TYPHUS FEVER

CRUDE DATA	
Number of Cases	47
Annual Incidence[a]	
LA County	0.49
California[b]	N/A
United States[c]	N/A
Age at Diagnosis	
Mean	41.6
Median	42
Range	9-89

[a]Cases per 100,000 population
[b]Not notifiable

DESCRIPTION

Fleaborne typhus (murine typhus and endemic typhus) is caused by the bacteria *Rickettsia typhi* and *Rickettsia felis* and is transmitted through contact with feces that is discharged when an infected flea bites. Reservoir animals are predominantly feral cats, opossums, and rats. In LAC, most reported cases of typhus have historically occurred in residents of the foothills of central LAC. However, since 2006, the distribution of typhus has expanded to other regions of LAC. Symptoms include fever, severe headache, chills, and myalgia. A fine, macular rash may appear three to five days after onset. Occasionally, complications such as pneumonia or hepatitis may occur. Fatalities are uncommon, occurring in less than one percent of cases but increase with age. The disease is typically mild in young children. Typhus is not vaccine preventable but can be treated with antibiotics.

Because fleaborne typhus is not reportable to the Centers for Disease Control and Prevention (CDC), there is no national case definition. In California, a standard case definition was developed in 2012 due to emergence or re-emergence of this disease into other areas of southern California including Long Beach and Orange County. Cases included in LAC surveillance have, at minimum, a single high IgM or IgG titer positive for *Rickettsia typhi* along with the appropriate symptoms.

Typhus infection can be prevented through flea control measures implemented on pets. Foliage in the yard should be trimmed so that it does not harbor small mammals. Screens can be placed on windows and crawl spaces to prevent entry of animals and their fleas into the house.

2016 TRENDS AND HIGHLIGHTS

- LAC continues to document high numbers of typhus compared to the previous decade, in which the count did not exceed 20 cases per year. The case count began rising in 2010 with 31 cases and peaked in 2013 with 68 cases (Figure 1). No outbreaks were documented in 2016.
- In 2016, the age group with the largest percentage of cases was 35-44 year olds (29.8%) followed by 15-34 year olds (25.5%) for a total of 55.3% of cases. These are the largest percentage of cases in these age groups compared to 2012-2015 when these age groups accounted for 33-48% of cases each year. There were no infections in children less than five years old (Figure 2).
- Typhus cases continue to be documented in SPAs 2 through 8. The highest number of typhus cases occurred in SPA 3 (n=18, 38%), which has historically had higher case counts (Figure 3). SPA 4 also continues to have a high case count with 11 cases in 2016.
- Cases were documented every month in 2016, ranging from one case in March to nine cases in June. This year's peak in June is earlier than the typical seasonal curve (Figure 4). Physicians and residents should be aware that there is year-round risk of typhus infection in LAC.
- All but three cases in 2016 were seen in the emergency department (ED) or hospitalized,

similar to previous years. No fatalities were documented. The provider reporting the most number of cases was Huntington Hospital in SPA 3 (n=9). This may reflect both an increased frequency of occurrence of the disease in the SPA as well as an increased awareness by hospital physicians to consider and report a typhus diagnosis. The high proportion of cases seen in EDs or hospitals indicates that milder cases may not be diagnosed and/or reported.

- A total of nine cases (19%) recalled having flea exposure. The majority of cases (n=34, 72%) reported exposure to animals at or around their home, with only one having exposure exclusively at work. Nearly half the cases (n=19, 55%) reported exposure to cats at or around their home and about one-third (n=10, 32%) reported exposure to feral cats in particular (Table 1). These numbers are similar to those in 2015. Reported exposure to cats had increased in the last few years but dropped in 2016 (Figure 5). Overall exposure to cats decreased from 57% of cases in 2015 to 40% of cases in 2016. The percent of exposure to cats around the home still remains high, thus community education regarding flea precautions around the home would be prudent.
- The increase in cases of typhus in LAC may be due to a number of factors including the natural relocation of host animals (possums and feral cats) to regions not previously enzootic for typhus, changes in weather that favor flea survival, increased testing and reporting due to better educated physicians, and increased reporting to LAC DPH by electronic laboratory reporting.

Reported Fleaborne Typhus Cases and Rates* per 100,000 by Age Group, Race/Ethnicity, and SPA
LAC, 2012-2016

	2012 (N=50)			2013 (N=68)			2014 (N=44)			2015 (N=54)			2016 (N=47)		
	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000
Age Group															
<1	0	-	-	0	-	-	0	-	-	0	-	-	0	-	-
1-4	0	-	-	1	1.5	0.2	1	2.3	0.2	1	1.9	0.2	0	-	-
5-14	6	12.0	0.5	5	7.4	0.4	1	2.3	0.1	2	3.7	0.2	2	4.3	0.2
15-34	11	22.0	0.4	16	23.5	0.6	10	22.7	0.4	10	18.5	0.4	12	25.5	0.4
35-44	13	26.0	1.0	12	17.6	0.9	6	13.6	0.5	8	14.8	0.6	14	29.8	1.1
45-54	10	20.0	0.8	13	19.1	1.0	10	22.7	0.8	18	33.3	1.4	7	14.9	0.5
55-64	4	8.0	0.4	13	19.1	1.3	8	18.2	0.8	9	16.7	0.8	8	17.0	0.7
65+	6	12.0	0.5	8	11.8	0.7	8	18.2	0.7	6	11.1	0.5	4	8.5	0.3
Unknown	0	-	-	0	-	-	0	-	-	0	-	-	0	-	-
Race / Ethnicity															
Asian	0	-	-	3	4.4	0.2	3	6.8	0.2	3	5.6	0.2	4	8.5	0.3
Black	2	4.0	0.3	1	1.5	0.1	0	0.0	0.0	4	7.4	0.5	2	4.3	0.3
Hispanic	15	30.0	0.3	24	35.3	0.5	17	38.6	0.4	20	37.0	0.4	15	31.9	0.3
White	25	50.0	0.9	35	51.5	1.3	17	38.6	0.6	24	44.4	0.9	21	44.7	0.8
Other	3	6.0	-	1	1.5	-	1	2.3	-	1	1.9	-	4	8.5	-
Unknown	5	10.0	-	4	5.9	-	6	13.6	-	2	3.7	-	1	2.1	-
SPA															
1	0	-	-	0	-	-	0	-	-	0	-	-	0	-	-
2	5	10.0	0.2	6	8.8	0.3	3	6.8	0.1	10	18.5	0.4	3	6.4	0.1
3	18	36.0	1.1	20	29.4	1.2	17	38.6	1.0	22	40.7	1.3	18	38.3	1.1
4	13	26.0	1.2	18	26.5	1.6	5	11.4	0.4	8	14.8	0.7	11	23.4	0.9
5	6	12.0	0.9	5	7.4	0.8	6	13.6	0.9	1	1.9	0.2	3	6.4	0.5
6	4	8.0	0.4	7	10.3	0.7	3	6.8	0.3	0	0.0	0.0	3	6.4	0.3
7	3	6.0	0.2	4	5.9	0.3	5	11.4	0.4	6	11.1	0.5	7	14.9	0.5
8	1	2.0	0.1	8	11.8	0.7	5	11.4	0.5	7	13.0	0.6	1	2.1	0.1
Unknown	0	-	-	0	-	-	0	-	-	0	-	-	0	-	-

*Rates calculated based on less than 19 cases or events are considered unreliable

Figure 1. Fleaborne Typhus Cases by Year
LAC, 2006-2016

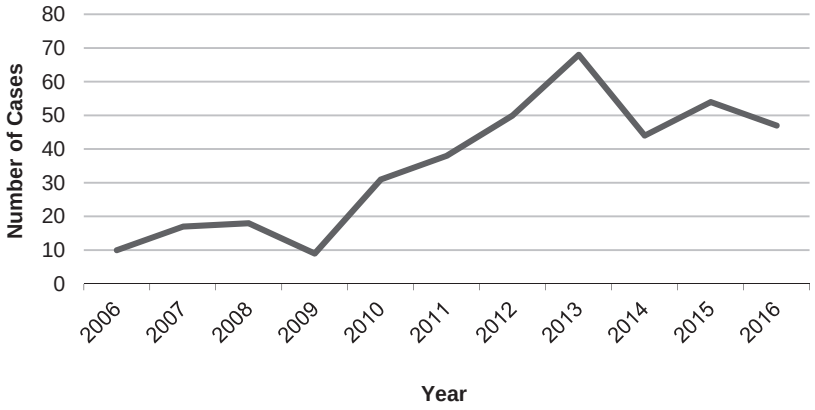


Figure 2. Fleaborne Typhus by Age Group
LAC, 2016 (N=47)

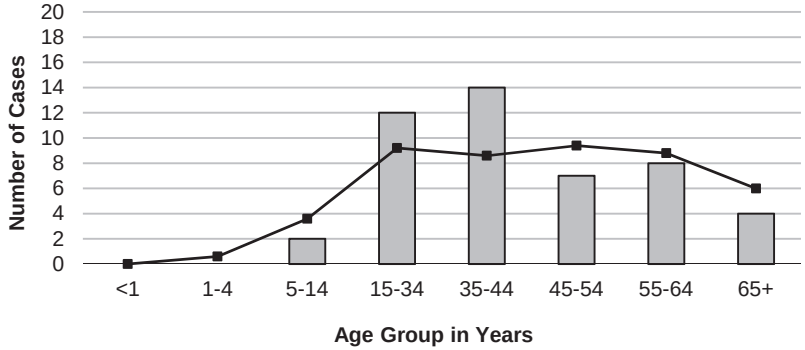


Figure 3. Fleaborne Typhus Cases by SPA
LAC, 2011-2015

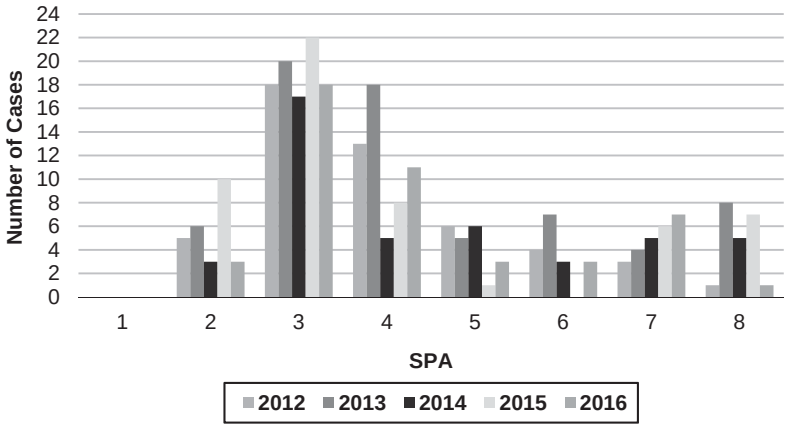


Figure 4. Fleaborne Typhus Cases by Month of Onset
LAC, 2016 (N=47)

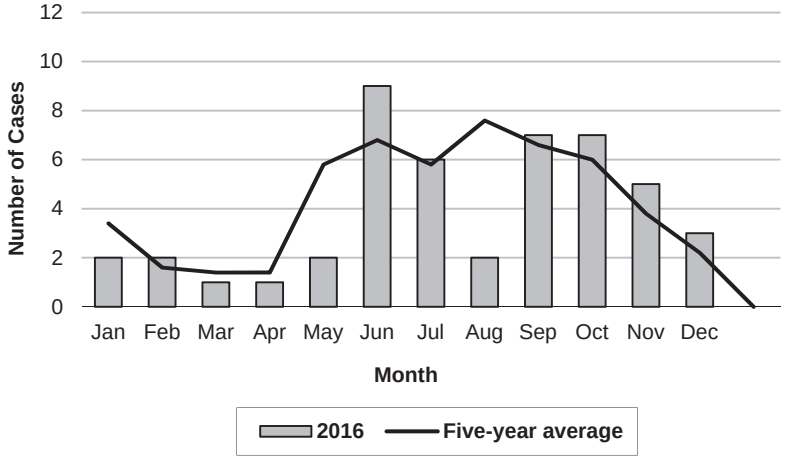
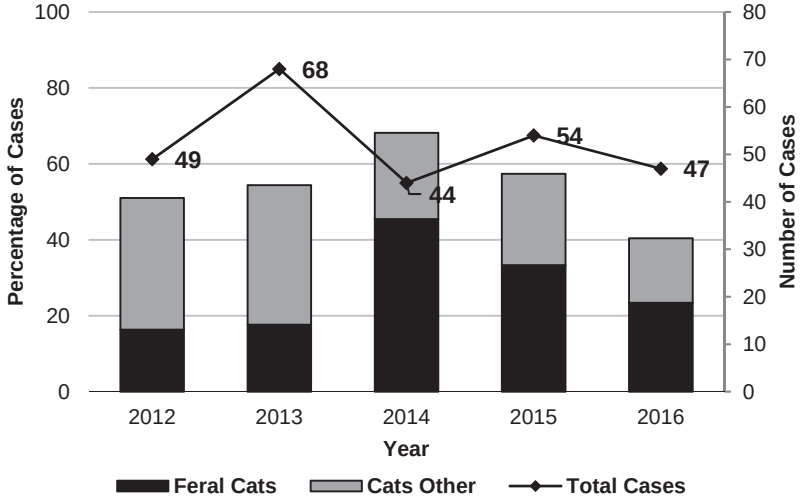


Figure 5. Fleaborne Typhus Cases with Reported Cat Exposure Near Home LAC, 2012 -2016



*Cases may report more than one exposure and in both the home and employment location.

Table 1. Animal Exposure* of Fleaborne Typhus Cases, LAC, 2016 (N=47)

	At or around Home n (%)	At or around Employment n (%)
Cat	19 (40)	3 (6)
Feral Cat	11 (23)	2 (4)
Dog	23 (49)	2 (4)
Opossum	13 (28)	1 (2)
Rodent	12 (25)	1 (2)

TYPHUS FEVER

CRUDE DATA	
Number of Cases	54
Annual Incidence[a]	
LA County	0.56
California[b]	0.20
United States[c]	N/A
Age at Diagnosis	
Mean	45
Median	47
Range	4–82 years

[a]Cases per 100,000 population
[b]See Yearly Summary Reports of Selected General Communicable Diseases in California at: https://www.cdph.ca.gov/data/statistics/Documents/YearlySummaryReportsofSelectedGeneralCommDiseasesinCA2011-2015.pdf
[c]Not notifiable

DESCRIPTION

Fleaborne typhus (murine typhus and endemic typhus) is caused by the bacteria *Rickettsia typhi* and *Rickettsia felis* and is transmitted through contact with feces that is discharged when an infected flea bites. Reservoir animals are predominantly feral cats, opossums, and rats. In LAC, most reported cases of typhus have historically occurred in residents of the foothills of central LAC. However, since 2006, the distribution of typhus has expanded to other regions of LAC. Symptoms include fever, severe headache, chills, and myalgia. A fine, macular rash may appear three to five days after onset. Occasionally, complications such as pneumonia or hepatitis may occur. Fatalities are uncommon, occurring in less than 1% of cases, but increase with age. The disease is typically mild in young children. Typhus is not vaccine preventable but can be treated with antibiotics.

Because fleaborne typhus is not a nationally reportable disease, there is no national case definition. In California, a standard case definition was developed beginning in 2012 because of expansion of this disease into new regions including Long Beach and Orange County. Cases included in LAC surveillance have, at minimum, a single high IgM or IgG titer positive for *Rickettsia typhi* along with the appropriate symptoms.

Typhus infection can be prevented through flea control measures implemented on pets. Foliage in the yard should be trimmed so that it does not harbor small mammals. Screens can be placed on windows and crawl spaces to prevent entry of animals and their fleas into the house.

2015 TRENDS AND HIGHLIGHTS

- LAC continues to document higher numbers of typhus compared to the previous decade with 54 cases in 2015. The case count began rising in 2010 with 31 cases and peaked in 2013 with 68 cases (Figure 1). Most reported cases were hospitalized (n=46, 85%), indicating that mild cases may not be diagnosed and reported. Our surveillance then likely underestimates the true number of cases.
- In 2015, the mean age of cases was 45 years old. Infections in children five years old and younger were rare.
- The highest number of typhus cases occurred in SPA 3 (n=22, 41%), which historically has had high case counts (Figure 3). With the exception of SPA 1, typhus cases continue to exist in all SPAs, indicating that typhus has established itself in new areas.
- This year, the peak number of cases occurred earlier than the typical seasonal curve with the highest monthly case count in June (n=11, 20%) (Figure 4). However, cases were documented in all months of the year. Physicians and residents should be aware that there is year-round risk of typhus infection in LAC.
- Only 11 cases (20%) recalled having flea exposure. Three cases reported exposure to animals directly due to occupational activities including a geologist, a day laborer, and a construction worker.
- Over half of cases reported an exposure to cats at or around their home (n=31, 57%) and about one third (n=17, 31%) to feral cats, in particular (Table 1). Reported exposure to cats has increased in the last few years (Figure 5). Overall exposure to cats increased from 26% of cases in 2010 to 68% of cases in 2014. Feral cat exposure was extracted from interview notes beginning

2012 and occurred in 33% of cases in 2015, accounting for over half of all cat exposures.

- The increase in cases of typhus in LAC may be due to a number of factors including the natural relocation of host animals (possums and feral cats) to regions not previously enzootic for typhus, changes in weather that favor flea survival, increased testing and reporting due to better educated physicians, and increased reporting to LAC DPH by electronic laboratory reporting.
- In 2015, a cluster of fleaborne typhus cases occurred among residents of a mobile home community in the San Gabriel Valley. ACDC coordinated a multi-agency investigation including Environmental Health, San Gabriel Valley Mosquito and Vector Control District, and Veterinary Public Health as well as private organizations to determine the extent of the outbreak, to identify risk factors, and to implement control measures. A total of five outbreak cases of fleaborne typhus with symptom onsets from April 9 to June 5 were identified. Observed risk factors included an overabundance of fleas that were associated with opossums and free-roaming feral cats. These animals were sustained by ample amounts of domestic pet food that was left outdoors by the community's residents. A variety of control measures were implemented including enacting flea control within the mobile home park, reducing the feral cat population, and encouraging flea control for domesticated dogs and cats (see Special Studies report for details of this investigation).

