MENINGITIS, VIRAL

CRUDE DATA	
Number of Cases	400
Annual Incidence[a]	
LA County	4.23
Age at Diagnosis	
Mean	33.2
Median	30.5
Range	0–91 years

[a]Cases per 100,000 population.

DESCRIPTION

Viruses are the major cause of aseptic meningitis syndrome, a term used to define any meningitis (infectious or noninfectious), particularly one with a cerebrospinal fluid lymphocytic pleocytosis, for which a cause is not apparent after initial evaluation and routine stains and cultures do not support a bacterial or fungal etiology. Viral meningitis can occur at any age but is most common among the very young. Symptoms are characterized by sudden onset of fever, severe headache, stiff neck, photophobia, drowsiness, confusion, nausea and vomiting and usually last from seven to ten days.

The most common cause of viral meningitis is the nonpolio enteroviruses which are not vaccine-preventable and account for 85% to 95% of all cases in which a pathogen is identified. Transmission of enteroviruses may be by the fecal-oral, respiratory or other route specific to the etiologic agent. Other viral agents that can cause viral meningitis include herpes simplex virus (HSV), varicella-zoster virus (VZV), mumps virus, lymphocytic choriomeningitis virus, human immunodeficiency virus, adenovirus, parainfluenza virus type 3, influenza virus, measles virus and arboviruses, such as West Nile virus (WNV).

Antiviral agents are available for HSV and VZV, however, in most cases, only supportive measures are available for the treatment of viral meningitis. Recovery is usually complete and associated with low mortality rates.

Several types of viral meningitis are vaccine-preventable including VZV, mumps, influenza, and measles. Good personal hygiene, especially hand washing and avoiding contact with oral secretions of others, is the most practical and effective preventive measure for nonpolio enteroviruses.

2014 TRENDS AND HIGHLIGHTS

- In 2014, viral/aseptic meningitis incidence was 4.2 cases per 100,000. There has been a small rise in incidence each year since 2012 when a rate of 3.3 per 100,000 was documented. However, the incidence was previously as high as 9.6 per 100,000 in 2002 and the current rate is lower than the average over the past 15 years (Figure 1).
- SPA 1 (Antelope Valley) continued to report the highest rate of viral meningitis in LAC, and has increased from 4.6 cases per 100,000 in 2012 to 8.4 per 100,000 in 2014. The Varicella Active Surveillance Project, a national surveillance study conducted in the Antelope Valley from January 1996 to September 30, 2012, likely contributed by enhancing communicable disease reporting to LAC DPH.
- The distribution of viral/aseptic meningitis by age groups remains similar to previous years with the <1 year old age group experiencing the highest age-specific incidence rate at 39.7 per 100,000 (Figure 3).
- The etiologies of 131 cases were identified (33%). Of those, over half (n=74, 56%) were caused by WNV. Thirty percent (n=39) were caused by an enterovirus (Figure 6).
- Two deaths were reported (<1%), one of which was determined to be caused by enterovirus. Both patients were in their thirties.
- An outbreak of enteroviral meningitis was documented among ten children associated with a high school football team in August 2014. Five were hospitalized. The enterovirus was identified as echovirus 30 and determined to be most likely spread by the sharing of water bottles, inadequate washing of water bottles, and poor hand hygiene[1] (see Special Studies Report for additional details).

[1] Centers for Disease Control and Prevention. Morbidity and Mortality Weekly Report. Notes from the Field: Aseptic Meningitis Outbreak Associated with Echovirus 30 Among High School Football Players – Los Angeles County, California, 2014. 2 Jan 2015, 63 (51): 1228.

