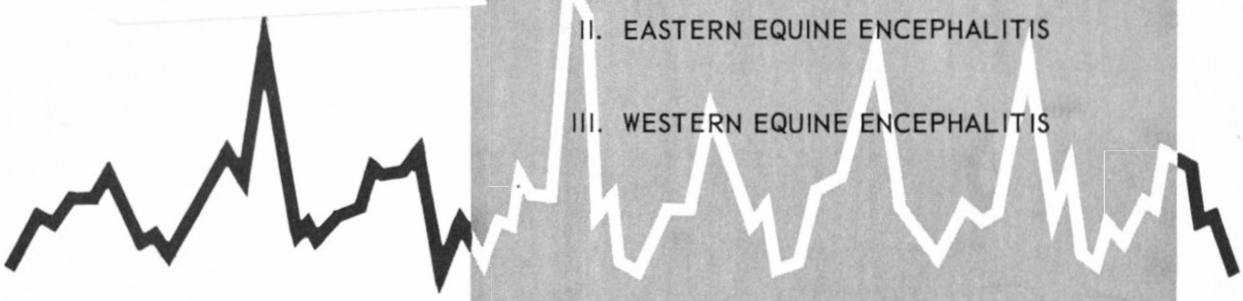

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE / PUBLIC HEALTH SERVICE

PREFACE

Summarized in this report is information received from State Health Departments, university investigators, virology laboratories and other pertinent sources, domestic and foreign. Much of the information is preliminary. It is intended primarily for the use of those with responsibility for disease control activities. Anyone desiring to quote this report should contact the original investigator for confirmation and interpretation.

Contributions to the Surveillance Report are most welcome. Please address to:

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I. SUMMARY

An extensive outbreak of Eastern Equine Encephalitis (EEE) among horses has been reported from a number of southeastern States in 1965. An apparent northward movement of EEE virus activity has been evident. In Florida and Georgia, cases of encephalitis in horses were first documented in April and May. Cases subsequently were reported from South Carolina (June and July), North Carolina (June, July and August) and Virginia (July and August). To date, five confirmed human cases have been reported (2 each from Florida and Georgia, one from North Carolina).

Western Equine Encephalitis is occurring in epidemic form in eastern Colorado and in Hale County, Texas. More than 70 suspected cases in humans have been reported from Colorado.

The material presented in this report is preliminary and subject to change daily. It is provided specifically to those responsible for surveillance of communicable diseases and should be considered confidential.

II. EASTERN EQUINE ENCEPHALITIS

A. Louisiana

During June and July, 1965, a total of 31 cases of encephalitis including 15 deaths in horses has been reported by Dr. Charles Caraway, Assistant Chief, Section of Epidemiology. No cases have been reported thus far in August. There have been no cases of human illness reported.

B. Mississippi

Dr. Durward Blakey, Director, Division of Preventable Disease Control, reports only one case of suspected encephalitis in a horse that died in June, 1965. Laboratory studies are pending.

C. Alabama

No cases of EEE in either humans or horses have been reported by Dr. W. H. Y. Smith, Director, Bureau of Preventable Diseases.

D. Florida

Dr. E. Charlton Prather, State Epidemiologist, reports that two serologically confirmed human cases of Eastern Equine Encephalitis have occurred to date in Florida. The cases were not epidemiologically related; however, both were from the northern part of the State.

In northern and central areas of Florida, there have been reported cases of encephalitis in horses. There has not, however, been an unusually high incidence. The earliest confirmed case developed illness on May 24. Dr. James B. Nichols, Veterinary Public Health Director, reports the largest number of cases have occurred in Duval County (10 cases). No other county has had more than 4 cases.

E. Georgia

Two fatal cases of Eastern Equine Encephalitis have been reported from the southeastern part of the State by Dr. John McCroan, Director, Biologics Studies. The first case, a 6 year old white male, became ill on early July 11, and resided in Emanuel County. The second case, a resident of Cook County, was in a 7 year old white female who had onset of illness on August 2. Eastern Equine Encephalitis virus was isolated from central nervous system tissue from both cases.

Cases of encephalitis in horses are occurring in the southeastern area of Georgia; however, the incidence does not appear to be significantly greater than in 1964. Dr. John H. Richardson, Public Health Veterinarian, reports that EEE virus has been isolated from CNS tissue from 6 horses and serologic confirmation of EEE has been obtained from five additional cases. The earliest confirmed case had onset of illness on April 17, 1965.