Reported Fleaborne Typhus Cases and Rates* per 100,000 by Age Group, Race/Ethnicity, and SPA
LAC, 2011-2015

	2011 (N=38)			2012 (N=50)			2013 (N=68)			2014 (N=44)			2015 (N=54)		
	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000
Age Group															
<1	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
1-4	1	2.6	0.2	0	0.0	0.0	1	1.5	0.2	1	2.3	0.2	1	1.9	0.2
5-14	3	7.9	0.2	6	12.0	0.5	5	7.4	0.4	1	2.3	0.1	2	3.7	0.2
15-34	5	13.2	0.2	11	22.0	0.4	16	23.5	0.6	10	22.7	0.4	10	18.5	0.4
35-44	5	13.2	0.3	13	26.0	1.0	12	17.6	0.9	6	13.6	0.5	8	14.8	0.6
45-54	9	23.7	0.7	10	20.0	0.8	13	19.1	1.0	10	22.7	0.8	18	33.3	1.4
55-64	9	23.7	0.9	4	8.0	0.4	13	19.1	1.3	8	18.2	0.8	9	16.7	0.8
65+	6	15.8	0.6	6	12.0	0.5	8	11.8	0.7	8	18.2	0.7	6	11.1	0.5
Unknown	0	-	-	0	-	-	0	-	-	0	-	-	0	-	-
Race / Ethnicity															
Asian	1	2.6	0.1	0	0.0	0.0	3	4.4	0.2	3	6.8	0.2	3	5.6	0.2
Black	2	5.3	0.2	2	4.0	0.3	1	1.5	0.1	0	0.0	0.0	4	7.4	0.5
Hispanic	9	23.7	0.2	15	30.0	0.3	24	35.3	0.5	17	38.6	0.4	20	37.0	0.4
White	23	60.5	0.8	25	50.0	0.9	35	51.5	1.3	17	38.6	0.6	24	44.4	0.9
Other	0	-	-	3	6.0	-	1	1.5	-	1	2.3	-	1	1.9	-
Unknown	3	7.9	-	5	10.0	-	4	5.9	-	6	13.6	-	2	3.7	-
SPA															
1	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
2	9	23.7	0.4	5	10.0	0.2	6	8.8	0.3	3	6.8	0.1	10	18.5	0.4
3	13	34.2	0.7	18	36.0	1.1	20	29.4	1.2	17	38.6	1.0	22	40.7	1.3
4	5	13.2	0.4	13	26.0	1.2	18	26.5	1.6	5	11.4	0.4	8	14.8	0.7
5	5	13.2	0.8	6	12.0	0.9	5	7.4	0.8	6	13.6	0.9	1	1.9	0.2
6	0	0.0	0.0	4	8.0	0.4	7	10.3	0.7	3	6.8	0.3	0	0.0	0.0
7	5	13.2	0.4	3	6.0	0.2	4	5.9	0.3	5	11.4	0.4	6	11.1	0.5
8	1	2.6	0.1	1	2.0	0.1	8	11.8	0.7	5	11.4	0.5	7	13.0	0.6
Unknown	0	-	-	0	-	-	0	-	-	0	-	-	0	-	-

*Rates calculated based on less than 19 cases or events are considered unreliable

Figure 1. Fleaborne Typhus Cases by Year
LAC, 2006-2015

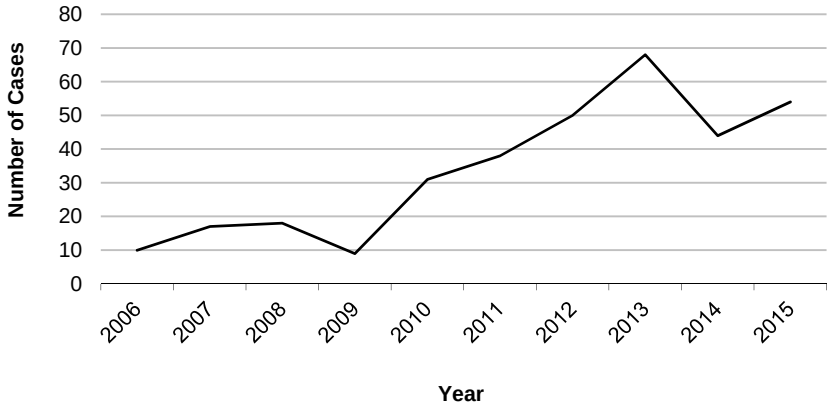


Figure 2. Fleaborne Typhus by Age Group
LAC, 2015 (N=54)

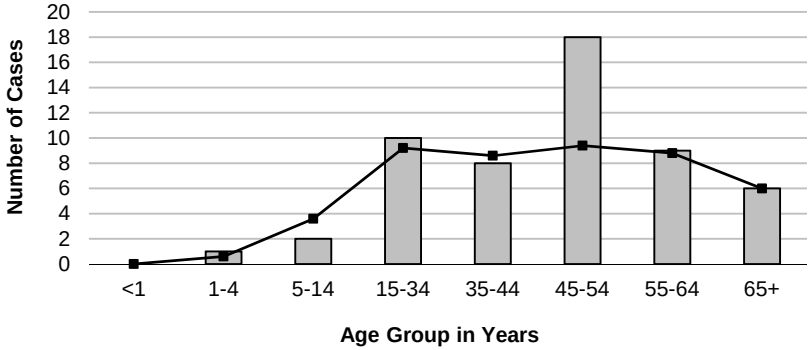


Figure 3. Fleaborne Typhus Cases by SPA
LAC, 2011-2015

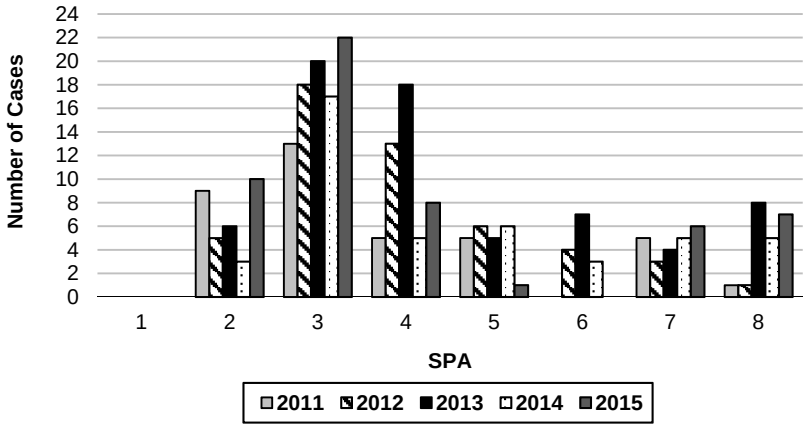


Figure 4. Fleaborne Typhus Cases by Month of Onset
LAC, 2015 (N=54)

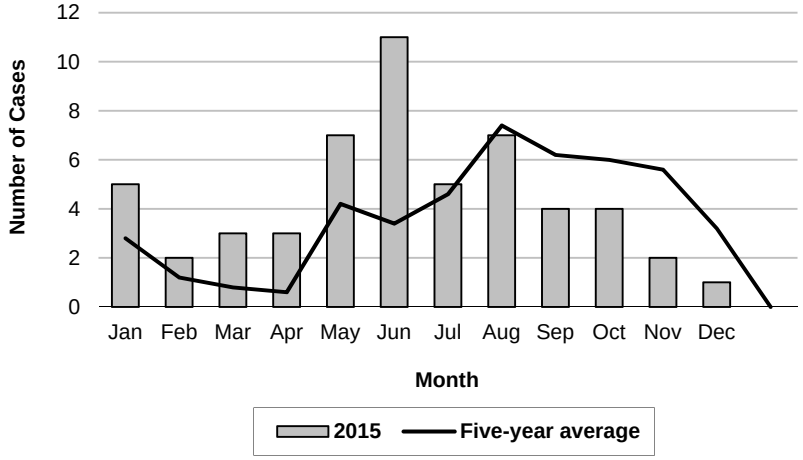
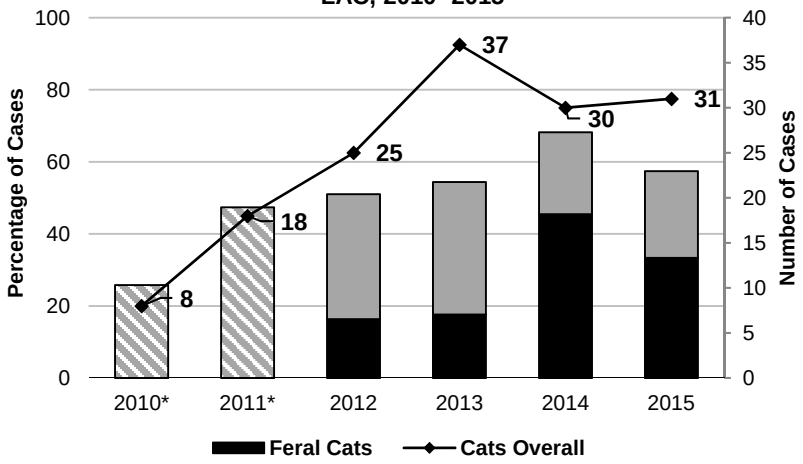


Figure 5. Fleaborne Typhus Cases with Reported Cat Exposure Near Home LAC, 2010 -2015



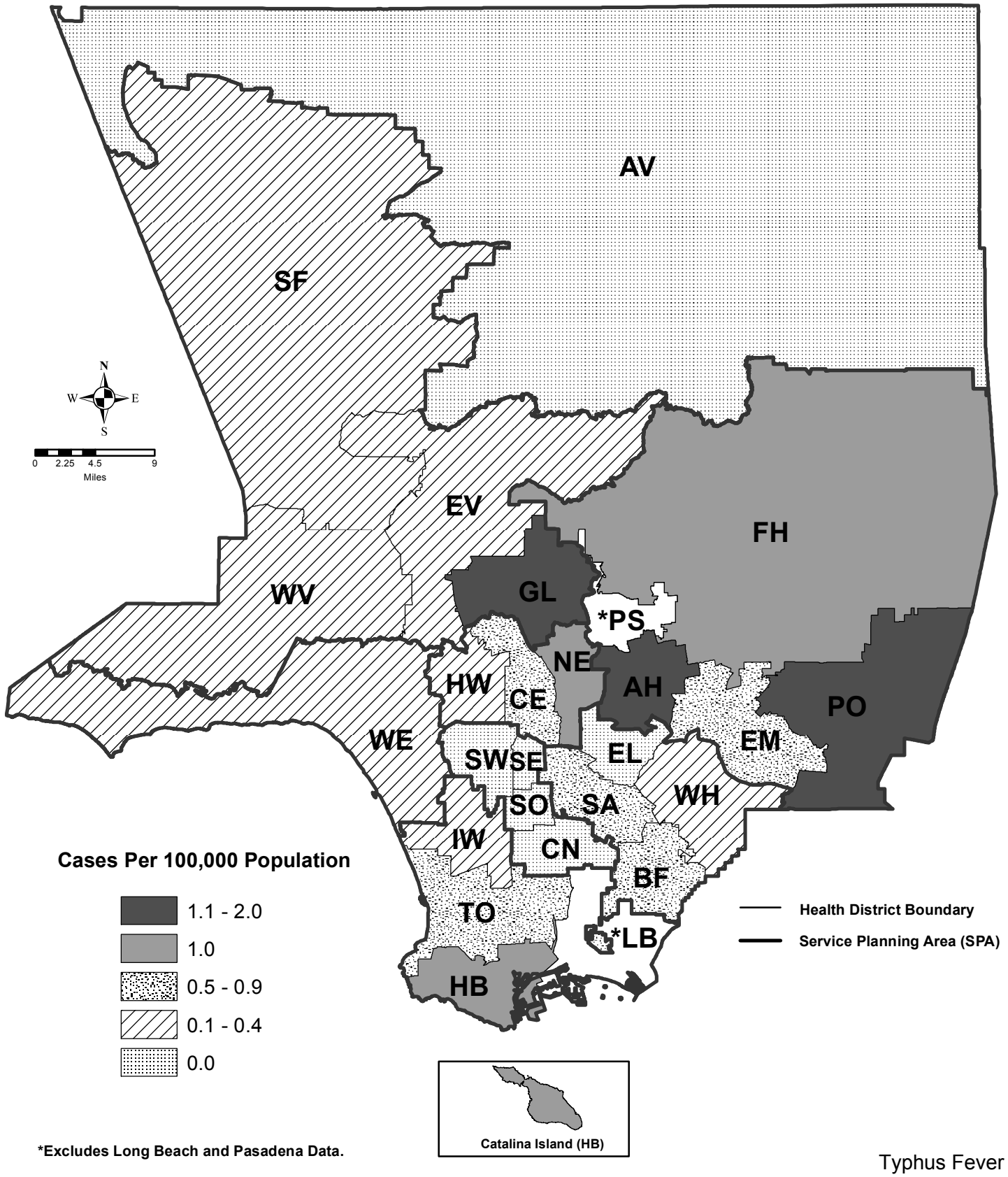
*Hash marked bars denotes exposure to any type of cat including feral cats.

Table 1. Animal Exposure* of Fleaborne Typhus Cases, LAC, 2015 (N=54)

	At or around Home n (%)	At or around Employment n (%)
Cat	31 (57)	3 (6)
Feral Cat	17 (31)	3 (6)
Dog	30 (56)	1 (2)
Opossum	19 (35)	1 (2)
Rodent	8 (15)	4 (7)

*Cases may report more than one exposure and in both the home and employment location.

Map 15. Typhus Fever
Rates by Health District, Los Angeles County, 2015*



*Excludes Long Beach and Pasadena Data.

FLEABORNE TYPHUS

CRUDE DATA	
Number of Cases	44
Annual Incidence[a]	
LA County	0.47
California	N/A
United States[b]	N/A
Age at Diagnosis	
Mean	45.8
Median	50
Range	4–73 years

[a]Cases per 100,000 population.
[b]Not notifiable.

DESCRIPTION

Fleaborne typhus (murine typhus, endemic typhus) is caused by the bacteria *Rickettsia typhi* and *Rickettsia felis* and is transmitted through contact with feces that is discharged when an infected flea bites. Reservoir animals are predominantly feral cats, opossums, and rats. In LACf, most reported cases of typhus have historically occurred in residents of the foothills of central LAC. However, since 2006 the distribution of typhus has expanded to other regions of LAC. Symptoms include fever, severe headache, chills, and myalgia. A fine, macular rash may appear three to five days after onset. Occasionally, complications such as pneumonia or hepatitis may occur. Fatalities are uncommon, occurring in less than 1% of cases, but increase with age. The disease is typically mild in young children. Typhus is not vaccine preventable, but can be treated with antibiotics.

Because fleaborne typhus is not a nationally reportable disease, there is no national case definition. In California, a standard case definition was developed beginning 2012 because of expansion of the disease into new regions, including Long Beach and Orange County. Cases included in LAC surveillance have, at minimum, a single high IgM or IgG titer positive for *Rickettsia* typhi, along with the appropriate symptoms.

Typhus infection prevention includes controlling fleas on pets and reducing exposure to feral cats, opossums and rats. This may be done by reducing habitat (trimming brush, removing rocks and wood piles) and food sources for these animals. Screens can be placed on windows and crawl spaces to prevent entry of animals and their fleas into homes.

2014 TRENDS AND HIGHLIGHTS

- LAC documented a decrease in reported typhus cases in 2014 (n=44) after several years of increased case counts. The case count began rising in 2010 with 31 cases and peaked in 2013 with 68 cases (Figure 1). However, the case count in 2014 remains much higher than the baseline prior to 2010. Most reported cases were hospitalized (n=38, 86%), indicating that milder cases may not have been diagnosed and reported. Surveillance likely substantially undercounts the true number of cases.
- The mean age of cases was 45.8 years. Although cases are rarely reported among young children <5 years old, one case was documented in a 4 year old (Figure 2).
- The large majority of cases were of white or Hispanic/Latino race/ethnicity (both with 17 cases each, 39%). Asians and blacks have been consistently underrepresented in comparison to the general LAC population.
- The highest number of typhus cases occurred in SPA 3 (n=17) (Figure 3), which historically has had high case counts. Typhus has been an increasing problem in SPA 4 in recent years and likely contributed to spikes in 2012 and 2013. However, in 2014 it decreased in this area to 5 cases (11%). Typhus cases identified in 2014 resided in all SPAs with the exception of SPA 1, indicating that typhus has established itself in new areas where it has not often been usually seen for decades.
- This year followed the typical seasonal curve with the highest monthly case count in August (n=8) (Figure 4). However, cases were documented in all months of the year. Physicians and residents should assume that there is risk of typhus infection throughout the entire year in LAC.

- Only eight cases (18%) recalled any flea exposure at or around their home. Animal exposures at cases' places of employment were minimal. None reported exposure to animals and insects directly due to occupational activities.
- Over half of cases reported an exposure to cats at or around their home (54%) (Table 1). Reported exposure to cats, and feral cats in particular, has increased in the last few years (Figure 5). Overall exposure to cats increased from 26% of cases in 2010 to 66% of cases in 2014. Exposure to feral cats, extracted from interview notes beginning in 2012, increased from 16% of cases in 2012 to 45% of cases in 2014, accounting for over half of all cat exposures.
- The recent increase in cases may be due to a number of factors including the natural relocation of host animals (opossums and feral cats) to regions not previously enzootic for typhus; changes in weather (increasing temperatures) that favor flea survival; increased testing and reporting due to better educated physicians; and increased reporting to LAC DPH through electronic laboratory reporting.

Reported Fleaborne Typhus Cases and Rates* per 100,000 by Age Group, Race/Ethnicity, and SPA
Los Angeles County, 2010-2014

	2010 (N=31)			2011 (N=38)			2012 (N=50)			2013 (N=68)			2014 (N=44)		
	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000
Age Group															
<1	0	-	-	0	-	-	0	-	-	0	-	-	0	-	-
1-4	0	-	-	1	2.6	-	0	-	-	1	1.5	-	1	2.3	-
5-14	3	9.7	-	3	7.9	-	6	12.0	-	5	7.4	-	1	2.3	-
15-34	4	12.9	-	5	13.2	-	11	22.0	-	16	23.5	-	10	22.7	-
35-44	7	22.6	-	5	13.2	-	13	26.0	-	12	17.6	-	6	13.6	-
45-54	5	16.1	-	9	23.7	-	10	20.0	-	13	19.1	-	10	22.7	-
55-64	10	32.3	-	9	23.7	-	4	6.7	-	13	19.1	-	8	18.2	-
65+	2	6.5	-	6	15.8	-	6	12.0	-	8	11.8	-	8	18.2	-
Unknown	0	-	-	0	-	-	0	-	-	0	-	-	0	-	-
Race/Ethnicity															
Asian	2	6.5	-	1	2.6	-	0	-	-	3	4.4	-	3	6.8	-
Black	2	6.5	-	2	5.3	-	2	4.0	-	1	1.5	-	0	-	-
Hispanic	10	32.3	-	9	23.7	-	15	30.0	-	24	35.3	-	17	38.6	-
White	14	45.2	-	23	60.5	-	25	50.0	-	35	51.5	-	17	38.6	-
Other	0	0.0	-	0	-	-	3	6.0	-	1	1.5	-	1	2.3	-
Unknown	3	9.7	-	3	7.9	-	5	10.0	-	4	5.9	-	6	13.6	-
SPA															
1	0	-	-	0	-	-	0	-	-	0	-	-	0	-	-
2	5	16.1	-	9	23.7	-	5	10.0	-	6	8.8	-	3	6.8	-
3	9	29.0	-	13	34.2	-	18	36.0	-	20	29.4	-	17	38.6	-
4	5	16.1	-	5	13.2	-	13	26.0	-	18	26.5	-	5	11.4	-
5	6	19.4	-	5	13.2	-	6	12.0	-	5	7.4	-	6	13.6	-
6	4	12.9	-	0	-	-	4	6.7	-	7	10.3	-	3	6.8	-
7	0	-	-	5	13.2	-	3	6.0	-	4	5.9	-	5	11.4	-
8	2	6.5	-	1	2.6	-	1	2.0	-	8	11.8	-	5	11.4	-
Unknown	0	-	-	0	-	-	0	-	-	0	-	-	0	-	-

*Rates calculated based on less than 19 cases or events are considered unreliable.