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

	2010 (N=570)			2011 (N=317)			2012 (N=303)			2013 (N=355)			2014 (N=400)		
	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000
Age Group															
<1	89	15.6	63.8	33	10.4	23.6	28	9.2	23.5	43	12.1	35.6	47	11.8	39.7
1-4	33	5.8	5.7	6	1.9	1.0	4	1.3	0.8	9	2.5	1.8	8	2.0	1.6
5-14	138	24.2	10.4	53	16.7	4.0	24	7.9	2.0	57	16.1	4.7	54	13.5	4.5
15-34	164	28.8	5.6	102	32.2	3.5	93	30.7	3.4	105	29.6	3.7	114	28.5	4.0
35-44	56	9.8	3.9	39	12.3	2.7	45	14.9	3.4	27	7.6	2.0	43	10.8	3.3
45-54	39	6.8	2.9	41	12.9	3.0	40	13.2	3.1	44	12.4	3.4	43	10.8	3.3
55-64	17	3.0	1.8	24	7.6	2.5	32	10.6	3.1	35	9.9	3.4	42	10.5	4.0
65+	33	5.8	3.1	18	5.7	1.7	37	12.2	3.3	31	8.7	2.8	44	11.0	3.9
Unknown	1	0.2	-	0	-	-	0	-	-	4	1.1	-	5	1.3	-
Race/Ethnicity															
Asian	36	6.3	2.7	21	6.6	1.6	23	7.6	1.7	21	5.9	1.5	22	5.5	1.6
Black	64	11.2	7.5	37	11.7	4.3	36	11.9	4.7	26	7.3	3.3	26	6.5	3.3
Hispanic	259	45.4	5.5	147	46.4	3.1	131	43.2	2.9	158	44.5	3.4	186	46.5	4.0
White	112	19.6	3.9	78	24.6	2.7	86	28.4	3.2	88	24.8	3.3	99	24.8	3.7
Other	13	2.3	-	7	2.2	-	10	3.3		19	5.4	-	12	3.0	-
Unknown	86	15.1	-	27	8.5	-	17	5.6		43	12.1	-	55	13.8	-
SPA															
1	45	7.9	12.1	33	10.4	8.8	18	5.9	4.6	29	8.2	7.4	33	8.3	8.4
2	86	15.1	3.9	67	21.1	3.0	63	20.8	2.9	67	18.9	3.1	73	18.3	3.3
3	98	17.2	5.6	75	23.7	4.3	68	22.4	4.2	64	18.0	3.9	97	24.3	5.9
4	29	5.1	2.3	14	4.4	1.1	16	5.3	1.4	32	9.0	2.8	34	8.5	3.0
5	13	2.3	2.0	15	4.7	2.3	10	3.3	1.6	7	2.0	1.1	14	3.5	2.1
6	76	13.3	7.1	26	8.2	2.4	29	9.6	2.9	43	12.1	4.2	38	9.5	3.7
7	92	16.1	6.7	48	15.1	3.5	57	18.8	4.4	56	15.8	4.3	71	17.8	5.4
8	121	21.2	10.8	35	11.0	3.1	36	11.9	3.4	52	14.7	4.8	37	9.3	3.4
Unknown	10	1.8	-	4	1.3	-	6	2.0	-	5	1.4	-	3	1.0	-