F. South Carolina

Dr. G. E. McDaniel, Director, Division of Disease Control, reports that encephalitis in horses has occurred in 7 coastal counties from mid-June through August 20. A total of 39 cases have been reported of which 2 have thus far been confirmed as EEE by virus isolation. Laboratory studies on other cases are currently in process.

G. North Carolina

There have been 255 cases of encephalitis in horses reported to date in North Carolina. Of these 9 became ill in June, 177 in July and 69 in August. Most of the cases have occurred in the eastern portion of the State, particularly in counties along the Atlantic coast. Eastern Equine Encephalitis virus has been isolated from two equine brains. In addition, single sera collected from six convalescent horses have demonstrated significant HAI and CF antibody titers to EEE virus.

A case of encephalitis due to EEE virus occurring in a 17½ year old Negro female has been reported by North Carolina. The patient is a farm worker who resides in the area of the equine epizootic. The onset of illness occurred on August 8, 1965, with symptoms of headache, nausea and fever. There then followed a progressive somnolence which resulted in hospitalization on August 10. The initial hospital course was marked by recurrent seizures, high fever, and profound coma. Seven days after the patient became ill, the fever aborted and since that time there has been progressive improvement. Results on sera collected on August 10, 12, and 13, have shown a confirmatory rise in HI antibody titer (1:40, 1:80, 1:160) and neutralizing antibody titer to EEE virus.

Entomologists of the CDC and the chief entomologist of the North Carolina State Board of Health made live mosquito collections in the affected area of eastern North Carolina between August 3-10, 1965, in attempts to determine the species responsible for transmission of EEE virus to horses. Approximately 35,000 mosquitoes representing at least 23 species were collected on 8 premises in 3 of the most severely affected counties, Duplin, Onslow and Jones. Premises were selected on the basis of current or recent horse infection. Collections were restricted generally to the infected pastures and their margins so that the mosquitoes sampled would be representative of those to which the horses had been exposed.

Abnormally great rainfall during July had fostered large populations of flood-water moqsuito species, and apparently also allowed extension of Culiseta melanura beyond its usual permanent-swamp habitat. The main mosquito species present, in descending order of abundance, were Psorophora confinnis, Culiseta melanura, Psorophora ferox, Aedes atlanticus, Culex salinarius and Anopheles crucians.

The large number of Culiseta melanura is of special interest since this species is the main vector of EEE virus for wild birds. Hand collection of mosquitoes at night in one of the infected pastures, using a mule as bait, confirmed that Culiseta melanura was attracted to and would bite equines, although in relatively small numbers as compared with the more aggressive Psorophora confinnis and Aedes atlanticus.

Virus tests have been completed on only a fraction of the mosquitoes collected. However, at least one isolation of EEE virus has thus far been made, from Culiseta melanura collected by light trap in a pasture.

Coincident with the mosquito surveys, a team of ecologists trapped and bled a total of 331 birds representing 30 species. Preliminary laboratory results indicate a high incidence of hemagglutination-inhibition antibody to EEE in many of the species sampled. The resident species had consistently high antibody rates, some as high as 50 percent. The most involved species, in descending frequency, were: white-eyed vireo, blue jay, cardinal, carolina wren, and bobwhite. With laboratory data still incomplete, at least one virus isolation has been made; preliminary identification indicates the agent is probably EEE. This isolate was made from a blue jay trapped in Jones County on August 8, 1965.

(Reported by Dr. Ronald H. Levine, Chief, Communicable Disease Control Section; Dr. Martin P. Hines, Director, Division of Epidemiology; Dr. Lynn G. Maddry, Acting Director of Laboratories; and a team from the Communicable Disease Center.)

H. Virginia

Dr. James B. Kenley, Director, Bureau of Epidemiology, Virginia State Department of Health, reports the recent occurrence of encephalitis in horses from eastern areas of the State. Eleven suspected cases have been reported, of which two has been confirmed. The earliest case was first seen by a veterinarian on July 10. Eight of the cases have been initially examined since July 28. Intensive efforts of additional case finding are currently underway, particularly in the tidewater area. No human cases have been reported thus far. Vector and vertebrate studies by State and CDC personnel are in progress.