Figure 1. Fleaborne Typhus Cases by Year
LAC, 2000-2014

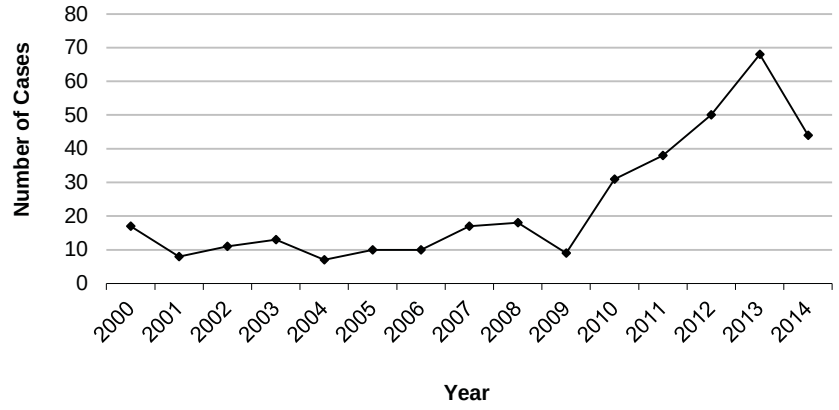


Figure 2. Fleaborne Typhus by Age Group
LAC, 2014 (N=44)

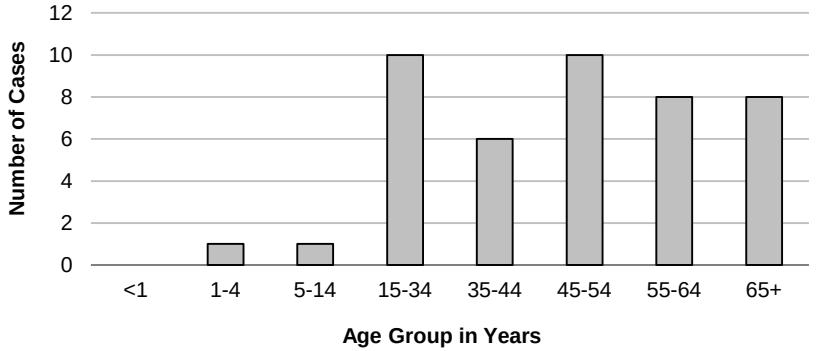


Figure 3. Fleaborne Typhus Cases by SPA
LAC, 2010-2014

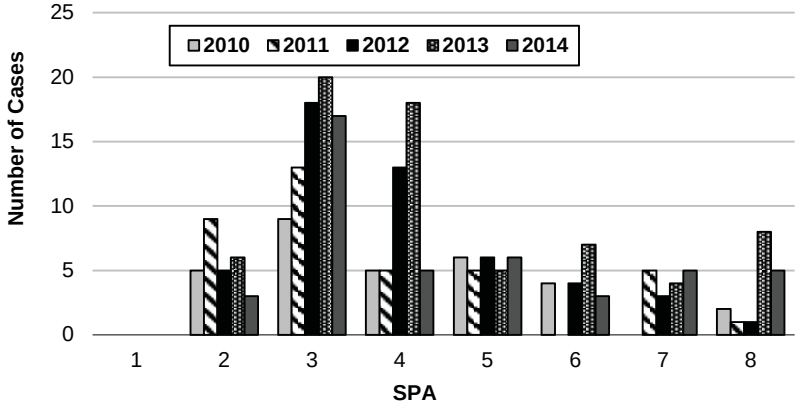


Figure 4. Fleaborne Typhus Cases by Month of Onset
LAC, 2014 (N=44)

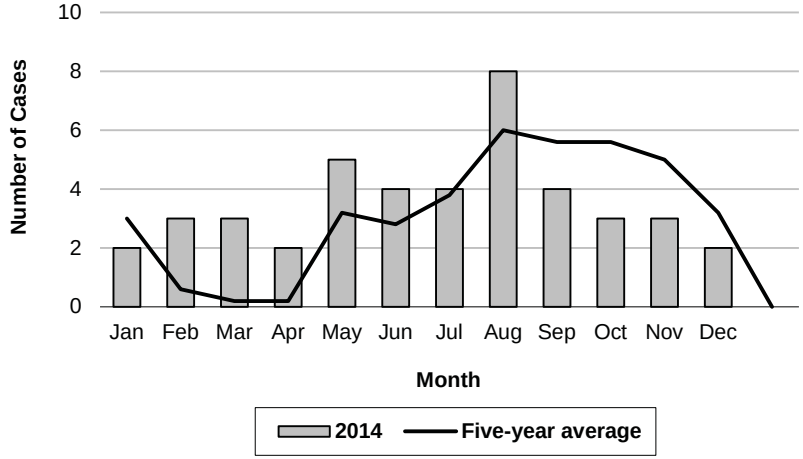
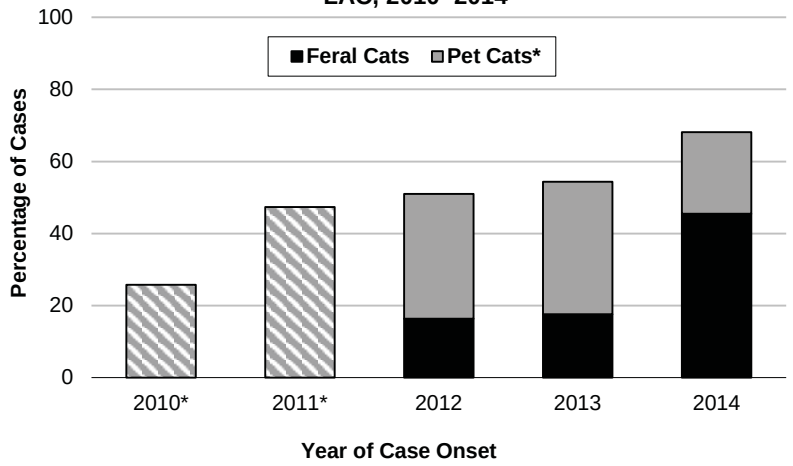


Figure 5. Fleaborne Typhus Cases with Reported Cat Exposure Near Home LAC, 2010 -2014



*Hash marked bars denotes all cats. Does not distinguish between feral or pet cats.

Table 1. Animal Exposure* of Fleaborne Typhus Cases LAC, 2014 (N=44)

	At or around Home n (%)	At or around Employment n (%)
Cat	30 (55)	3 (7)
Dog	19 (43)	0 (0)
Opossum	23 (53)	1 (3)
Rodent	7 (16)	1 (3)

*Exposures will total more than 100% as cases may report more than one exposure.

TYPHUS FEVER

CRUDE DATA	
Number of Cases	68
Annual Incidence[a]	
LA County	0.72
California	
United States[b]	N/A
Age at Diagnosis	
Mean	42.7
Median	43
Range	4-77

[a]Cases per 100,000 population.
[b]Not notifiable.

DESCRIPTION

Typhus fever (murine typhus, endemic typhus) is caused by the bacteria *Rickettsia typhi* and *Rickettsia felis* and is transmitted through contact with feces that is discharged when an infected flea bites. Reservoir animals are predominantly rats, opossums, and feral cats. In Los Angeles County (LAC), most reported cases of typhus occur in residents of the foothills of central LAC. However, since 2006 the distribution of typhus has expanded to other regions of LAC, particularly towards the western part of the county (SPA 5). Symptoms include fever, severe headache, chills, and myalgia. A fine, macular rash may appear three to five days after onset. Occasionally, complications such as pneumonia or hepatitis may occur. Fatalities are uncommon, occurring in less than 1% of cases, but increase with age. The disease is typically mild in young children. Typhus is not vaccine preventable, but can be treated with antibiotics.

Because typhus fever is not a nationally reportable disease, there is no national case definition. In California, a standard case definition was developed beginning 2012 because of expansion of the agent into new regions, including Long Beach and Orange County. Cases included in LAC surveillance have, at minimum, a single high IgM or IgG titer positive for any *Rickettsia* species, along with the appropriate symptoms

Typhus infection can be prevented through flea control measures implemented on pets. Foliage in the yard should be trimmed so that it does not provide harborage for small mammals. Screens can be placed on windows and crawl spaces to prevent entry of animals and their fleas into the house.

2013 TRENDS AND HIGHLIGHTS

- LAC continued to document a record number of typhus fever cases in 2013 with a 36% increase from 50 cases in 2012 to 68 cases in 2013 (Figure 1). Most reported cases were hospitalized (n=50, 74%), indicating that milder cases may not have been diagnosed and reported. Our surveillance then would grossly undercount the true number of cases.
- The mean and median ages of hospitalized patients were 44.5 years and 44 years, respectively. Ages of non-hospitalized cases were slightly younger, with a mean and median of 36.7 and 43 years, respectively. Cases occurring in young children <5 years old are rare.
- The large majority of cases were of white or Hispanic/Latino race/ethnicity (n=35, 52%, and n=24, 35%, respectively). Asians and blacks have been consistently underrepresented in comparison to the general LAC population (Figure 5).
- The number of typhus cases continued to be highest in SPA 3 (n=20) (Figure 3), which has had high numbers historically, followed by SPA 4 (n=18). Typhus has been an increasing problem in SPA 4 in recent years. Typhus cases resided in all SPAs with the exception of SPA 1, indicating that typhus has established itself in new areas where it has not been usually seen for decades.
- This year followed a more typical seasonal curve with the highest monthly case count in August (n=15) (Figure 4). However, cases were documented in nearly all months of the year. Physicians and residents should assume that there is risk of typhus infection throughout the entire year in LAC.
- Only fifteen cases recalled a flea exposure (22%). A large proportion of cases reported an exposure to cats or dogs at or around

[1] 2007 Los Angeles County Health Survey. Los Angeles County Department of Public Health. http://www.publichealth.lacounty.gov/ha/hasurveyintro.htm

their home (n=50, 74%) (Table 1). This is much higher than the overall rate of pet ownership in LAC (40%).[1] Animal exposures at their place of employment were minimal.

- The increase in cases may be due to a number of factors including the natural relocation of host animals (opossums and feral cats) to regions not previously enzootic for typhus; changes in weather that favor flea survival; increased testing and reporting due to better educated physicians; and increase reporting to public health department by electronic laboratory reporting.

Reported Typhus Fever Cases and Rates* per 100,000 by Age Group, Race/Ethnicity, and SPA
Los Angeles County, 2009-2013

	2009 (N=9)			2010 (N=31)			2011 (N=38)			2012 (N=50)			2013 (N=68)		
	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000
Age Group															
<1	0	0.0		0	0.0		0	0.0		0	0.0		0	0.0	0.0
1-4	0	0.0		0	0.0		1	2.6		0	0.0		1	1.5	0.2
5-14	2	22.2		3	9.7		3	7.9		6	12.0		5	7.4	0.4
15-34	1	11.1		4	12.9		5	13.2		11	22.0		16	23.5	0.6
35-44	0	0.0		7	22.6		5	13.2		13	26.0		12	17.6	0.9
45-54	4	44.9		5	16.1		9	23.7		10	20.0		13	19.1	1.0
55-64	2	22.2		10	32.3		9	23.7		4	6.7		13	19.1	1.3
65+	0	0.0		2	6.5		6	15.8		6	12.0		8	11.8	0.7
Unknown	0	0.0		0	0.0		0	0.0		0	0.0		0	0.0	
Race/Ethnicity															
Asian	1	11.1		2	6.5		1	2.6		0	0.0		3	4.4	0.2
Black	0	0.0		2	6.5		2	5.3		2	4.0		1	1.5	0.1
Hispanic	1	11.1		10	32.3		9	23.7		15	30.0		24	35.3	0.5
White	7	77.8		14	45.2		23	60.5		25	50.0		35	51.5	1.3
Other	0	0.0		0	0.0		0	0.0		3	6.0		1	1.5	
Unknown	0	0.0		3	9.7		3	7.9		5	10.0		4	5.9	
SPA															
1	0	0.0		0	0.0		0	0.0		0	0.0		0	0.0	0.0
2	1	11.1		5	16.1		9	23.7		5	10.0		6	8.8	0.3
3	5	55.6		9	29.0		13	34.2		18	36.0		20	29.4	1.2
4	3	33.3		5	16.1		5	13.2		13	26.0		18	26.5	1.6
5	0	0.0		6	19.4		5	13.2		6	12.0		5	7.4	0.8
6	0	0.0		4	12.9		0	0.0		4	6.7		7	10.3	0.7
7	0	0.0		0	0.0		5	13.2		3	6.0		4	5.9	0.3
8	0	0.0		2	6.5		1	2.6		1	2.0		8	11.8	0.7
Unknown	0	0.0		0	0.0		0	0.0		0	0.0		0	0.0	

*Rates calculated based on less than 19 cases or events are considered unreliable.

Figure 1. Typhus Fever Cases by Year
LAC, 2000-2013

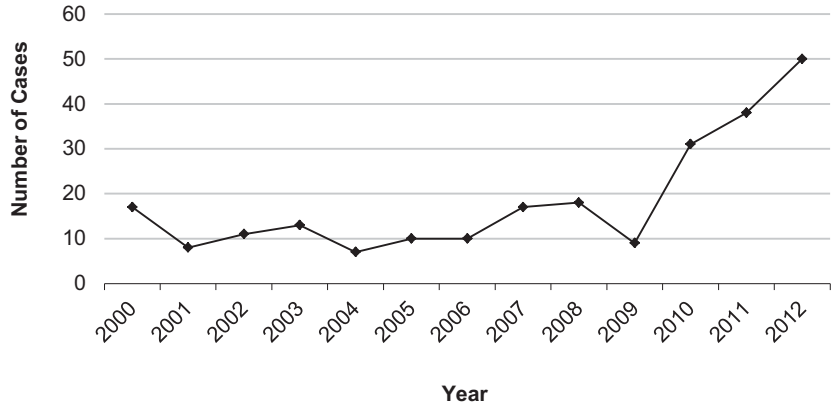


Figure 2. Typhus Fever by Age Group
LAC, 2013 (N=68)

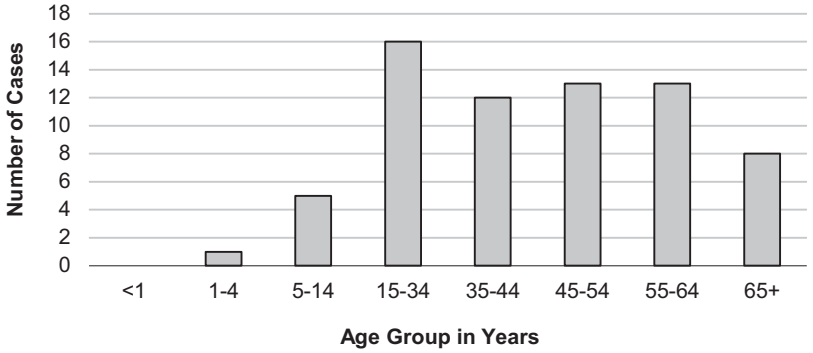


Figure 3. Typhus Fever Cases by SPA
LAC, 2013 (N=68)

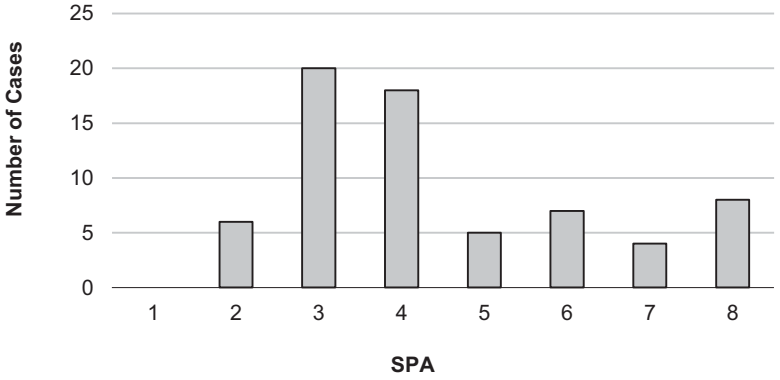


Figure 4. Typhus Fever Cases by Month of Onset
LAC, 2013 (N=68)

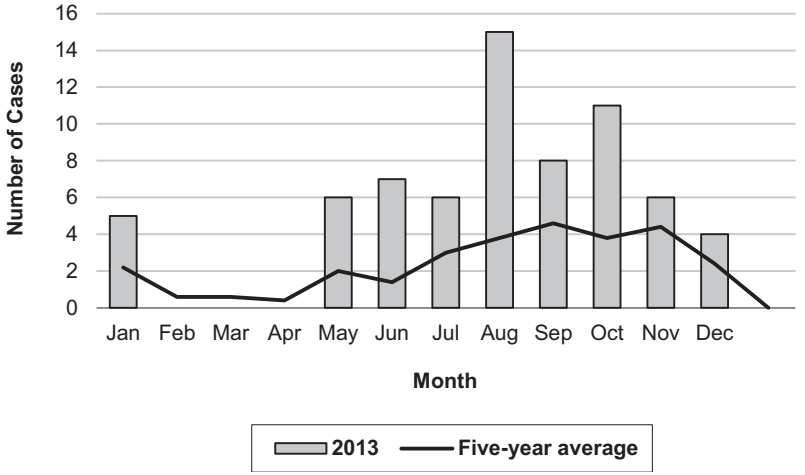


**Figure 5. Typhus Fever Cases by Race/Ethnicity
LAC, 2009 -2013**

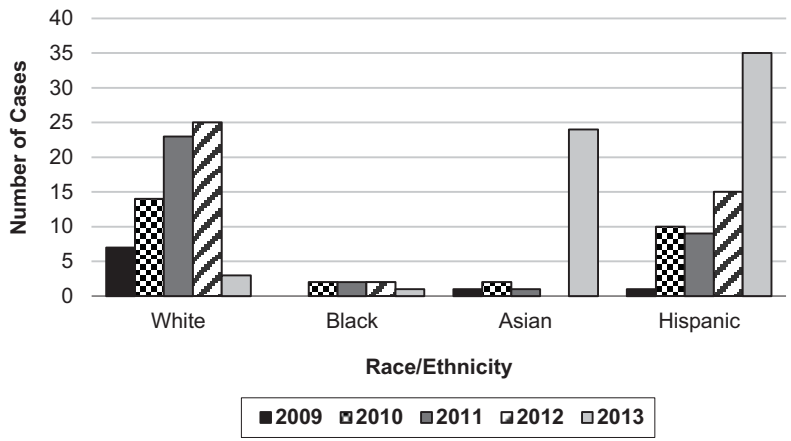
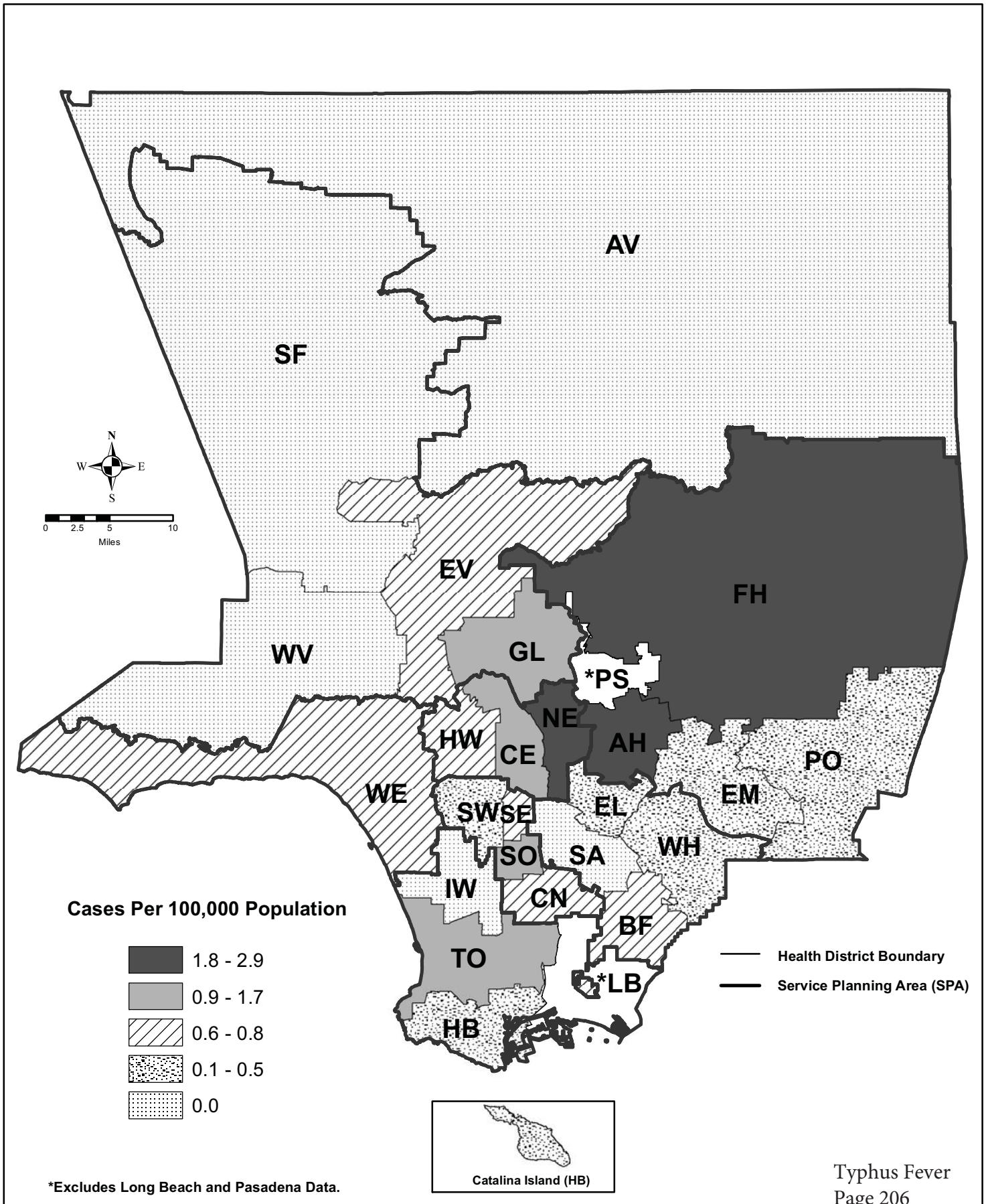


Table 1. Animal Exposure* of Cases, LAC, 2013 (N=68)		
	Home n (%)	Employment n (%)
Cat	37 (54)	5 (7)
Dog	32 (47)	3 (4)
Cat or Dog	50 (74)	6 (9)
Opossum	39 (57)	3 (4)
Rodent	12 (18)	2 (3)

*Exposures will total more than 100% as cases may report more than one exposure.

Map 16. Typhus Fever
Rates by Health District, Los Angeles County, 2013*



*Excludes Long Beach and Pasadena Data.

TYPHUS FEVER

CRUDE DATA	
Number of Cases	50
Annual Incidence[a]	
LA County	0.54
California[b]	N/A
United States[b]	N/A
Age at Diagnosis	
Mean	40
Median	41
Range	5-71

[a]Cases per 100,000 population.
[b]Not notifiable.

DESCRIPTION

Typhus fever (murine typhus, endemic typhus) is caused by the bacteria *Rickettsia typhi* and *Rickettsia felis* and is transmitted through contact with feces that is discharged when an infected flea bites. Reservoir animals are predominantly rats, opossums, and feral cats. In Los Angeles County (LAC), most reported cases of typhus occur in residents of the foothills of central LAC. However, since 2006 the distribution of typhus has expanded to other regions of LAC, particularly towards the western part of the county (SPA 5). Symptoms include fever, severe headache, chills, and myalgia. A fine, macular rash may appear three to five days after onset. Occasionally, complications such as pneumonia or hepatitis may occur. Fatalities are uncommon, occurring in less than 1% of cases, but increase with age. The disease is typically mild in young children. Typhus is not vaccine preventable, but can be treated with antibiotics.

Because typhus fever is not a nationally reportable disease, there is no national case definition. In California, a standard case definition was developed beginning 2012 because of expansion of the agent into new regions, including Long Beach and Orange County. Cases included in LAC surveillance have, at minimum, a single high IgM or IgG titer positive for any *Rickettsia* species, along with the appropriate symptoms

Typhus infection can be prevented through flea control measures implemented on pets. Foliage in the yard should be trimmed so that it does not provide harborage for small mammals. Screens can be placed on windows and crawl spaces to prevent entry of animals and their fleas into the house.

2012 TRENDS AND HIGHLIGHTS

- LAC documented a record number of typhus fever cases in 2012. There were 50 cases in 2012, up from the previous record of 38 cases in 2011 (Figure 1). Most reported cases were hospitalized (n=39, 78%), indicating that milder cases may not have been diagnosed and reported in which would make actual total number of cases occur even higher.
- The mean age of cases was 40 years, with the majority of cases being over 35 years old (n=33, 66%). Cases occurring in young children <5 years are rare.
- The large majority of cases were of Hispanic/Latino and white race/ethnicity (n=15, 30%, and n=25, 50%, respectively). Asians and blacks have been consistently underrepresented in comparison to the general LAC population (Figure 5).
- The number of typhus cases continued to be highest in SPA 3 (n=18) (Figure 3), which has had high numbers historically. Typhus cases resided in nearly all SPAs with the exception of SPA 1, indicating that typhus has established itself in new areas where it has not been usually seen for decades.
- The monthly number of typhus cases began rising in May, earlier than previous years (Figure 4). Cases were documented in nearly all months of the year. Physicians and residents should assume that there is risk of typhus infection throughout the entire year in LAC.
- Only seventeen cases recalled a flea exposure (34%). A large proportion of cases reported an exposure to cats or dogs at or around their home (n=34, 68%) (Table 1). This is much higher than the overall rate of pet ownership in LAC (40%).[1] Animal exposures at their place of employment was negligible.

[1] 2007 Los Angeles County Health Survey. Los Angeles County Department of Public Health. http://www.publichealth.lacounty.gov/ha/hasurveyintro.htm

- The increase in cases may be due to a number of factors including the natural relocation of host animals (possums and feral cats) to regions not previously enzootic for typhus; changes in weather that favor flea survival; increased testing and reporting due to better educated physicians; and increase reporting to public health department by electronic laboratory reporting.

Reported Typhus Fever Cases and Rates* per 100,000 by Age Group, Race/Ethnicity, and SPA
Los Angeles County, 2008-2012

	2008 (N=18)			2009 (N=9)			2010 (N=31)			2011 (N=38)			2012 (N=50)		
	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000
Age Group															
<1	0	0.0		0	0.0		0	0.0		0	0.0		0	0.0	
1-4	0	0.0		0	0.0		0	0.0		1	2.6		0	0.0	
5-14	3	16.7		2	22.2		3	9.7		3	7.9		6	12.0	
15-34	3	16.7		1	11.1		4	12.9		5	13.2		11	22.0	
35-44	4	22.2		0	0.0		7	22.6		5	13.2		13	26.0	
45-54	4	22.2		4	44.9		5	16.1		9	23.7		10	20.0	
55-64	3	16.7		2	22.2		10	32.3		9	23.7		4	6.7	
65+	1	5.6		0	0.0		2	6.5		6	15.8		6	12.0	
Unknown	0	0.0		0	0.0		0	0.0		0	0.0		0	0.0	
Race/Ethnicity															
Asian	1	5.6		1	11.1		2	6.5		1	2.6		0	0.0	
Black	0	0.0		0	0.0		2	6.5		2	5.3		2	4.0	
Hispanic	5	27.8		1	11.1		10	32.3		9	23.7		15	30.0	
White	12	66.7		7	77.8		14	45.2		23	60.5		25	50.0	
Other	0	0.0		0	0.0		0	0.0		0	0.0		3	6.0	
Unknown	0	0.0		0	0.0		3	9.7		3	7.9		5	10.0	
SPA															
1	0	0.0		0	0.0		0	0.0		0	0.0		0	0.0	
2	2	11.1		1	11.1		5	16.1		9	23.7		5	10.0	
3	9	50.0		5	55.6		9	29.0		13	34.2		18	36.0	
4	1	5.6		3	33.3		5	16.1		5	13.2		13	26.0	
5	3	16.7		0	0.0		6	19.4		5	13.2		6	12.0	
6	1	5.6		0	0.0		4	12.9		0	0.0		4	6.7	
7	2	11.1		0	0.0		0	0.0		5	13.2		3	6.0	
8	0	0.0		0	0.0		2	6.5		1	2.6		1	2.0	
Unknown	0	0.0		0	0.0		0	0.0		0	0.0		0	0.0	

*Rates calculated based on less than 19 cases or events are considered unreliable.

Figure 1. Typhus Fever Cases by Year
LAC, 2000-2012

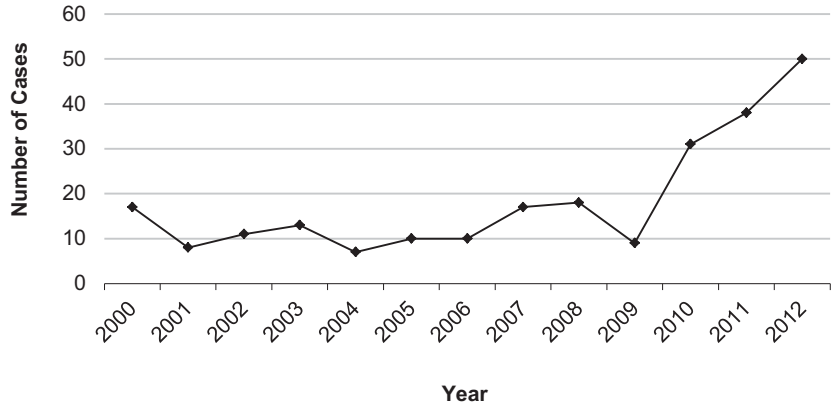


Figure 2. Typhus Fever by Age Group
LAC, 2012 (N=50)

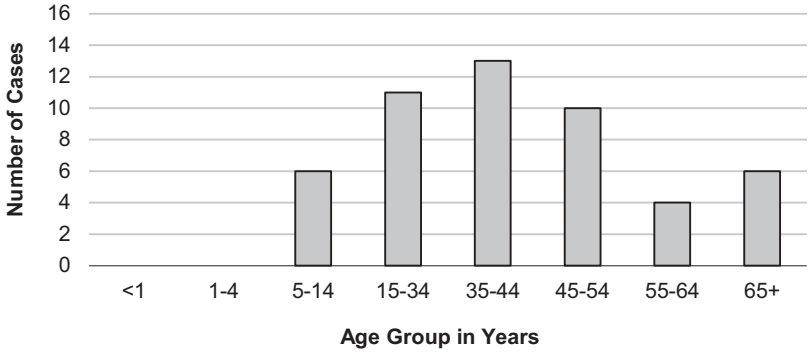


Figure 3. Typhus Fever Cases by SPA
LAC, 2012 (N=50)

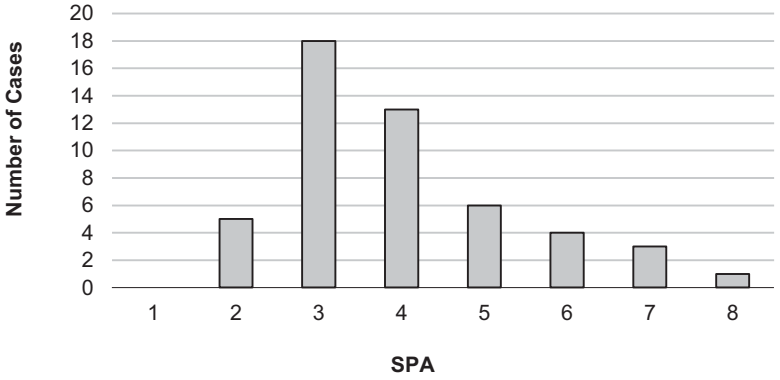


Figure 4. Typhus Fever Cases by Month of Onset
LAC, 2012 (N=50)

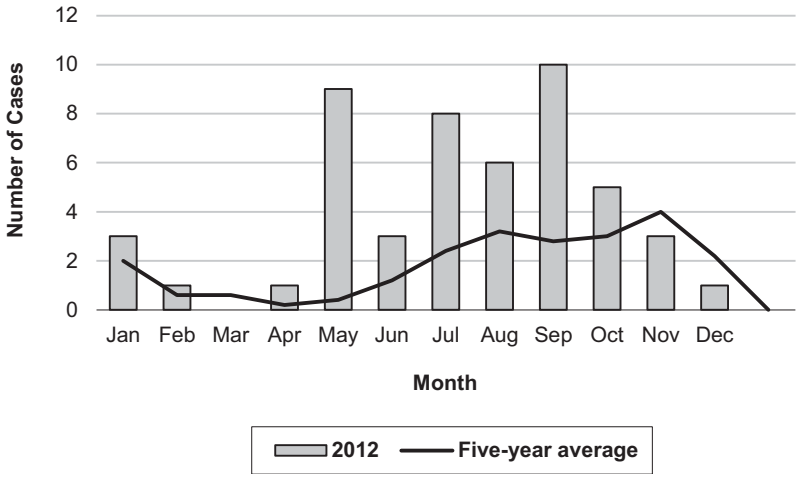


Figure 5. Typhus Fever Cases by Race/Ethnicity LAC, 2008 -2012

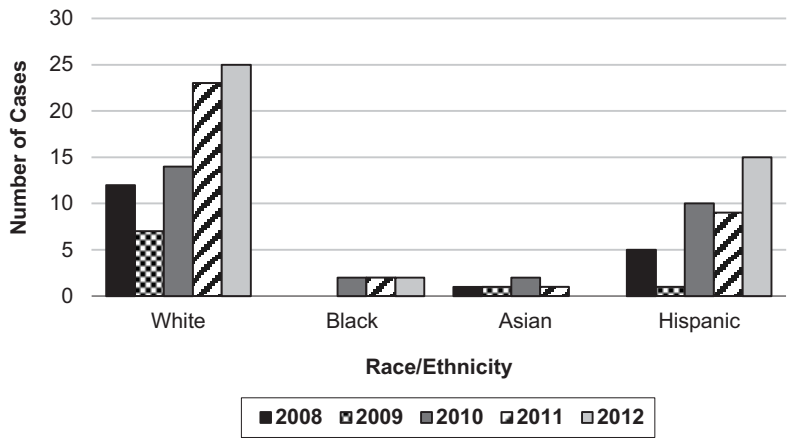


Table 1. Animal Exposure* of Cases, LAC, 2012 (N=50)

	Home n (%)	Employment n (%)
Cat	25 (50)	3 (6)
Dog	24 (48)	2 (4)
Cat or Dog	34 (68)	--
Opossum	23 (46)	1 (2)
Rodent	6 (12)	2 (4)

*Exposures will total more than 100% as cases may report more than one exposure.

TYPHUS FEVER

CRUDE DATA	
Number of Cases	38
Annual Incidence[a]	
LA County	0.39
California[b]	N/A
United States[b]	N/A
Age at Diagnosis	
Mean	47.6
Median	52
Range	2-77

[a]Cases per 100,000 population.
[b]Not notifiable.

DESCRIPTION

Typhus fever (murine typhus, endemic typhus) is caused by the bacteria *Rickettsia typhi* and *R. felis*; and is transmitted through the bite or contact with feces of an infected flea. Reservoir animals are predominantly rats, opossums, and feral cats. In Los Angeles County (LAC), most reported cases of typhus occur in residents of the foothills of central LAC. Symptoms include fever, severe headache, chills, and myalgia. A fine, macular rash may appear three to five days after onset. Occasionally, complications such as pneumonia or hepatitis may occur. Fatalities are uncommon, occurring in less than 1% of cases, but increase with age. The disease is typically mild in young children. Typhus is not vaccine preventable, but can be treated with antibiotics.

Because typhus fever is not a nationally reportable disease, there is no national case definition. In Southern California, a workgroup developed a standard case definition because of expansion of the agent into new regions, including Long Beach and Orange County. For the purpose of surveillance in LAC, cases are considered confirmed with a single high IgM titer and appropriate symptoms and exposure history.

Typhus infection can be prevented through flea control measures implemented on pets. Foliage in the yard should be trimmed so that it does not provide harborage for small mammals. Screens can be placed on windows and crawl spaces to prevent entry of animals and their fleas into the house.

2011 TRENDS AND HIGHLIGHTS

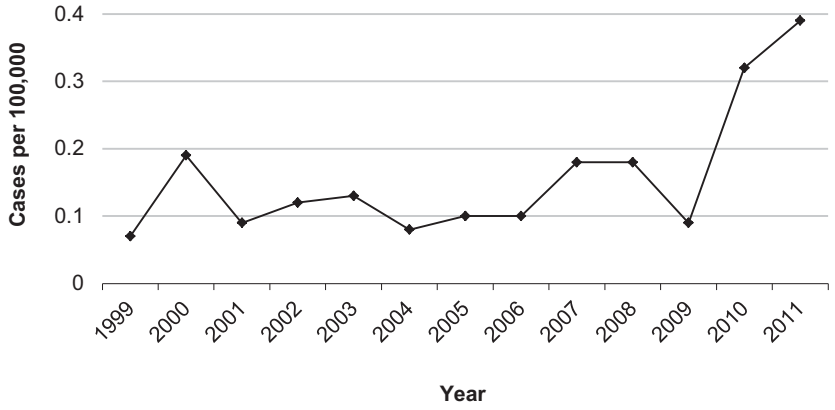
- LAC continues to document record numbers of typhus fever. There were 38 cases (0.39 per 100,000) in 2011, up from the previous recent record of 31 cases (0.32 per 100,000) in 2010 (Figure 1).
- The incidence of typhus continued to be highest in SPA 5 at 0.8 per 100,000 (Figure 3). Typhus cases resided in all eight SPAs with the exception of 1 and 6, indicating that typhus has established itself in new areas where it has not been usually seen for decades.
- Most typhus cases had symptom onsets within the summer through winter, with cases being documented in 9 of 12 months (Figure 4). Physicians and residents should assume that there is risk of typhus infection throughout the entire year in LAC.
- Most cases report an exposure to fleas and animals, and particularly to owning a pet dog or cat (n=27, 71%) (Table 1).
- The increase in cases may be due to a number of factors including the relocation of host animals (possums and feral cats) to regions not previously enzootic for typhus; changes in weather that favor flea survival; increased testing and reporting due to better educated physicians; and increase reporting to public health department by electronic laboratory reporting.

Reported Typhus Fever Cases and Rates* per 100,000 by Age Group, Race/Ethnicity, and SPA
Los Angeles County, 2007-2011

	2007 (N=17)			2008 (N=18)			2009 (N=9)			2010 (N=31)			2011 (N=38)		
	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000
Age Group															
<1	0	0.0		0	0.0		0	0		0	0.0		0	0.0	
1-4	1	5.9		0	0.0		0	0		0	0.0		1	2.6	
5-14	1	5.9		3	16.7		2	0.2		3	9.7		3	7.9	
15-34	3	17.6		3	16.7		1	0.1		4	12.9		5	13.2	
35-44	3	17.6		4	22.2		0	0		7	22.6		5	13.2	
45-54	6	35.3		4	22.2		4	0.4		5	16.1		9	23.7	
55-64	2	11.8		3	16.7		2	0.2		10	32.3		9	23.7	
65+	1	5.9		1	5.6		0	0		2	6.5		6	15.8	
Unknown	0	0.0		0	0.0		0	0		0	0.0		0	0.0	
Race/Ethnicity															
Asian	1	5.9		1	5.6		1	0.1		2	6.5		1	2.6	
Black	0	0.0		0	0.0		0	0		2	6.5		2	5.3	
Hispanic	1	5.9		5	27.8		1	0.1		10	32.3		9	23.7	
White	13	76.5		12	66.7		7	0.7		14	45.2		23	60.5	0.8
Other	0	0.0		0	0.0		0	0		0	0.0		0	0.0	
Unknown	2	11.8		0	0.0		0	0		3	9.7		3	7.9	
SPA															
1	0	0.0		0	0.0		0	0		0	0.0		0	0.0	
2	2	11.8		2	11.1		1	0.1		5	16.1		9	23.7	
3	8	47.1		9	50.0		5	0.6		9	29.0		13	34.2	
4	1	5.9		1	5.6		3	0.3		5	16.1		5	13.2	
5	4	23.5		3	16.7		0	0		6	19.4		5	13.2	
6	0	0.0		1	5.6		0	0		4	12.9		0	0.0	
7	1	5.9		2	11.1		0	0		0	0.0		5	13.2	
8	1	5.9		0	0.0		0	0		2	6.5		1	2.6	
Unknown	0	0.0		0	0.0		0	0		0	0.0		0	0.0	

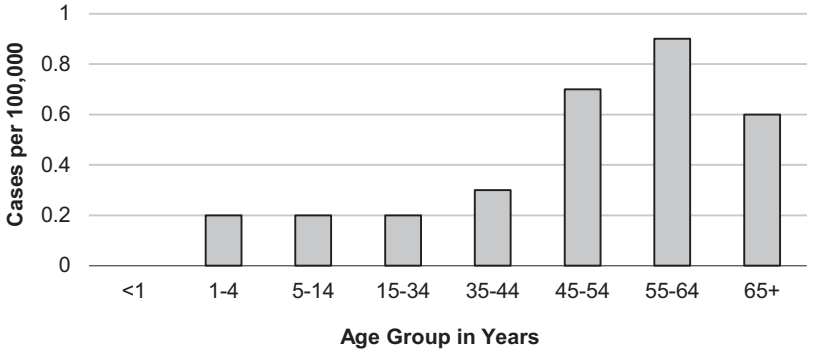
*Rates calculated based on less than 19 cases or events are considered unreliable.