I. Middle Atlantic States and New England

There have been no reports of suspected cases of Eastern Equine Encephalitis in humans or in horses in any States north of Virginia along the east coast. Through August 20, 1965, no signs of EEE virus activity was evident in Delaware, Maryland, New Jersey, Pennsylvania, New York, Rhode Island, Connecticut or Massachusetts.

III. WESTERN EQUINE ENCEPHALITIS

A. Colorado

An outbreak of Western Equine Encephalitis (WEE) is now occurring in Colorado. This report has been prepared by Dr. A. D. Hess and the staff of the Disease Ecology Section, Technology Branch, CDC, Greeley, Colorado.

Human Cases

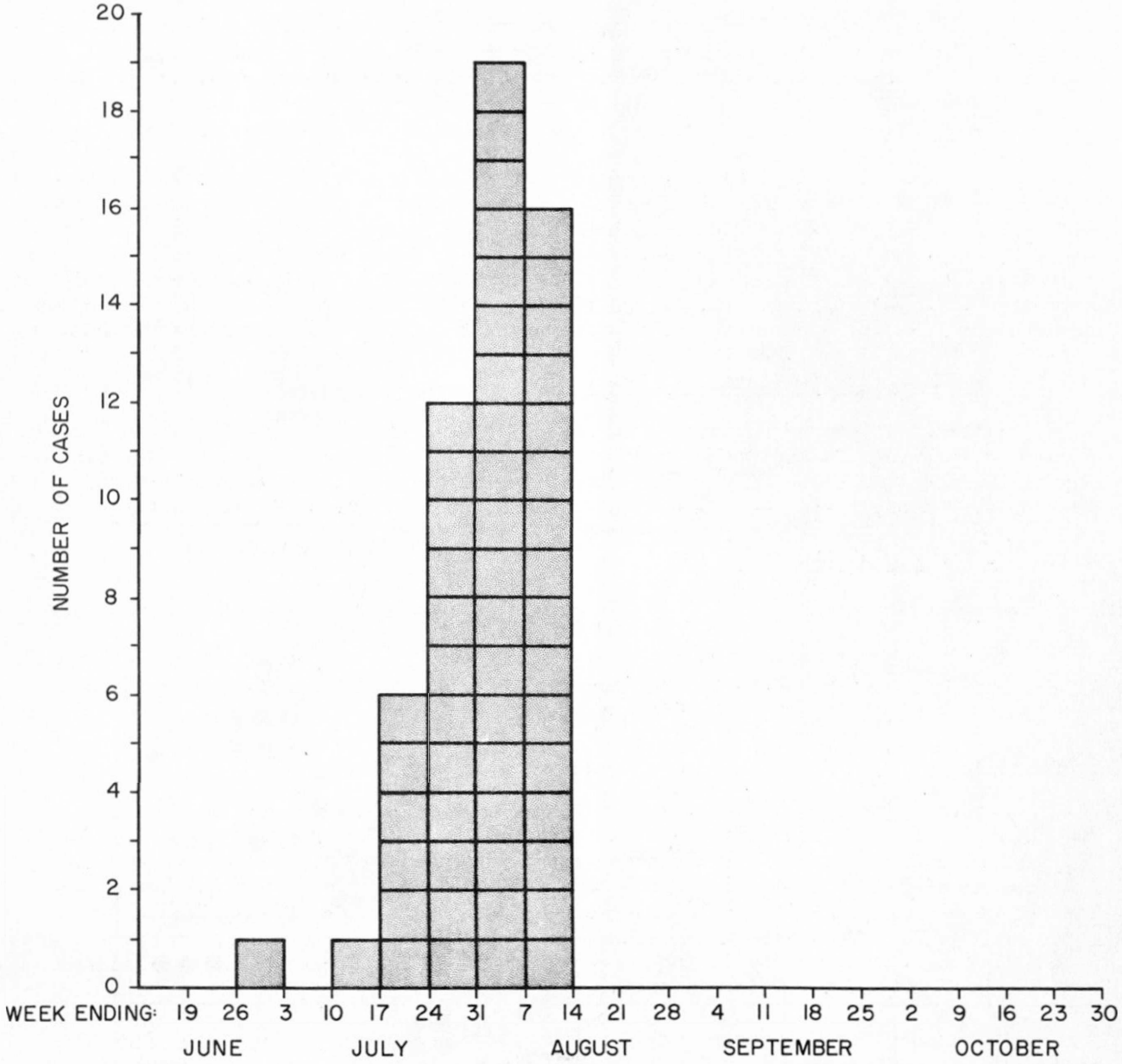
A total of 91 suspected cases of encephalitis have been reported to the Colorado State Health Department through August 20. The epidemic began in early July and a rapid increase in incidence occurred during late July and early August. A histogram of the 55 cases with known dates of onset is shown on the following page. The geographic distribution of 71 cases on which data are currently available is shown on page 5. The cases have been concentrated in the Arkansas, South Platte, and Cache la Poudre River valleys. The largest numbers of cases have been reported from Denver and from Weld and Otero counties.

Paired acute and convalescent sera from fourteen of the early cases have been tested for HAI antibodies to WEE. Of these, six demonstrate either confirmed or presumptive evidence of recent WEE infection. Eight sera were negative for WEE and SLE.

Equine Cases

A total of 144 suspected cases in horses have been reported to the State Health Department through August 20, 1965. The distribution of these cases is shown in the map on page 5. In general, the distribution is similar to the distribution of

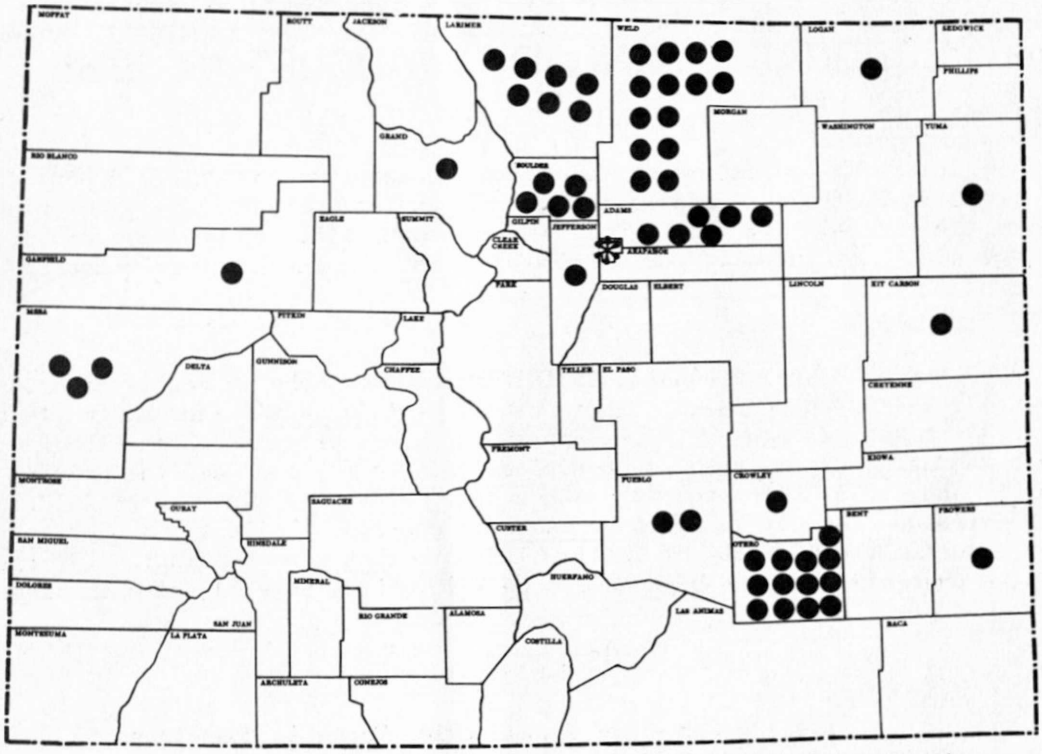
SUSPECTED CASES OF ENCEPHALITIS IN HUMANS BY WEEK OF ONSET COLORADO, JANUARY 1 - AUGUST 18, 1965*



*55 cases with known dates of onset.