**Figure 1. Incidence Rates* of Typhus Fever
LAC, 1999-2011**



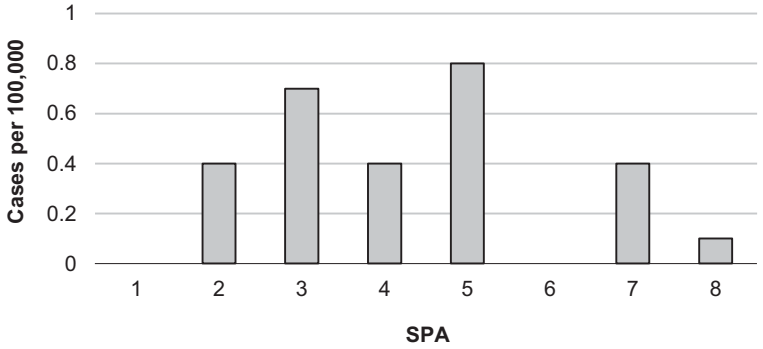
*Rates calculated based on less than 19 cases or events are considered unreliable.

**Figure 2. Incidence Rates* of Typhus Fever by Age Group
LAC, 2011 (N=38)**



*Rates calculated based on less than 19 cases or events are considered unreliable.

**Figure 3. Incidence Rates* of Typhus Fever by SPA
LAC, 2011 (N=38)**



*Rates calculated based on less than 19 cases or events are considered unreliable

**Figure 4. Reported Typhus Fever Cases by Month of Onset
LAC, 2011 (N=38)**

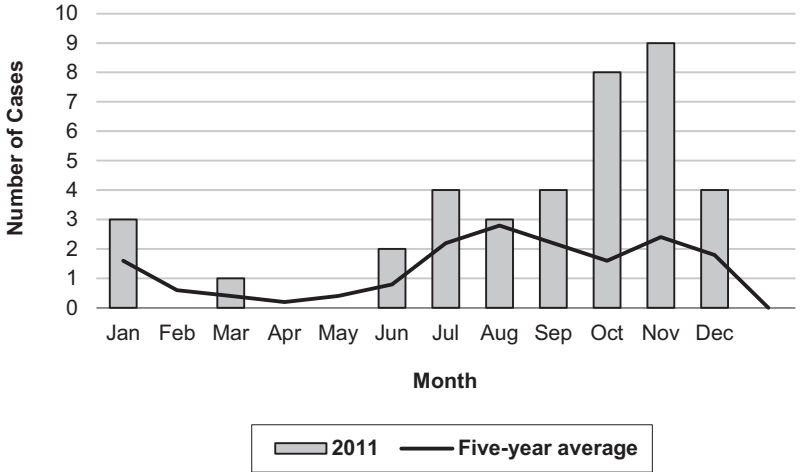


Figure 5. Reported Typhus Fever Cases by Race/Ethnicity LAC, 2007-2011

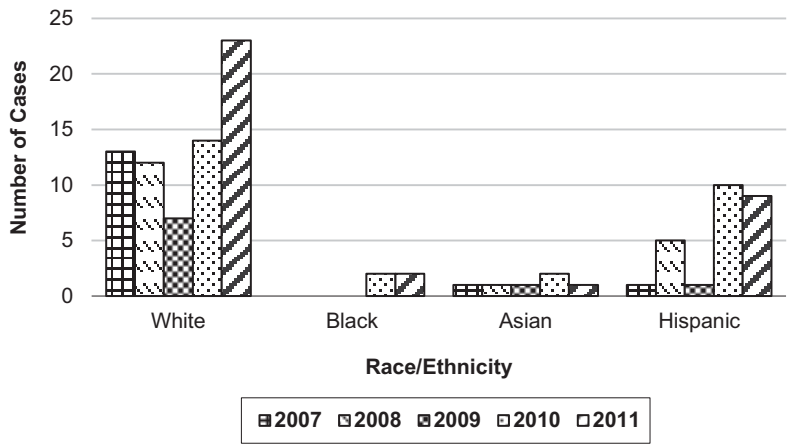


Table 1. Flea and Animal Exposure of Cases, LAC, 2006-2011

	2006-2010 N=85 n (%)	2011 N=38 n (%)
Fleas	29 (34)	7 (18)
Pet Dog/Cat	70 (84)	27 (71)
Opossums*	36 (42)	6 (6)
Rodents*	32 (38)	12 (32)
Denies Recent Exposures	4 (5)	4 (11)

*In and around house or neighborhood.

TYPHUS FEVER

CRUDE DATA	
Number of Cases	31
Annual Incidence[a]	
LA County	0.32
California[b]	N/A
United States[b]	N/A
Age at Diagnosis	
Mean	44.5
Median	50
Range	7-74

[a]Cases per 100,000 population.
[b]Not notifiable.

DESCRIPTION

Typhus fever (murine typhus, endemic typhus) is caused by the bacteria *Rickettsia typhi* and *R. felis*; and is transmitted through the bite or contact with feces of an infected flea. Reservoir animals are predominantly rats and opossums that live in areas with heavy foliage. In Los Angeles County (LAC), most reported cases of typhus occur in residents of the foothills of central LAC. Symptoms include fever, severe headache, chills, and myalgia. A fine, macular rash may appear three to five days after onset. Occasionally, complications such as pneumonia or hepatitis may occur. Fatalities are uncommon, occurring in less than 1% of cases, but increase with age. The disease is typically mild in young children. Typhus infection is not vaccine preventable, but can be treated with antibiotics.

Because typhus fever is not a nationally reportable disease, there is no standard case definition across county and state jurisdictions. In Southern California, a workgroup developed a standard case definition because of expansion of the agent into new regions, including Long Beach and Orange County. For the purpose of surveillance in LAC, cases are considered confirmed with a single high IgM titer and appropriate symptoms and exposure history.

Typhus infection can be prevented through flea control measures implemented on pets. Foliage in the yard should be trimmed so that it does not provide harborage for small mammals. Screens can be placed on windows and crawl spaces to prevent entry of animals and their fleas into the house.

2010 TRENDS AND HIGHLIGHTS

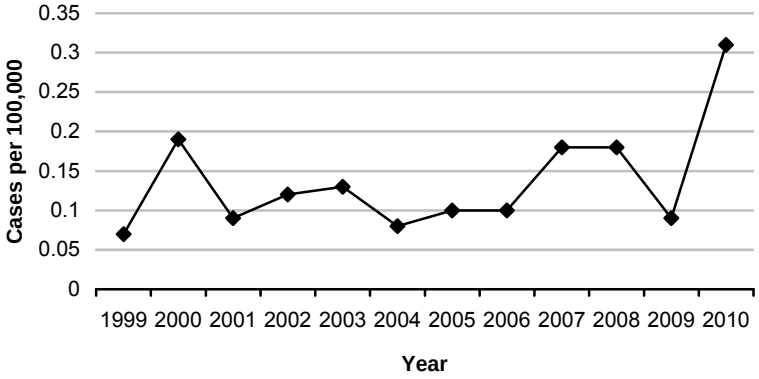
- Total cases of murine typhus increased by over 240% from 9 cases in 2009 to 31 cases in 2010 (Figure 1). LAC has not recorded this many cases in decades.
- In 2010, the incidence of typhus was highest in SPA 5 at 0.9 per 100,000 and cases were distributed in many areas of LAC not historically endemic for typhus. This is indicative of geographical spread of typhus in several locations in southern California.
- The increase in cases may be due to a number of factors including the relocation of host animals (possums and feral cats) to regions not previously enzootic for typhus; changes in weather that favor flea survival; and increased testing and reporting due to better educated physicians.

Reported Typhus Fever Cases and Rates* per 100,000 by Age Group, Race/Ethnicity, and SPA
Los Angeles County, 2006-2010

	2006 (N=10)			2007 (N=17)			2008 (N=18)			2009 (N=9)			2010 (N=31)		
	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000
Age Group															
<1	0	0.0		0	0.0		0	0.0		0	0.0		0	0.0	0.0
1-4	0	0.0		1	5.9		0	0.0		0	0.0		0	0.0	0.0
5-14	1	10.0		1	5.9		3	16.7		2	22.2		3	9.7	0.2
15-34	1	10.0		3	17.6		3	16.7		1	11.1		4	12.9	0.1
35-44	5	50.0		3	17.6		4	22.2		0	0.0		7	22.6	0.5
45-54	0	0.0		6	35.3		4	22.2		4	44.4		5	16.1	0.4
55-64	1	10.0		2	11.8		3	16.7		2	22.2		10	32.3	1
65+	2	20.0		1	5.9		1	5.6		0	0.0		2	6.5	0.2
Unknown	0	0.0		0	0.0		0	0.0		0	0.0		0	0.0	
Race/Ethnicity															
Asian	1	10.0		1	5.9		1	5.6		1	11.1		2	6.5	0.1
Black	0	0.0		0	0.0		0	0.0		0	0.0		2	6.5	0.2
Hispanic	3	30.0		1	5.9		5	27.8		1	11.1		10	32.3	0.2
White	6	60.0		13	76.5		12	66.7		7	77.8		14	45.2	0.5
Other	0	0.0		0	0.0		0	0.0		0	0.0		0	0.0	0.0
Unknown	0	0.0		2	11.8		0	0.0		0	0.0		3	9.7	
SPA															
1	0	0.0		0	0.0		0	0.0		0	0.0		0	0.0	0.0
2	3	30.0		2	11.8		2	11.1		1	11.1		5	16.1	0.2
3	3	30.0		8	47.1		9	50.0		5	55.6		9	29.0	0.5
4	1	10.0		1	5.9		1	5.6		3	33.3		5	16.1	0.4
5	1	10.0		4	23.5		3	16.7		0	0.0		6	19.4	0.9
6	1	10.0		0	0.0		1	5.6		0	0.0		4	12.9	0.4
7	1	10.0		1	5.9		2	11.1		0	0.0		0	0.0	0.0
8	0	0.0		1	5.9		0	0.0		0	0.0		2	6.5	0.2
Unknown	0	0.0		0	0.0		0	0.0		0	0.0		0	0.0	

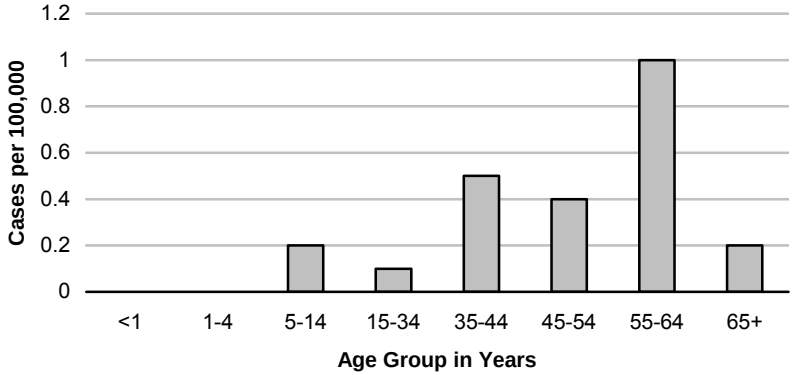
*Rates calculated based on less than 19 cases or events are considered unreliable.

Figure 1. Incidence Rates* of Typhus Fever
LAC, 1999-2010



*Rates calculated based on less than 19 cases or events are considered unreliable.

Figure 2. Incidence Rates* of Typhus Fever by Age Group
LAC, 2010 (N=31)



*Rates calculated based on less than 19 cases or events are considered unreliable.

Figure 3. Percent Cases of Typhus Fever by Race/Ethnicity
LAC, 2010 (N=31)

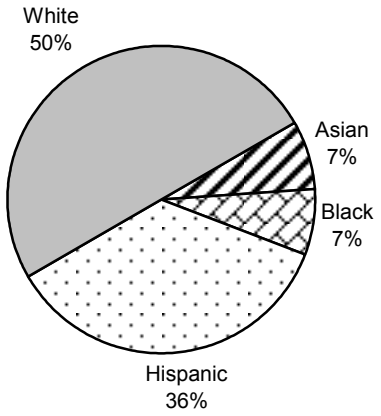
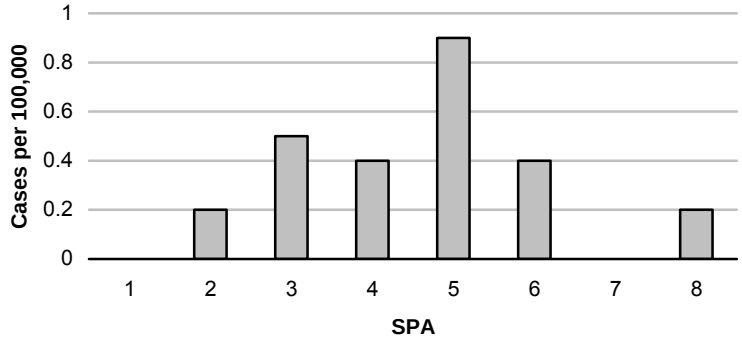


Figure 4. Incidence Rates* of Typhus Fever by SPA
LAC, 2010 (N=31)



*Rates calculated based on less than 19 cases or events are considered unreliable.

Figure 5. Reported Typhus Fever Cases by Month of Onset
LAC, 2010 (N=31)

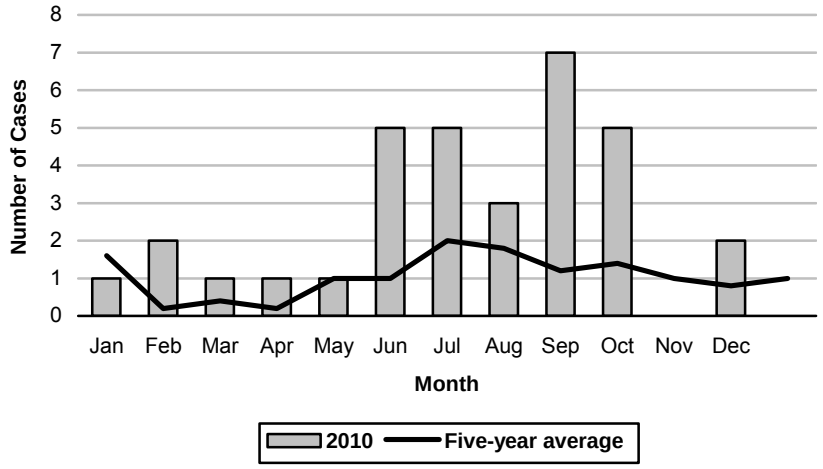
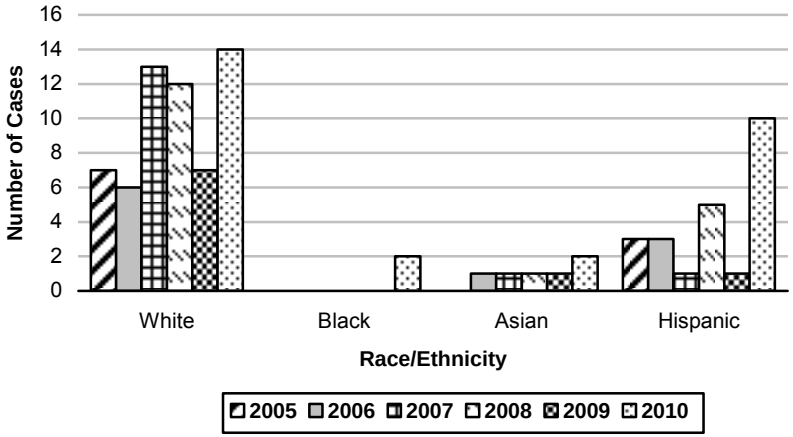


Figure 6. Reported Typhus Fever Cases by Race/Ethnicity
LAC, 2005-2010



TYPHUS FEVER

CRUDE DATA	
Number of Cases	9
Annual Incidence[a]	
LA County[b]	0.09
California	N/A
United States	N/A
Age at Diagnosis	
Mean	39.8
Median	46
Range	9-60

[a]Cases per 100,000 population.
[b]Rates calculated based on less than 19 cases or events are considered unreliable.

DESCRIPTION

Typhus fever (murine typhus, endemic typhus) is caused by the bacteria *Rickettsia typhi* and *R. felis* and is transmitted through the bite or contact with feces of an infected flea. Reservoir animals are predominantly rats and opossums that live in areas with heavy foliage. In Los Angeles County (LAC), most reported cases of typhus occur in residents of the foothills of central LAC. Symptoms include fever, severe headache, chills, and myalgia. A fine, macular rash may appear three to five days after onset. Occasionally, complications such as pneumonia or hepatitis may occur. Fatalities are uncommon, occurring in less than 1% of cases, but increase with age. The disease is typically mild in young children. Typhus infection is not vaccine preventable, but can be treated with antibiotics.

Because typhus fever is not a nationally reportable disease, there is no standard case definition across county and state jurisdictions. In Southern California, a workgroup has developed a standard case definition because of expansion of the agent into new regions, including Long Beach and Orange County. For the purpose of surveillance in LAC, cases have been confirmed with a single high IgM titer and appropriate symptoms and exposure history.

Typhus infection can be prevented through flea control measures implemented on pets. Foliage in the yard should be trimmed so that it does not provide harborage for small mammals. Screens can be placed on windows and crawl spaces to prevent entry of animals and their fleas into the house.

2009 TRENDS AND HIGHLIGHTS

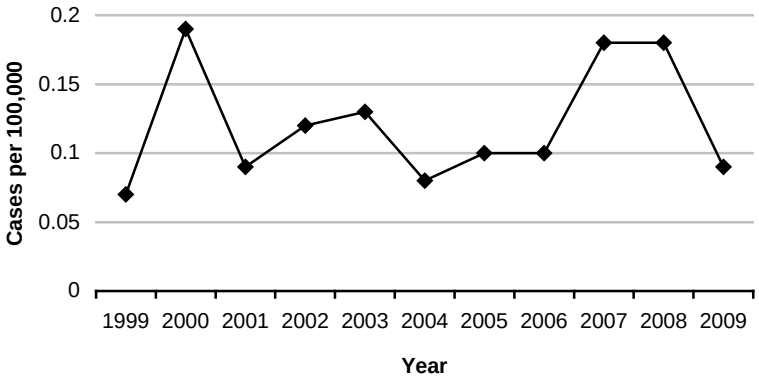
- Total cases of murine typhus declined by 50% in 2009 from 18 cases in 2008 to 9 cases in 2009. This is similar to case reports seen in the years prior to 2006.
- In 2009, the occurrence of typhus in LAC has been limited to its historically endemic areas around north central LAC and central Los Angeles.

Reported Typhus Fever Cases and Rates* per 100,000 by Age Group, Race/Ethnicity, and SPA
Los Angeles County, 2005-2009

	2005 (N=10)			2006 (N=10)			2007 (N=17)			2008 (N=18)			2009 (N=9)		
	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000
Age Group															
<1	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0	0
1-4	0	0.0	0.0	0	0.0	0.0	1	5.9	0.2	0	0.0	0.0	0	0	0
5-14	3	30.0	0.2	1	10.0	0.1	1	5.9	0.1	3	16.7	0.2	2	22.2	0.1
15-34	6	60.0	0.2	1	10.0	0.0	3	17.6	0.1	3	16.7	0.1	1	11.1	0
35-44	0	0.0	0.0	5	50.0	0.3	3	17.6	0.2	4	22.2	0.3	0	0	0
45-54	0	0.0	0.0	0	0.0	0.0	6	35.3	0.5	4	22.2	0.3	4	44.4	0.3
55-64	0	0.0	0.0	1	10.0	0.1	2	11.8	0.2	3	16.7	0.3	2	22.2	0.2
65+	0	0.0	0.0	2	20.0	0.2	1	5.9	0.1	1	5.6	0.1	0	0	0
Unknown	1	10.0		0	0.0		0	0.0		0	0.0		0	0	
Race / Ethnicity															
Asian	0	0.0	0.0	1	10.0	0.1	1	5.9	0.1	1	5.6	0.1	1	11.1	0.1
Black	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0	0
Hispanic	3	30.0	0.1	3	30.0	0.1	1	5.9	0.0	5	27.8	0.1	1	11.1	0
White	7	70.0	0.2	6	60.0	0.2	13	76.5	0.4	12	66.7	0.4	7	77.8	0.2
Other	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0	0
Unknown	0	0.0		0	0.0		2	11.8		0	0.0		0	0	
SPA															
1	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0	0
2	1	10.0	0.0	3	30.0	0.1	2	11.8	0.1	2	11.1	0.1	1	11.1	0
3	6	60.0	0.4	3	30.0	0.2	8	47.1	0.5	9	50.0	0.5	5	55.6	0.3
4	3	30.0	0.2	1	10.0	0.1	1	5.9	0.1	1	5.6	0.1	3	33.3	0.2
5	0	0.0	0.0	1	10.0	0.2	4	23.5	0.6	3	16.7	0.5	0	0	0
6	0	0.0	0.0	1	10.0	0.1	0	0.0	0.0	1	5.6	0.1	0	0	0
7	0	0.0	0.0	1	10.0	0.1	1	5.9	0.1	2	11.1	0.1	0	0	0
8	0	0.0	0.0	0	0.0	0.0	1	5.9	0.1	0	0.0	0.0	0	0	0
Unknown	0	0.0		0	0.0		0	0.0		0	0.0		0	0	

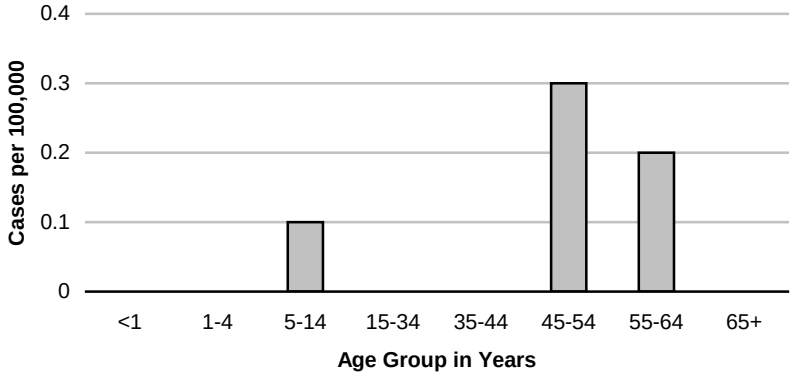
*Rates calculated based on less than 19 cases or events are considered unreliable.