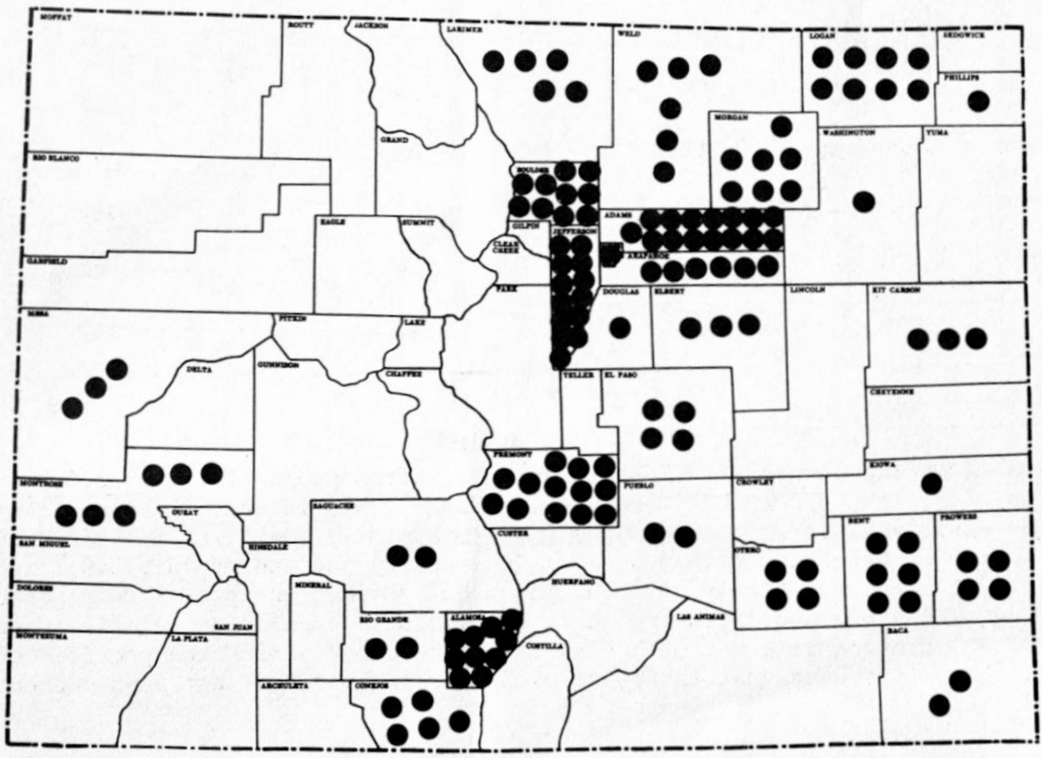
SUSPECTED CASES OF ENCEPHALITIS
COLORADO, JANUARY 1 - AUGUST 18, 1965

Humans



*13 CASES (DENVER CO.)

Horses



human cases. A possible exception is the occurrence of 19 reported suspected cases in the San Luis Valley (Saguache, Rio Grande, Alamos, and Conejos counties) with no reported human cases.

Relatively few sera have been received for diagnostic test so far; however, a high percentage of those submitted demonstrated confirmed or presumptive evidence of WEE infection.

Weather Conditions

A series of thunderstorms of unprecedented severity and extent during the middle of June resulted in the most destructive floods in the State's history for widespread areas from the mountains to the eastern border. Unusually wet weather has continued through the middle of August. In addition temperatures in June were unusually cool.

Mosquito Populations

The flooding of the Arkansas, South Platte, and Cache la Poudre River areas during June resulted in unusually large numbers of *Aedes vexans* and other floodwater mosquitoes. It also created many semi-permanent pools of water which were favorable for the breeding of *Culex tarsalis*, (previously shown to have been the primary vector of both WEE and SLE in this region). Subsequent rains maintained water in *C. tarsalis* breeding sites over extensive areas of eastern Colorado. Collections of *C. tarsalis* from two sites in the vicinity of Greeley indicate that peak populations in early August were over six times as high as the peak in 1964 (Table 1), also an outbreak year.

Table 1

Average Number of Female *Culex Tarsalis* Mosquitoes
Per Trap Night, Weld County, Colorado, 1964-1965

Dates of Collection	Average number per trap night	
	1964	1965
May 31 - June 13	7	18
June 14 - June 27	14	8
June 28 - July 11	84	77
July 12 - July 25	106	264
July 26 - Aug. 8	74	460
Aug. 9 - Aug. 22	49	187

Mosquito Infection Rates

The first isolations of WEE virus were made from pools of *C. tarsalis* mosquitoes collected during the third week in June. This is one of the earliest isolations of this virus from mosquitoes in Colorado. By the first week in July the WEE infection rate had reached 6 per 1,000, and by the end of July had reached a peak of 17.9 per 1,000 (Table 2). This is about 3 times the peak rate reached in 1964. Thus, WEE virus was demonstrated in the mosquito population relatively early and the peak infection rate was much higher than occurred during the previous year. (It should be pointed out that these are minimum rates and have not been corrected by