Figure 1. Incidence Rates* of Typhus Fever
LAC, 1999-2009 (N=9)



*Rates calculated based on less than 19 cases or events are considered unreliable.

Figure 2. Incidence Rates* of Typhus Fever by Age Group
LAC, 2009 (N=9)



*Rates calculated based on less than 19 cases or events are considered unreliable.

Figure 3. Percent Cases of Typhus Fever by Race/Ethnicity
LAC, 2009 (N=9)

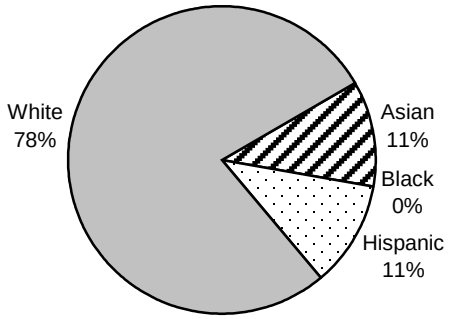
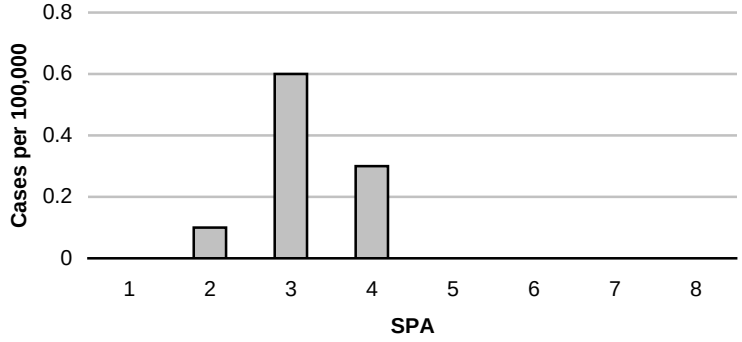


Figure 4. Incidence Rates* of Typhus Fever by SPA
LAC, 2009 (N=9)



*Rates calculated based on less than 19 cases or events are considered unreliable.

Figure 5. Reported Typhus Fever Cases by Month of Onset
LAC, 2009 (N=9)

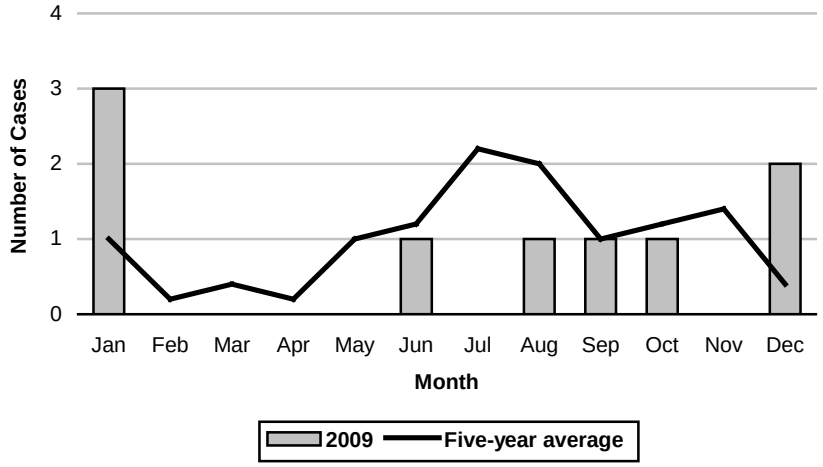
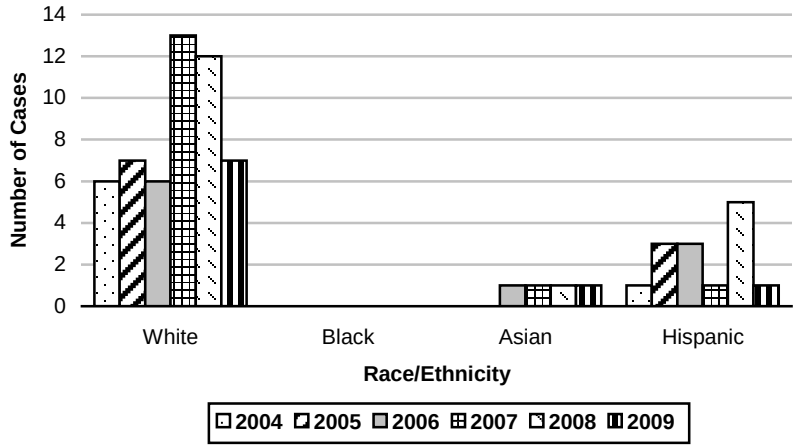


Figure 6. Reported Typhus Fever Cases by Race/Ethnicity
LAC, 2004-2009



TYPHUS FEVER

CRUDE DATA	
Number of Cases	18
Annual Incidence[a]	
LA County[b]	0.18
California	N/A
United States	N/A
Age at Diagnosis	
Mean	39.3
Median	39
Range	7-65

[a]Cases per 100,000 population.
[b]Rates calculated based on less than 19 cases or events are considered unreliable.

DESCRIPTION

Typhus fever (murine typhus, endemic typhus) is caused by the bacteria *Rickettsia typhi* and *R. felis* and is transmitted through the bite or contact with feces of an infected flea. Reservoir animals are predominantly rats and opossums that live in areas with heavy foliage. In Los Angeles County (LAC), most reported cases of typhus occur in residents of the foothills of central LAC. Symptoms include fever, severe headache, chills, and myalgia. A fine, macular rash may appear three to five days after onset. Occasionally, complications such as pneumonia or hepatitis may occur. Fatalities are uncommon, occurring in less than 1% of cases, but increase with age. The disease is typically mild in young children. Typhus infection is not vaccine preventable, but can be treated with antibiotics.

Because typhus fever is not a nationally reportable disease, there is no standard case definition across county and state jurisdictions. In Southern California, a workgroup has developed a standard case definition because of expansion of the agent into new regions, including Long Beach and Orange County. For the purpose of surveillance in LAC, cases have been confirmed with a single high IgM titer and appropriate symptoms and exposure history.

Typhus infection can be prevented through flea control measures implemented on pets. Foliage in the yard should be trimmed so that it does not provide harborage for small mammals. Screens can be placed on windows and crawl spaces to prevent entry of animals into the house.

2008 TRENDS AND HIGHLIGHTS

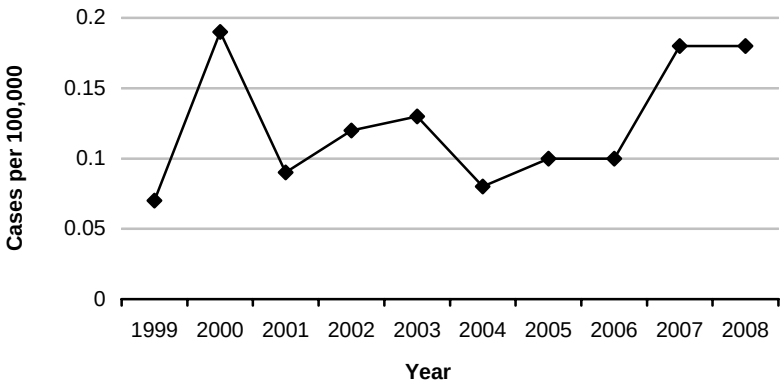
- Both the incidence (0.18 per 100,000) (Figure 1) and number of reported cases (n=18) continue to be about twice as high as the several years prior to 2006.
- Typhus has spread out from its historically endemic areas within the Service Planning Area (SPA) 3-San Gabriel Valley and north central LAC, and is now commonly reported among residents in the west LAC (SPA 5), particularly Venice and Santa Monica.

Reported Typhus Fever Cases and Rates* per 100,000 by Age Group, Race/Ethnicity, and SPA
Los Angeles County, 2004-2008

	2004 (N=8)			2005 (N=10)			2006 (N=10)			2007 (N=17)			2008 (N=18)		
	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000
Age Group															
<1	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
1-4	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	1	5.9	0.2	0	0.0	0.0
5-14	0	0.0	0.0	3	30.0	0.2	1	10.0	0.1	1	5.9	0.1	3	16.7	0.2
15-34	4	50.0	0.1	6	60.0	0.2	1	10.0	0.0	3	17.6	0.1	3	16.7	0.1
35-44	0	0.0	0.0	0	0.0	0.0	5	50.0	0.3	3	17.6	0.2	4	22.2	0.3
45-54	2	25.0	0.2	0	0.0	0.0	0	0.0	0.0	6	35.3	0.5	4	22.2	0.3
55-64	1	12.5	0.1	0	0.0	0.0	1	10.0	0.1	2	11.8	0.2	3	16.7	0.3
65+	0	0.0	0.0	0	0.0	0.0	2	20.0	0.2	1	5.9	0.1	1	5.6	0.1
Unknown	1	12.5		1	10.0		0	0.0		0	0.0		0	0.0	
Race / Ethnicity															
Asian	0	0.0	0.0	0	0.0	0.0	1	10.0	0.1	1	5.9	0.1	1	5.6	0.1
Black	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
Hispanic	1	12.5	0.0	3	30.0	0.1	3	30.0	0.1	1	5.9	0.0	5	27.8	0.1
White	6	75.0	0.2	7	70.0	0.2	6	60.0	0.2	13	76.5	0.4	12	66.7	0.4
Other	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
Unknown	1	12.5		0	0.0		0	0.0		2	11.8		0	0.0	
SPA															
1	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
2	0	0.0	0.0	1	10.0	0.0	3	30.0	0.1	2	11.8	0.1	2	11.1	0.1
3	3	37.5	0.2	6	60.0	0.4	3	30.0	0.2	8	47.1	0.5	9	50.0	0.5
4	4	50.0	0.3	3	30.0	0.2	1	10.0	0.1	1	5.9	0.1	1	5.6	0.1
5	0	0.0	0.0	0	0.0	0.0	1	10.0	0.2	4	23.5	0.6	3	16.7	0.5
6	0	0.0	0.0	0	0.0	0.0	1	10.0	0.1	0	0.0	0.0	1	5.6	0.1
7	0	0.0	0.0	0	0.0	0.0	1	10.0	0.1	1	5.9	0.1	2	11.1	0.1
8	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	1	5.9	0.1	0	0.0	0.0
Unknown	1	12.5		0	0.0		0	0.0		0	0.0		0	0.0	

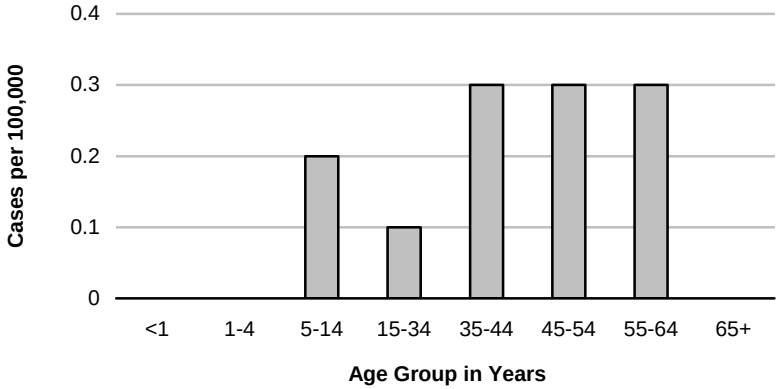
*Rates calculated based on less than 19 cases or events are considered unreliable.

**Figure 1. Incidence Rates* of Typhus Fever
LAC, 1999-2008**



*Rates calculated based on less than 19 cases or events are considered unreliable.

**Figure 2. Incidence Rates* of Typhus Fever by Age Group
LAC, 2008**



*Rates calculated based on less than 19 cases or events are considered unreliable.

**Figure 3. Percent Cases of Typhus Fever by Race/Ethnicity
LAC, 2008**

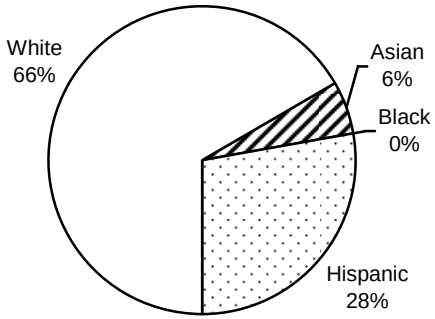
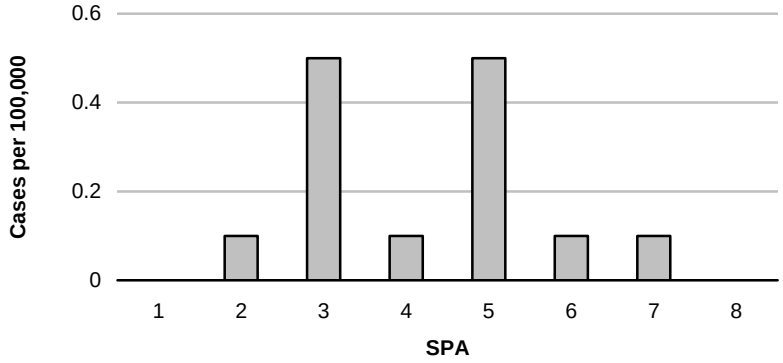


**Figure 4. Incidence Rates* of Typhus Fever by SPA
LAC, 2008**



*
Rates calculated based on less than 19 cases or events are considered unreliable.

Figure 5. Reported Typhus Fever Cases by Month of Onset
LAC, 2008

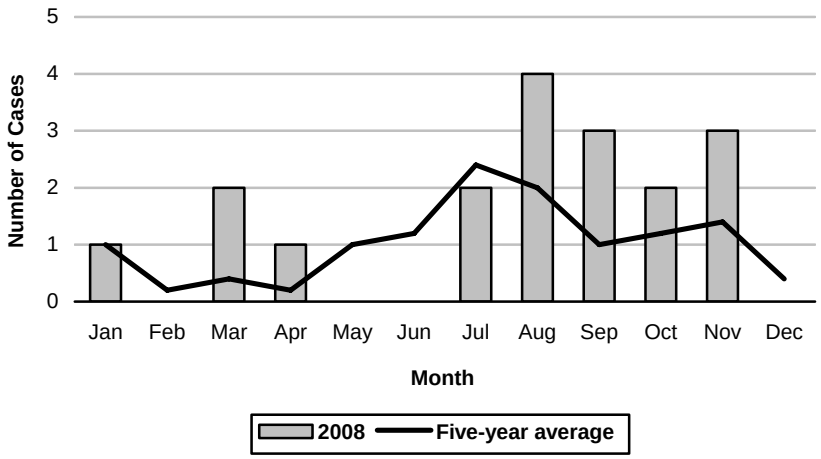
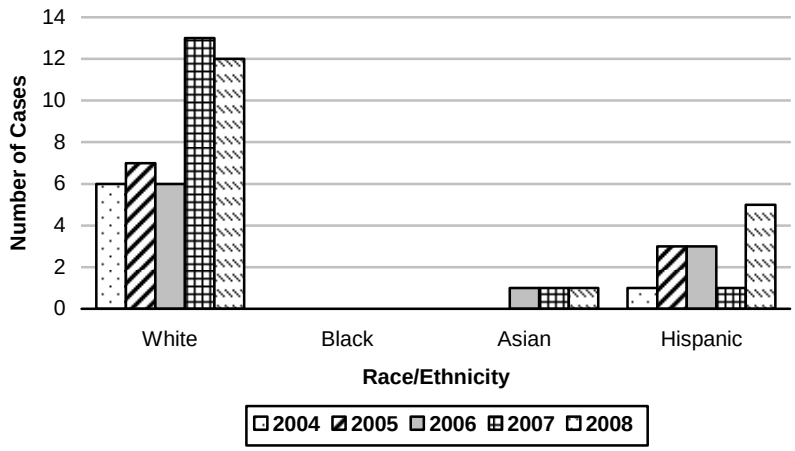


Figure 6. Reported Typhus Fever Cases by Race/Ethnicity
LAC, 2004-2008

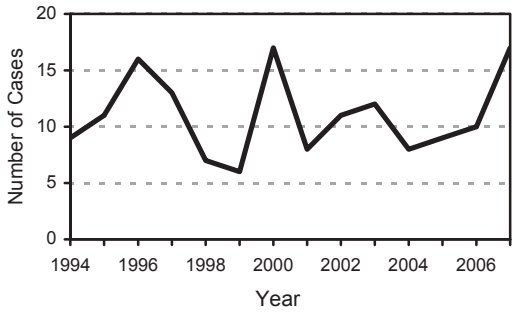


TYPHUS FEVER

CRUDE DATA	
Number of Cases	17
Annual Incidence[a]	
LA County	0.18[b]
United States	N/A
Age at Onset	
Mean	39
Median	46
Range	4–65 years

[a] Cases per 100,000 population.
[b] Rates based on less than 20 observations are unreliable.

Figure 1
Murine Typhus
Cases by Year of Onset
LAC, 1994–2007



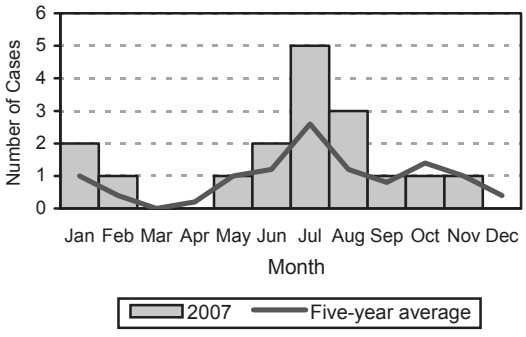
DESCRIPTION

Typhus fever (murine typhus, endemic typhus) is caused by the bacteria, *Rickettsia typhi* and *R. felis*, and transmitted through the bite or contact with feces of an infected flea. Reservoir animals are predominantly rats and opossums that live in areas with heavy foliage. In Los Angeles County (LAC), most reported cases of typhus occur in residents of the foothills of central LAC. Symptoms include fever, severe headache, chills, and myalgia. A fine, macular rash may appear three to five days after onset. Occasionally, complications such as pneumonia or hepatitis may occur. Fatalities are uncommon, occurring in less than 1% of cases, but increases with age. The disease is typically mild in young children. Typhus infection is not vaccine preventable, but can be treated with antibiotics.

DISEASE ABSTRACT

- The number of cases reported in 2007 (n=17) is a 70% increase from 2006 and continues a rise since 2004.
- No outbreaks occurred. However, two cases were linked to visiting a park in San Marino.
- There continues to be increased reports of typhus in LAC Health Districts where typhus has not historically been often seen.

Figure 2
Murine Typhus
Cases by Month of Onset
LAC, 2007



STRATIFIED DATA

Trends: Seventeen cases were reported in 2007, a 70% increase from 2006 (n=10). This number is equivalent to the highest ever reported to LAC DPH when seventeen was also reported in 2000 (Figure 1).

Seasonality: In 2007, a substantial number of cases occurred in July and August (Figure 2). Typhus fever is a seasonal disease and most cases will be seen in the summer and fall. Seasonality is mostly likely related to chance exposure to fleas relating to time spent outdoors with animal reservoirs of infection and their infected fleas.

Age: In 2007, the mean and median ages were 39 and 46 years, respectively. Ages of cases ranged from 4 to 65 years; the largest number of cases occurred in those between 45 and 54 years old (n=6, 35%) (data not shown).

Sex: There were almost twice as many cases reported among females as males. The male-to-female case ratio was 1:1.8. In the past in LAC, gender had been distributed evenly.

Race/Ethnicity: Most cases were of white race/ethnicity (n=12, 71%). One case each (6%) occurred in a Hispanic and an Asian (data not shown). Two cases (12%) had unknown race/ethnicity information.

Location: More than half of the cases (n=11, 65%) were residents of, or reported substantial recreational activity in, health districts around the foothills of central LAC or in the metropolitan area, localities which have historically been endemic for typhus fever. Mammalian reservoirs such as rats, opossum, and cats from these areas have been serologically positive for *R. typhus* and *R. felis*. The remaining six cases resided in the West (n=4, 24%), Torrance (n=1, 6%), and Bellflower (n=1, 6%) health districts, and did not report any activity in the endemic localities.

Transmission and Risk Factors: Human infection most commonly occurs by introduction of infectious flea fecal matter into the bite site or into adjacent areas that have been abraded by scratching. Almost half of the cases in 2007(n=8, 47%) reported an exposure to fleas or flea bites within the 2 weeks prior to onset of illness. Of the cases that were not exposed to fleas, almost all reported keeping pets or observing other types of small mammals (e.g., rats, opossums) on their residential property, and thus may have had exposure to animals that carry fleas. The single case that denied having pets or seeing animals around his residence resided near Griffith Park and had substantial foliage around his home.

COMMENTS

The rise in confirmed cases in 2007 continues an increase seen since 2004. No outbreaks occurred; however, a cluster of two cases were reported with onset in July and was linked to visiting a park in San Marino. The occurrence of typhus in localities where typhus is not usually seen (e.g., West and Bellflower Health Districts) also substantially contribute to the number seen this year. Results from a CDPH/CDC study of fleas collected from opossums from the Long Beach/Orange County outbreak in 2006 indicate that *R. felis* may be the main infectious agent in those jurisdictions. It is possible that *R. felis* is a main infectious agent in adjacent LAC areas as well. On the other hand, the increase in reporting and confirmation may reflect increased awareness of endemic typhus due to media attention and alerts issued by these health departments.

When a diagnosis of typhus fever is confirmed by serology, each case is interviewed regarding potential exposures. If possible, field studies of the property where exposure occurred and surrounding areas in the neighborhood are conducted by an environmental health specialist. In addition, local residents are contacted and provided with education about typhus and prevention of the disease by controlling fleas and eliminating harborage for potentially typhus-infected animals that carry fleas.

The nonspecific clinical presentation and the lack of a definitive test during the acute phase of the illness make the early diagnosis of typhus fever difficult. Thus, diagnosis of typhus fever depends on the clinical acumen of the treating physician and often requires acute and convalescent serology, and so is frequently confirmed after the patient has recovered. Reporting of typhus or suspect typhus cases can help identify areas in LAC that may require monitoring for the presence of disease in the animal populations and the institution of control measures.

PREVENTION

Typhus infection can be prevented through flea control measures implemented on pets. Foliage in the yard should be trimmed so that it does not provide harborage for small mammals. Screens can be placed on windows and crawl spaces to prevent entry of animals into the house.

ADDITIONAL RESOURCES

General information about typhus fever is available from the ACDC website at:
http://www.lapublichealth.org/acd/vectormurine.htm

Publications:

Azad, A.F., Radulovic, S., Higgins, J.A., Noden, B.H. & Troyer, J.M. (2007). Flea-borne rickettsioses: ecologic considerations. *Emerging Infectious Diseases*, 3(3), 319–327.

Civen, R. & Ngo, V. (2008). Murine typhus: an unrecognized suburban vector-borne disease. *Clinical Infectious Diseases*, 46, 913-918.

Sorvillo, F.J., Gondo, B., Emmons, R., Ryan, P., Waterman, S.H., Tilzer, A., et al. (1993). A suburban focus of endemic typhus in Los Angeles County: association with seropositive domestic cats and opossums. *American Journal of Tropical Medicine and Hygiene*, 48(2), 269–273.

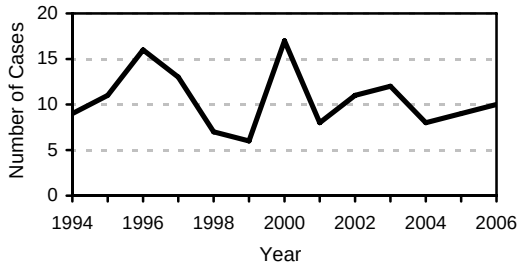
Williams, S.G., Sacci, J.B., Schriefer, M.E., Andersen, E.M., Fujioka, K.K., Sorvillo, F.J., et al. (1992). Typhus and typhuslike rickettsiae associated with opossums and their fleas in Los Angeles County, California. *Journal of Clinical Microbiology*, 30(7), 1758–1762.

TYPHUS FEVER

CRUDE DATA	
Number of Cases	10
Annual Incidence[a]	
LA County	0.09[b]
United States	N/A
Age at Onset	
Mean	43
Median	40.5
Range	13–73 years

[a] Cases per 100,000 population.
[b] Rates based on less than 20 observations are unreliable.

Figure 1
Murine Typhus
Cases by Year of Onset
LAC, 1994–2006



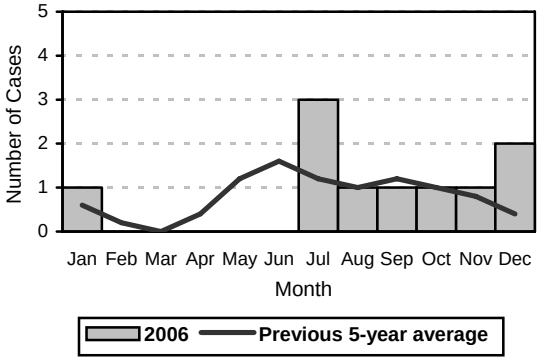
DESCRIPTION

Typhus fever (murine typhus, endemic typhus) is caused by the bacteria, *Rickettsia typhi* and *R. felis*, and transmitted through the bite or contact with feces of an infected flea. Reservoir animals are predominantly rats and opossums that live in areas with heavy foliage. In Los Angeles County (LAC), most reported cases of typhus occur in residents of the foothills of central LAC. Symptoms include fever, severe headache, chills, and myalgia. A fine, macular rash may appear three to five days after onset. Occasionally, complications such as pneumonia or hepatitis may occur. Fatalities are uncommon, occurring in less than 1% of cases, but increases with age. The disease is typically mild in young children. Typhus infection is not vaccine preventable, but can be treated with antibiotics.

DISEASE ABSTRACT

- The number of cases reported in 2006 (n=10) falls within range of the number reported annually in previous years. No outbreaks occurred.
- Increased reports of typhus in unusual localities as well as those occurring in the Long Beach and Orange County jurisdictions indicate the endemic areas of typhus may be shifting.

Figure 2
Murine Typhus
Cases by Month of Onset
LAC, 2006



STRATIFIED DATA

Trends: The number of cases reported in 2006 (n=10) increased in compared to the 9 cases reported in 2005. However, the number of 2006 case report fall within the range of 8–12 cases reported annually in the previous five years (Figure 2).

Seasonality: Typhus fever is a seasonal disease and most cases will be seen in the summer and fall. Seasonality is mostly likely related to chance exposure to fleas relating to time spent outdoors with animal reservoirs of infection and their infected fleas. In 2006, most cases occurred during these times of the

year; however, cases were also uncharacteristically reported throughout the fall and into December (Figure 2).

Age: In 2006, the mean and median ages were 43 and 40.5 years, respectively. Ages of cases ranged from 13 to 73 years; most cases occurred in those under 65 years (n=8, 80%) (data not shown).

Sex: There were at least twice as many cases reported in males as females. The male-to-female case ratio was 2.3:1. The gender distribution in previous years has been roughly equivalent.

Race/Ethnicity: Most cases were of white race/ethnicity (n=6, 60%). Three cases (30%) occurred in Latinos and one (10%) in an Asian (data not shown).

Location: Most cases (n=7, 70%) were residents of, or reported substantial recreational activity in, health districts around the foothills of central LAC or in the metropolitan area, localities which have historically been endemic for typhus fever. Mammalian reservoirs such as rats, opossum, and cats from these areas have been serologically positive for *R. typhus and R. felis*. The remaining three cases (30%) resided in the West, West Valley, and Bellflower health districts, and did not report any activity in the endemic localities.

Transmission and Risk Factors: Human infection most commonly occurs by introduction of infectious flea fecal matter into the bite site or into adjacent areas that have been abraded by scratching. Only 30% of the cases in 2006 (n=3) reported an exposure to fleas or flea bites within the 2 weeks prior to onset of illness. Of the cases that were not exposed to fleas, almost all reported observing other types of small mammals (e.g., rats, opossums, dogs and cats) on their residential property, and thus may have had exposure to animals that carry fleas. One case worked as a parking attendant in the downtown LA area and reported no exposure to animals or activity in the foothills of central LAC. Typhus infection cannot be transmitted from person to person.

PREVENTION

Typhus infection can be prevented through flea control measures implemented on pets. Foliage in the yard should be trimmed so that it does not provide harborage for small mammals. Screens can be placed on windows and crawl spaces to prevent entry of animals into the house.

COMMENTS

Though the number of typhus fever cases confirmed in LAC in 2006 has not changed remarkably relative to previous years, the higher proportion of cases appearing in health districts in which typhus is not usually seen has shown that the endemic areas of typhus may be shifting. In addition to cases reported in unusual locations within the county, the public health departments of Long Beach and Orange County have also confirmed cases in their jurisdictions during the latter part of 2006, either for the very first time or the first in many years. However, the increase in reporting and confirmation may reflect increased awareness of endemic typhus due to media attention and alerts issued by these health departments.

When a diagnosis of typhus fever is confirmed by serology, each case is interviewed regarding potential exposures. If possible, field studies of the property where exposure occurred and surrounding areas in the neighborhood are conducted by an environmental health specialist. In addition, local residents are contacted and provided with education about typhus and prevention of the disease by controlling fleas and eliminating harborage for potentially typhus-infected animals that carry fleas.

The nonspecific clinical presentation and the lack of a definitive test during the acute phase of the illness make the early diagnosis of typhus fever difficult. Thus, diagnosis of typhus fever depends on the clinical acumen of the treating physician and often requires acute and convalescent serology, and so is frequently confirmed after the patient has recovered. Reporting of typhus or suspect typhus cases can help identify areas in LAC that may require monitoring for the presence of disease in the animal populations and the institution of control measures.

ADDITIONAL RESOURCES

General information about typhus fever is available from the ACDC website at:
www.lapublichealth.org/acd/vectormurine.htm

Publications:

Azad AF, Radulovic S, Higgins JA, Noden BH, Troyer JM. Flea-borne rickettsioses: ecologic considerations. Emerg Infect Dis 1997; 3(3):319–327.

Sorvillo FJ, Gondo B, Emmons R, et al. A suburban focus of endemic typhus in Los Angeles County: association with seropositive domestic cats and opossums. Am J Trop Med Hyg 1993; 48(2):269–273.

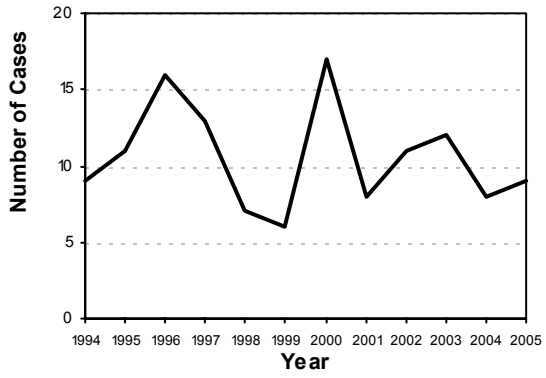
Williams SG, Sacci JB, Schriefer ME, et al. Typhus and typhuslike rickettsiae associated with opossums and their fleas in Los Angeles County, California. J Clin Microbiol 1992; 30(7):1758–1762.

TYPHUS, MURINE

CRUDE DATA	
Number of Cases	9
Annual Incidence[a]	
LA County	0.09[b]
United States	N/A
Age at Diagnosis	
Mean	46
Median	49
Range	10–65 years
Case Fatality	
LA County	0.0%
United States	N/A

[a] Cases per 100,000 population.
[b] Rates based on less than 20 observations are unreliable.

Figure 1
Murine Typhus
Cases by Year of Onset
LAC, 1994–2005



DESCRIPTION

Typhus refers to a group of infectious diseases that are caused by rickettsial organisms and result in an acute febrile illness; arthropod vectors transmit the etiologic agents to humans. The principle diseases of this group are epidemic (or louse-borne) typhus, murine (or endemic) typhus, and scrub typhus. Murine typhus is the only one of these diseases naturally occurring in LAC and is caused by two bacteria *Rickettsia typhi* and *R. felis*; both are transmitted through the bite or contact with feces of an infected flea. Reservoir animals are predominantly rats and opossums that live in areas with heavy foliage. In LAC, most reported cases of typhus occur in residents of the foothills of central LAC. Symptoms include fever, severe headache, chills, and myalgia. A fine, macular rash may appear three to five days after onset. Occasionally, complications such as pneumonia or hepatitis may occur. Fatalities are uncommon, occurring in less than 1% of cases. The disease is typically mild in young children. Typhus infection is not vaccine preventable, but can be treated with antibiotics.

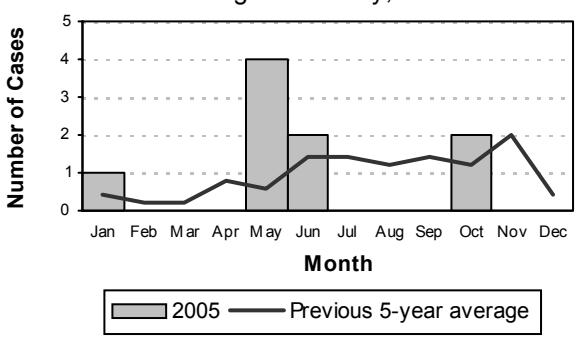
DISEASE ABSTRACT

- An outbreak of four cases, two confirmed and two probable, occurred during May in a South Pasadena neighborhood. All cases recovered with doxycycline treatment.
- Despite the occurrence of an outbreak, all trends and demographics remain similar to 2004.

STRATIFIED DATA

Trends: The number of cases reported in 2005 (N=9) is similar to that reported in 2004 (N=8). The majority of cases (n=6, 67%) occurred during the spring (May

Figure 2
Murine Typhus
Cases by Month of Onset
Los Angeles County, 2005



and June) (Figure 2).

Age: The mean and median ages of cases were higher in 2005 than in 2004. In 2005, the mean and median ages were 46 and 49 years, respectively. Ages ranged from 10 to 65 years. Most cases occurred among adults age 18 years and over (n=8, 89%).

Sex: The number of males and females were nearly equivalent. The male to female case ratio was 0.8:1.0.

Race/Ethnicity: Most cases were of White race/ethnicity (n=6, 67%). The remaining cases were Latino.

Location: Of the nine cases, four were residents of Alhambra, two from Hollywood-Wilshire, and one each from Central, Foothill and Glendale health districts, respectively. Typhus is endemic in the foothills of central LAC and rats, opossum, and cats from these areas have tested positive for typhus-group rickettsial antibodies.

Transmission and Risk Factors: Human infection most commonly occurs by introduction of infectious flea fecal matter into the bite site or into adjacent areas that have been abraded by scratching. Over half of the cases in 2005 (n=5, 56%) reported an exposure to fleas or flea bites within the 2-weeks prior to onset of illness. Of the cases that were not exposed to fleas, most reported observing other types of small mammals (e.g., rats, opossums, dogs and cats) on their residential property, and thus may have had exposure to fleas. Typhus infection cannot be transmitted from person to person.

PREVENTION

Typhus infection can be prevented through flea control measures implemented on pets. Foliage in the yard should be trimmed so that it does not provide harborage for small mammals. Screens can be placed on windows and crawl spaces to prevent entry of animals into the house.

COMMENTS

In May 2005, an outbreak of four cases involving residents within one street block in South Pasadena was investigated. Two cases were confirmed and two were probable; two additional suspects had compatible symptomatology but refused testing. Although smaller clusters of typhus cases in LAC have been reported in past years, this was the largest outbreak documented in LAC. The four confirmed and probable cases reported seeing opossums near their residence. Interestingly, the two confirmed cases required convalescent serology to make the diagnosis. When a diagnosis of typhus fever is suspected a convalescent serological test is recommended. However, most clinicians obtain only acute serology, which can be negative early in the infection. It is possible that many cases in LAC are missed in this manner. For further details of this outbreak, see the Special Studies Report section.

When a diagnosis of typhus fever is confirmed by serology, each case is interviewed regarding potential exposures. If possible, LACDHS an environmental health specialist conducts field studies of the property where exposure occurred and surrounding areas in the neighborhood. In addition, local residents are contacted and provided with education about typhus and prevention of the disease by controlling fleas and eliminating harborage for potentially typhus-infected animals that carry fleas.

The nonspecific clinical presentation and the lack of a definitive test during the acute phase of the illness make the early diagnosis of typhus fever difficult. Thus, diagnosis of typhus fever depends on the clinical acumen of the treating physician and often requires acute and convalescent serology, and so is frequently confirmed after the patient has recovered. Reporting of typhus or suspect typhus cases can help identify areas in LAC that may require monitoring for the presence of disease in the animal populations and the institution of control measures.

ADDITIONAL RESOURCES

General information about typhus fever is available from the ACDC website at:
www.lapublichealth.org/acd/vectormurine.htm

Publications:

Azad AF, Radulovic S, Higgins JA, Noden BH, and Troyer JM. Flea-borne rickettsioses: ecologic considerations. Emerg Infect Dis 1997;3:319–27.

Sorvillo FJ, Gondo B, Emmons R, Ryan P, Waterman SH, Tilzer A, Andersen EM, Murray RA, and Barr AR. A suburban focus of endemic typhus in LAC: association with seropositive domestic cats and opossums. Am J Trop Med Hyg 1993;48:269–73.

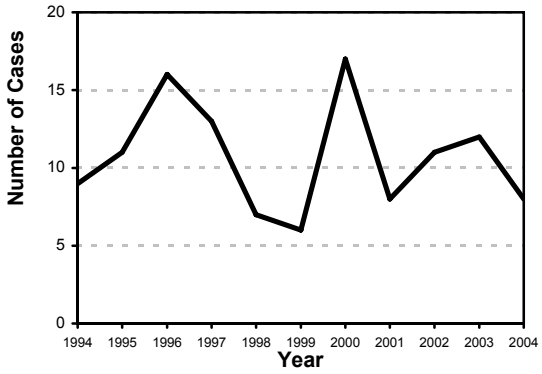
Williams SG, Sacci JB Jr, Schriefer ME, et al. Typhus and typhus-like rickettsiae associated with opossums and their fleas in Los Angeles County, California. J Clin Microbiol 1992;30:1758–62.

TYPHUS FEVER

CRUDE DATA	
Number of Cases	8
Annual Incidence[a]	
LA County	---[b]
United States	N/A
Age at Diagnosis	
Mean	36
Median	32
Range	19–60 years
Case Fatality	
LA County	0.0%
United States	N/A

[a] Cases per 100,000 population.
[b] Rates based on less than 20 observations are unreliable.