Table 2

WEE INFECTION RATES FOR CULEX TARSALIS MOSQUITOES,
WELD AND LARIMER COUNTIES, COLORADO, 1964 and 1965

Date of collection	Number of mosquitoes	Number of pools	Isolations*		WEE infection rate/1000	
			WEE	SLE	1964	1965
April	389	19			--	0
May	100	2			--	0
June 2-4	200	4			--	0
June 7-9	250	5			--	0
June 16-18	150	3			--	0
June 21-25	250	5	1		--	4.0
June 29-30	450	9			--	0
July 1-2	750	15			--	0
July 6-9	1,650	33	10		0	6.0
July 12-15	2,450	49	14	1	1.4	5.7
July 19-22	1,950	39	13		0	6.7
July 27-31	390	19	7		5.2	17.9
Aug. 2-8	4,000	80	33		3.5	8.3
Aug. 9-13	2,750	55	17		6.2	6.2
Total	15,729	337	95			

* A few of these isolates are only tentatively identified.

Chiang's formula[1] which enables calculation of the probable number of infected mosquitoes). Because SLE virus has occurred in the State and because of the masking of SLE virus by WEE in the duck embryo tissue culture test, subsequent tests in which WEE will be suppressed may produce more isolations of SLE virus.

A WEE-like agent was also isolated from a single pool of Aedes vexans mosquitoes collected during the last week in July. This isolation is significant in that only 8 pools comprising 321 specimens of A. vexans were tested, whereas almost 16,000 specimens of C. tarsalis have been tested. The species, A. vexans, a known WEE vector in the past, feeds on large domestic animals and may also be involved as a vector, particularly among cases in horses in the present outbreak. Other species studied have included A. dorsalis, A. increpitus, C. pipiens, and Culiseta inornata.

Transmission Rates in Chicken Sentinel Flocks

Among chickens in a sentinal flock at Timnath, Colorado, (Halfway between Greeley and Fort Collins), one fourth of the chickens were infected by the third week in July. By August 3, half of the birds had developed HAI antibodies, and by August 17, seventy percent were serologically positive to WEE (Table 3). This is the highest WEE transmission rate ever recorded during the 17 years in which sera have been collected from sentinel birds (chickens, turkeys, pigeons, magpies, and sparrows) in the Greeley area. By August 17, ten percent of the chickens had also developed SLE antibodies.

Table 3

Arbovirus Transmission to
Sentinel Chickens, Timnath, Colorado, 1965

Date of Bleeding	Number of Chickens Tested	Percent with HAI antibody	
		WEE	SLE
July 7	30	0	0
July 21	30	23	0
Aug. 3	30	50	7
Aug. 17	30	70	10

Pattern of Virus Activity

An intensive and widespread pattern of WEE virus activity during the current outbreak has been observed. Based on the geographic pattern of virus isolations from mosquitoes, antibodies in sentinel birds and farm chicken flocks, and confirmed human and equine cases, there has been positive evidence of WEE virus activity from 10 different communities within a 30-mile radius of Greeley. Comparable data are not available for other areas of eastern Colorado, but the distribution of human and equine cases suggests a similar widespread pattern of virus activity, particularly in the Arkansas and South Platte River valleys.

[1]Chiang, Chin Long and Reeves, William C. Statistical estimations of virus infection rates in mosquito vector populations. Am. J. Hyg. 75, No. 3:377-391, May, 1962.

Table 5

VIRUS ISOLATIONS AND INFECTION RATES FOR CULEX TARSALIS, HALE COUNTY, TEXAS

Date of collection	1965 Collections		1965 Isolations*		WEE Infection Rate/1000**	
	Number of mosquitoes	Number of pools	WEE	SLE	1964	1965
April 13	2	1			--	0
May 25	2	2			--	0
June 1-6	10	2			--	0
June 6-12	41	3			--	0
June 13-21	699	17			--	0
June 20-26	148	9			--	0
June 28-30	329	29			--	0
July 6-7	577	41	6		--	10.4
July 13-15	640	25	11		--	17.2
July 19-23	510	23	12		--	23.5
July 26-28	1300	26	16		14.6	12.3
Aug. 2-4	800	16			9.6	10.0
Totals	5058	194	45			

* A few of these isolates are only tentatively identified.

** This is a minimum rate not corrected for the most probable number of infected mosquitoes (op.cit.).

B. Texas

For a number of years, arthropod-borne encephalitis has occurred in Hale County, Texas. In 1963, there was a mixed outbreak of WEE and SLE as well as aseptic meningitis of enterovirus etiology (Coxsackie B_2 and $ECHO_{11}$). Cooperative investigations, including personnel from the Plainview-Hale County Health Department, Texas State Health Department and CDC, are underway to study the current outbreak. This report has been prepared by Dr. A. D. Hess and the staff of the Disease Ecology Section, Technology Branch, CDC, Greeley, Colorado.

Human Cases

Thirty-eight human cases of suspected encephalitis have been reported to the Plainview-Hale County Health Department through August 17, 1965. During the latter half of June and early July, 7 cases occurred. There then followed a sudden increase in incidence with 8 cases during the week ended July 24 and 11 cases for the week ended July 31. Age specific attack rates for 35 of these cases are given in Table 4. The high attack rates indicated for infants less than one year of age is characteristic of both Western Equine Encephalitis and aseptic meningitis of enterovirus etiology.

Table 4

Age Specific Attack Rates for Cases of Suspected Encephalitis
Hale County, Texas

Age in Years	Population*	Cases	Rate/100,000
<1	989	4	404
1 - 4	3,715	6	161
5 - 9	4,495	5	111
10 - 19	7,010	7	100
20 - 29	4,798	7	146
30 - 39	4,546	3	66
40 - 59	7,455	2	27
60+	3,790	1	26
	36,798	35	95

* 1960 census

HAI antibody tests have been run in the Greeley laboratory on paired sera from four of the suspected cases. One of these is presumptive for WEE. In addition, an enterovirus (type not yet identified) has been isolated from stool specimens from 10 cases at the CDC field station in Kansas City.

Mosquito Populations and Infection Rates

Populations of Culex tarsalis reached a peak during the first week in August. The first isolations of WEE virus were made from pools of C. tarsalis collected during the first week in July, at which time the infection rate already exceeded 10 per 1,000. The infection rate continued to rise until it reached a peak of 23.5 per 1,000 during the third week in July (Table 5). Thus, the early appearance of virus and the high peak rate of infection in C. tarsalis have been favorable for apparent widespread transmission of WEE virus in Hale County in 1965.

Virus Isolations from Wild Birds

Eighteen isolations of WEE virus have been made from nestling sparrows collected in the Hale County. The first two isolations were from sparrows collected June 14-16 (Table 6). An additional six isolations of WEE virus were made from 14 sparrows collected during the third week in July. These isolations from sparrows reinforce the significance of the mosquito infection data, and further confirm the early appearance and high activity of WEE virus in Hale County.

Table 6

Virus Isolations from Nestling Sparrows (*Passer Domesticus*)
Hale County, Texas, 1965

Date of Collection	Number of Birds	WEE Virus Isolations
May 1	3	0
May 14	4	0
June 1	8	0
June 14-16	31	2
June 21-23	23	0
June 28-30	10	0
July 6-7	25	5
July 12-15	23	5
July 19-23	14	6
Total	141	18

Transmission Rates in Chicken Sentinel Flocks

The rate of infection with WEE virus, determined by HAI antibody testing, was found to be 10 percent on July 8. By August 5, 92 percent of these birds had developed WEE antibodies (Table 7). Thus, in Hale County, there has been a close correlation between WEE transmission rates in sentinel chickens, infection rates in *C. tarsalis*, and virus isolations from nestling sparrows. All show an early onset of WEE virus activity, with a high level of activity being reached by the third week in July.

Table 7

Arbovirus Transmission to Sentinel Chickens, Hale Center, Texas
1965

Date of Bleeding	Number of Chickens Tested	% with HAI Antibody	
		WE	SLE
July 8	30	10	0
July 22	30	47	0
Aug. 5	25	92	4

Key to all disease surveillance activities are those in each State who serve the function as State epidemiologists. Responsible for the collection, interpretation and transmission of data and epidemiological information from their individual States, the State epidemiologists perform a most vital role. Their major contributions to the evolution of this report are gratefully acknowledged.

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