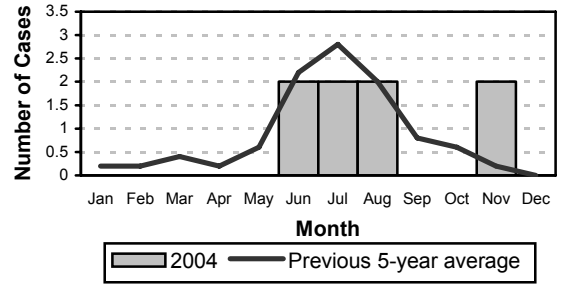
Figure 1
Murine Typhus
Cases by Year of Onset
LAC, 1994–2004



DESCRIPTION

Typhus fever (murine typhus, endemic typhus) is caused by bacteria, *Rickettsia typhi* and *R. felis*, and transmitted through the bite or contact with feces of an infected flea. Most reported cases of typhus reside in the foothills of central LAC. Reservoir animals are predominantly rats and opossums that live in areas with heavy foliage. Symptoms include fever, severe headache, chills, and myalgia. A fine, macular rash may appear three to five days after onset. Occasionally, complications such as pneumonia or hepatitis may occur. Fatalities are uncommon, occurring in less than 1% of cases. The disease is mild in young children. Typhus infection is not vaccine preventable, but can be treated with antibiotics.

Figure 2
Murine Typhus
Cases by Month of Onset
Los Angeles County, 2004



DISEASE ABSTRACT

- The majority of cases occurred in the summer. In 2004, six cases (75%) occurred during June, July, and August.
- Six cases were hospitalized (75%) and no fatalities occurred.
- There were 4 female cases and 4 male cases.
- Six cases were White and 2 cases were Hispanic.

STRATIFIED DATA

Location: Of the 8 cases, 2 were residents of Alhambra, 3 from Northeast, and one case from Central, Foothill and Southeast health districts, respectively. Typhus is endemic in the foothills of central LAC and rats, opossum, and cats from these areas have tested positive for typhus group *Rickettsia* antibodies. Cases were reported from the cities of Los Angeles, Pasadena, South Pasadena, and Temple City. The reasons for this localized endemic area are unclear.

Transmission and Risk Factors: Human infection most commonly occurs by introduction of infectious flea fecal matter into the bite site or into adjacent areas that have been abraded by scratching. Most cases observed small mammals (e.g., rats, opossums, dogs and cats) in their yards, and thus may have had exposure to animals that carry fleas. Typhus infection cannot be transmitted from person to person.

PREVENTION

Typhus infection can be prevented through flea control measures implemented on pets and in the yard. Foliage in the yard should be kept trim so that it does not provide harborage for small mammals. Screens can be placed on windows and crawl spaces to prevent entry of animals into the house.

COMMENTS

Each case of endemic typhus is carefully interviewed regarding potential exposures. If possible, field studies of the property where exposure occurred and surrounding areas in the neighborhood are conducted. In addition, local residents are contacted and provided with education about typhus and prevention of the disease by controlling fleas and eliminating harborage for potentially typhus-infected animals that carry fleas.

The nonspecific clinical presentation and the lack of a definitive test during the acute phase of the illness make the early diagnosis of endemic typhus difficult. Thus, diagnosis of endemic typhus depends on the clinical acumen of the treating physician, and is often confirmed after the patient has recovered. Accurate reporting of typhus or suspect typhus cases is important to identify endemic areas in LAC which can be monitored for the presence of disease in the animal populations and to institute control measures. Treatment with antibiotics hastens recovery and lessens the chance of complications.

ADDITIONAL RESOURCES

General information about murine typhus is available from the ACDC website at:
www.lapublichealth.org/acd/vectormurine.htm

Publications:

Azad AF, Radulovic S, Higgins JA, Noden BH, and Troyer JM. Flea-borne rickettsioses: ecologic considerations. Emerg Infect Dis 1997;3:319–27.

Sorvillo FJ, Gondo B, Emmons R, Ryan P, Waterman SH, Tilzer A, Andersen EM, Murray RA, and Barr AR. A suburban focus of endemic typhus in LAC: association with seropositive domestic cats and opossums. Am J Trop Med Hyg 1993;48:269–73.

Williams SG, Sacci JB Jr, Schriefer ME, et al. Typhus and typhuslike rickettsiae associated with opossums and their fleas in Los Angeles County, California. J Clin Microbiol 1992;30:1758–62.

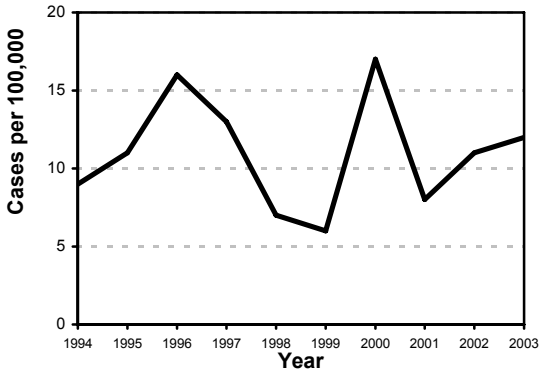
TYPHUS FEVER

CRUDE DATA	
Number of Cases	12
Annual Incidence[a]	
LA County	---[b]
United States	N/A
Age at Diagnosis	
Mean	42
Median	45
Range	16–60 years
Case Fatality	
LA County	0.0%
United States	N/A

[a] Cases per 100,000 population.

[b] Rates based on less than 20 observations are unreliable.

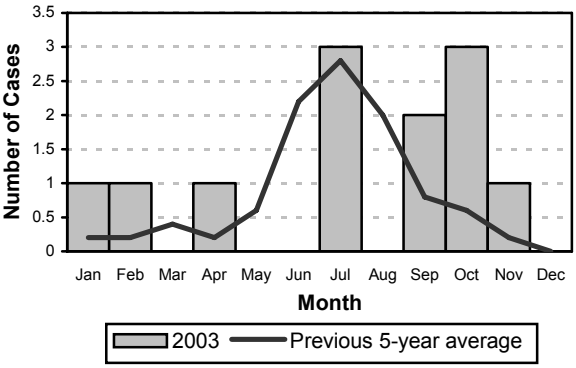
Figure 1
Murine Typhus
Cases by Year of Onset
LAC, 1994–2003



DESCRIPTION

Typhus fever (murine typhus, endemic typhus) is caused by bacteria, *Rickettsia typhi* and *R. felis*, and transmitted through the bite or contact with feces of an infected flea. Most reported cases of typhus reside in the foothills of central LAC. Reservoir animals are predominantly rats and other small mammals that live in areas with heavy foliage. Symptoms include fever, severe headache, chills, and myalgia. A fine, macular rash may appear three to five days after onset. Occasionally, complications such as pneumonia or hepatitis may occur. Fatalities are uncommon, occurring in less than 1% of cases. The disease is mild in young children. Typhus infection is not vaccine preventable, but can be treated with antibiotics.

Figure 2
Murine Typhus
Cases by Month of Onset
Los Angeles County, 2003



DISEASE ABSTRACT

- Cases occur more often in summer and fall. In 2003, the majority of cases (n=8, 67%) occurred during July, September and October.
- Nine cases (82%) were hospitalized—there were no fatalities.

STRATIFIED DATA

Location: Of the 12 cases, 4 were residents in Alhambra, 5 lived in Foothill, 2 in Glendale, and 1 in West Valley health district. Typhus is endemic in the foothills of central LAC and rats, opossum, and cats from these areas have tested positive for typhus group *Rickettsia* antibodies. The reasons for this localized endemic area are unclear.

Transmission and Risk Factors: Human infection most commonly occurs by introduction of infectious flea fecal matter into the bite site or into adjacent areas that have been abraded by scratching. Most cases observed small mammals (e.g., rats, opossums, dogs and cats) in their yards, and thus may have had exposure to animals that carry fleas. Typhus infection cannot be transmitted from person to person.

PREVENTION

Typhus infection can be prevented through flea control measures implemented on pets and in the yard. Foliage in the yard should be kept trim so that it does not provide harborage for small mammals. Screens can be placed on windows and crawl spaces to prevent entry of animals into the house.

COMMENTS

Each case of endemic typhus is carefully interviewed regarding potential exposures. If possible, field studies of the property where exposure occurred and surrounding areas in the neighborhood are conducted. In addition, local residents are contacted and provided with education about typhus and prevention of the disease by controlling fleas and eliminating harborage for potentially typhus-infected animals that carry fleas.

The nonspecific clinical presentation and the lack of a definitive test during the acute phase of the illness make the early diagnosis of endemic typhus difficult. Thus, diagnosis of endemic typhus depends on the clinical acumen of the treating physician, and is often confirmed after the patient has recovered. Accurate reporting of typhus or suspect typhus cases is important to identify endemic areas in LAC which can be monitored for the presence of disease in the animal populations and to institute control measures. Treatment with antibiotics hastens recovery and lessens the chance of complications.

ADDITIONAL RESOURCES

General information about murine typhus is available from the ACDC website at:
www.lapublichealth.org/acd/vectormurine.htm

Publications:

Azad AF, Radulovic S, Higgins JA, Noden BH and Troyer JM. Flea-borne rickettsioses: ecologic considerations. Emerg Infect Dis 1997;3:319–27.

Sorvillo FJ, Gondo B, Emmons R, Ryan P, Waterman SH, Tilzer A, Andersen EM, Murray RA, and Barr AR. A suburban focus of endemic typhus in LAC: association with seropositive domestic cats and opossums. Am J Trop Med Hyg 1993;48:269–73.

Williams SG, Sacci JB Jr, Schriefer ME, et al. Typhus and typhuslike rickettsiae associated with opossums and their fleas in Los Angeles County, California. J Clin Microbiol 1992;30:1758–62.

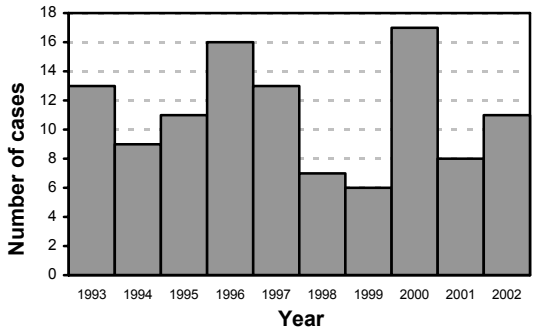
TYPHUS

CRUDE DATA	
Number of Cases	11
Annual Incidence[a]	
LA County	---[b]
United States	N/A
Age at Diagnosis	
Mean	31
Median	22
Range	10–60 years
Case Fatality	
LA County	0.0%
United States	N/A

[a] Cases per 100,000 population.

[b] Rates based on less than 20 observations are unreliable.

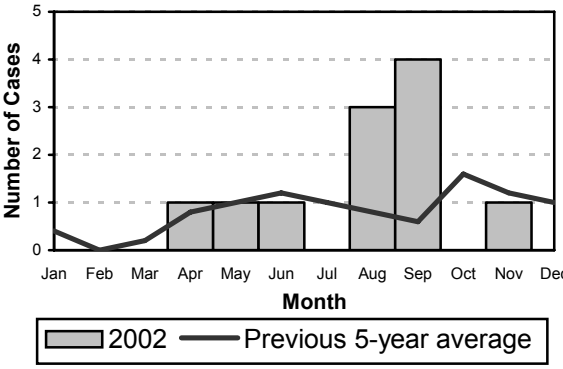
Figure 1
Murine Typhus
Cases by Year of Onset
LAC, 1994–2002



DESCRIPTION

Typhus (murine typhus, endemic typhus) is caused by bacteria, *Rickettsia typhi* and *R. felis*, and transmitted through the bite or contact with feces of an infected flea. Most reported cases of typhus reside in the foothills of central LAC. Reservoir animals are predominantly rats and other small mammals that live in areas with heavy foliage. Symptoms include fever, severe headache, chills, and myalgia. A fine, macular rash may appear three to five days after onset. Occasionally, complications such as pneumonia or hepatitis may occur. Fatalities are uncommon, occurring in less than 1% of cases. The disease is mild in young children. Typhus is not vaccine preventable, but can be treated with antibiotics.

Figure 2
Murine Typhus
Cases by Month of Onset
LAC, 2002



DISEASE ABSTRACT

- Cases occur more often in summer and fall. In 2002, over half of the cases (55%, n=6) occurred during August and September.
- Nine cases (82%) were hospitalized.
- There were 6 female cases and 5 male cases.
- Five cases were Latino, followed by Whites (n=4), and Blacks (n=2).

LOCATION

In 2002, four cases were residents in Alhambra, three lived in Central, and two in the San Antonio and one in South and Glendale health districts, respectively. Typhus is endemic in the foothills of central LAC. Cases are reported from Silver Lake, Echo Park, Eagle Rock, Glendale Hills, Pasadena and Altadena. Animals from these areas have tested positive for typhus group *Rickettsia*. The reasons for these localized endemic areas are unclear.

TRANSMISSION AND RISK FACTORS

Human infection most commonly occurs by introduction of infectious flea fecal matter into the bite site or into adjacent areas that have been abraded by scratching. Most cases observed small mammals (e.g., rats, opossums, dogs and cats) in their yards, and thus may have had exposure to animals that carry fleas. One case reported contact with an opossum. Typhus cannot be transmitted from person to person.

PREVENTION

Typhus infection can be prevented through flea control measures implemented on pets and in the yard. Foliage in the yard should be kept trim so that it does not provide harborage for small mammals. Screens can be placed on windows and crawl spaces to prevent entry of animals into the house.

COMMENTS

Each case of endemic typhus is carefully interviewed regarding potential exposures. If possible, field studies of the property where exposure occurred and surrounding areas in the neighborhood are conducted. Local residents are contacted and provided with education about typhus and prevention of the disease by controlling fleas and eliminating harborage for potentially typhus-infected animals that carry fleas.

The nonspecific clinical presentation and the lack of a definitive test during the acute phase of the illness make the early diagnosis of endemic typhus difficult. Thus, diagnosis of endemic typhus depends on the clinical acumen of the treating physician, and is often confirmed after the patient has recovered. Accurate reporting of typhus or suspect typhus cases is important to identify endemic areas in LAC which can be monitored for the presence of disease in the animal populations and to institute control measures. Treatment with antibiotics hastens recovery and lessens the chance of complications.

ADDITIONAL RESOURCES

General information about murine typhus is available from the ACDC website at:
www.lapublichealth.org/acd/vectormurine.htm

Publications:

Azad AF, Radulovic S, Higgins JA, Noden BH and Troyer JM. Flea-borne rickettsioses: Ecologic considerations. Emerg Infect Dis 1997; 3:319–27.

Sorvillo FJ, Gondo B, Emmons R, Ryan P, Waterman SH, Tilzer A, Andersen EM, Murray RA, and Barr AR. A suburban focus of endemic typhus in Los Angeles County: Association with seropositive domestic cats and opossums. Am J Trop Med Hyg 1993; 48:269–73.

Williams SG, Sacci JB Jr, Schriefer ME, et al. Typhus and typhuslike rickettsiae associated with opossums and their fleas in Los Angeles County, California. J Clin Microbiol 1992; 30:1758–62.

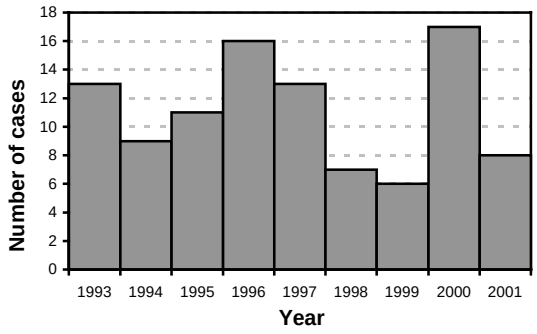
TYPHUS

CRUDE DATA	
Number of Cases	8
Annual Incidence[a]	
LA County	N/A[b]
United States	N/A
Age at Diagnosis	
Mean	42
Median	44
Range	6-73 years
Case Fatality	
LA County	0.0%
United States	N/A

[a] Cases per 100,000 population.

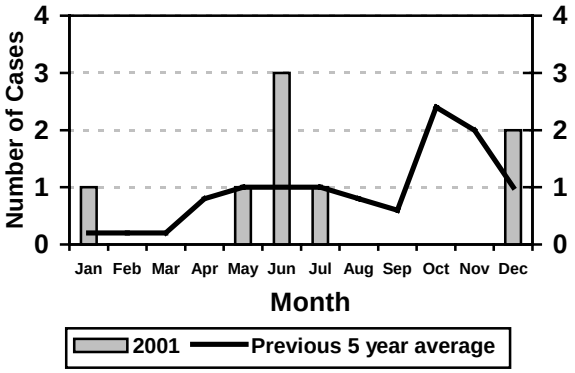
[b] Not calculated. Rates based on less than 20 observations are unreliable.

Figure 1
Murine Typhus
Cases by Year of Onset
LAC, 1993 - 2001*



*Data for 1992 not available.

Figure 2
Murine Typhus
Cases by Month of Onset
LAC, 2001



DESCRIPTION

Typhus (murine typhus, endemic typhus) is caused by the bacteria, *Rickettsia typhi* and *R. felis*. They are transmitted through the bite or contact with feces of an infected flea. Most reported cases of typhus live in the foothills of central LAC. Reservoir animals are predominantly rats and other small mammals that live in areas with heavy foliage. Symptoms include fever, severe headache, chills, and myalgia. A fine, macular rash may appear three to five days after onset. Occasionally, complications such as pneumonia or hepatitis may occur. Fatalities are uncommon, occurring in less than 1% of cases. The disease is mild in young children. Typhus is not vaccine preventable, but can be treated with antibiotics.

DISEASE ABSTRACT

- Cases occur more often in summer and fall. In 2001, four of eight reported cases occurred in June and July.
- Seventy-five percent of cases (6/8) were hospitalized.
- There were 4 male cases and 4 female cases.
- Whites led with 4 cases followed by Latinos with 3, there was 1 Asian case and one case of unknown race.

LOCATION

In 2001 four cases were residents in Alhambra, two lived in Central, and two resided in the Northeast health districts. Typhus is endemic in the foothills of central LAC. Cases have been reported from Silver Lake, Echo Park, Eagle Rock, Glendale Hills, Pasadena and Altadena. Animals from these areas have tested positive for typhus group *Rickettsia*. The reasons for this localized endemic area are unclear.

TRANSMISSION AND RISK FACTORS

Human infection most commonly occurs by introduction of infectious flea fecal matter into the bite site or into adjacent areas that have been abraded by scratching. Four of the six cases recalled being bitten by a flea and most did observe small mammals such as rats, opossums, dogs and cats in their yards, and thus had exposure to animals that carry fleas. One case reported contact with an opossum. Typhus cannot be transmitted from person to person.

COMMENTS

Each case of endemic typhus is carefully interviewed regarding potential exposures. If possible, field studies of the property where exposure occurred and surrounding areas in the neighborhood are conducted. Local residents are contacted and provided with education about typhus and prevention of the disease by controlling fleas and eliminating harborage for potentially typhus-infected animals that carry fleas.

The nonspecific clinical presentation and the lack of a definitive test during the acute phase of the illness make the early diagnosis of endemic typhus difficult. Thus, diagnosis of endemic typhus depends on the clinical acumen of the treating physician, and is often confirmed after the patient has recovered. Accurate reporting of typhus or suspect typhus cases is important to identify endemic areas in LAC which can be monitored for the presence of disease in the animal populations and to institute control measures. Treatment with antibiotics hastens recovery and lessens the chance of complications.

PREVENTION

Typhus infection can be prevented through flea control measures implemented on pets and around the yard. Foliage in the yard should be kept trim so that it does not provide harborage for small mammals. Screens can be placed on windows and crawl spaces to prevent entry of animals into the house.

ADDITIONAL RESOURCES

Azad AF, Radulovic S, Higgins JA, Noden BH and Troyer JM. Flea-borne rickettsioses: ecologic considerations. *Emerg Infect Dis* 1997;3:319-27.

Sorvillo FJ, Gondo B, Emmons R, et al. A suburban focus of endemic typhus in Los Angeles County: association with seropositive domestic cats and opossums. *Am J Trop Med Hyg* 1993;48:269-73.

Williams SG, Sacci JB Jr, Schriefer ME, et al. Typhus and typhuslike rickettsiae associated with opossums and their fleas in Los Angeles County, California. *J Clin Microbiol* 1992;30:1758-62.

Acute Communicable Disease Control website: www.lapublichealth.org/acd/vectormurine.htm