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

Figure 1. Incidence Rates of Viral Meningitis
LAC, 2000-2014

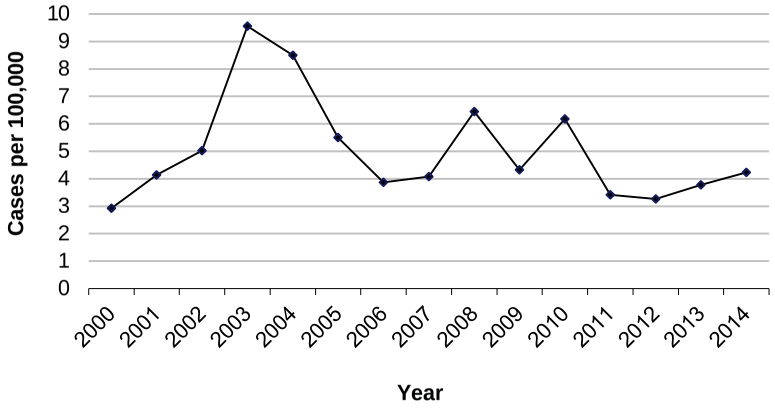


Figure 3. Incidence Rates of Viral Meningitis by Age Group
LAC, 2010-2014

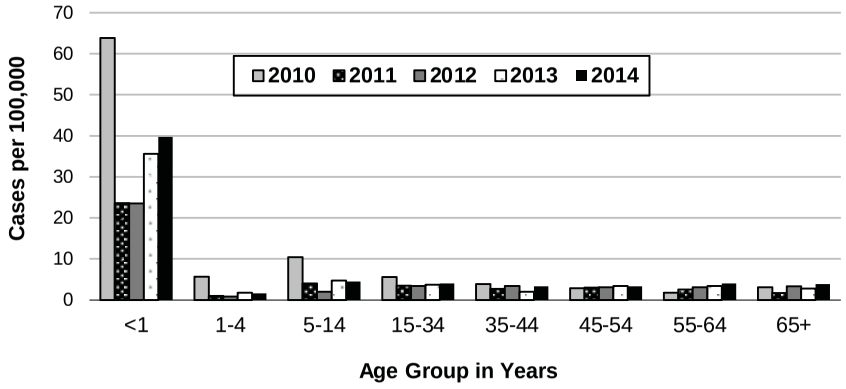


Figure 2. Incidence Rates of Viral Meningitis by SPA
LAC, 2010-2014

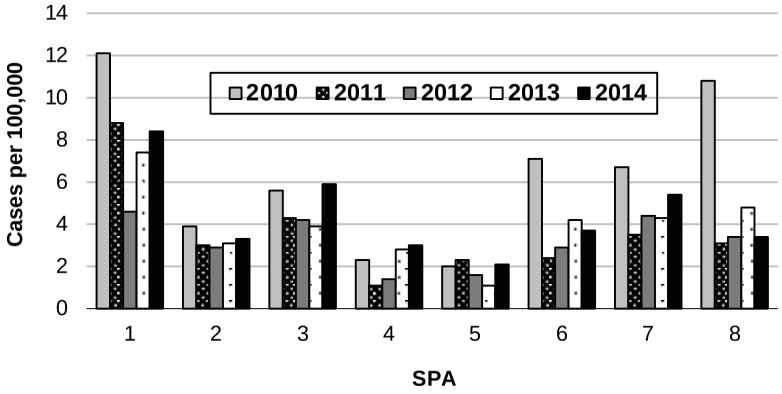
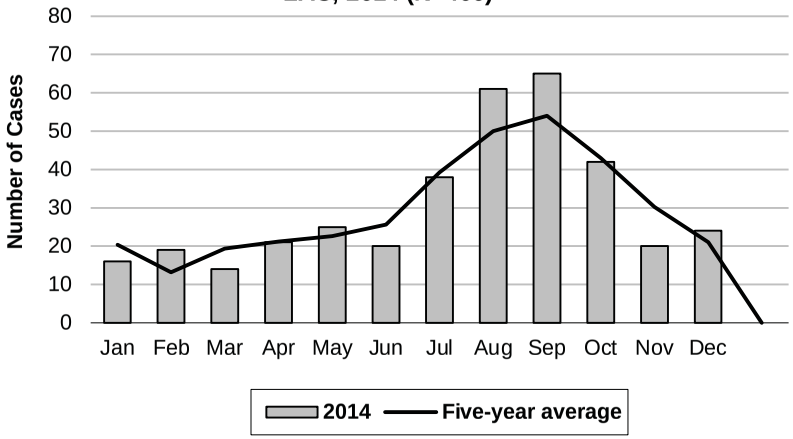


Figure 4. Reported Viral Meningitis Cases by Month of Onset
LAC, 2014 (N=400)*



*35 cases missing onset date.

Figure 5. Incidence Rates of Viral Meningitis by Race/Ethnicity LAC, 2010-2014

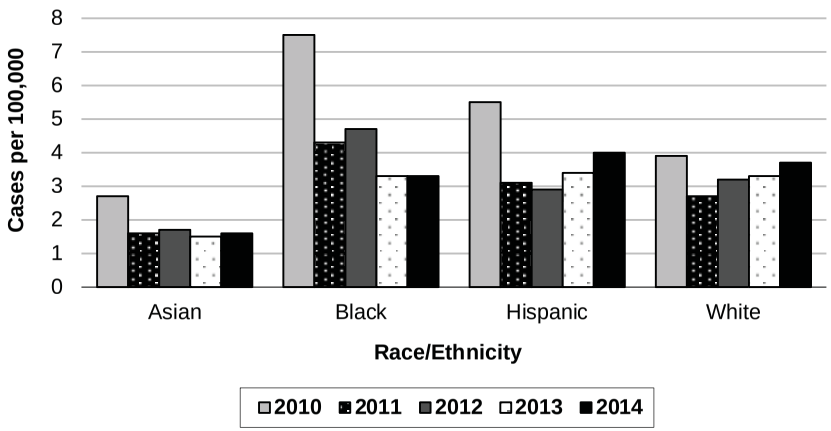
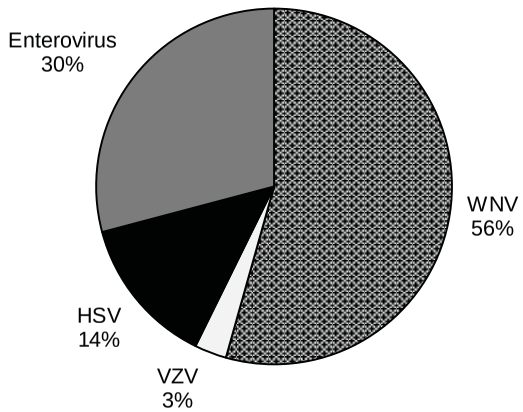
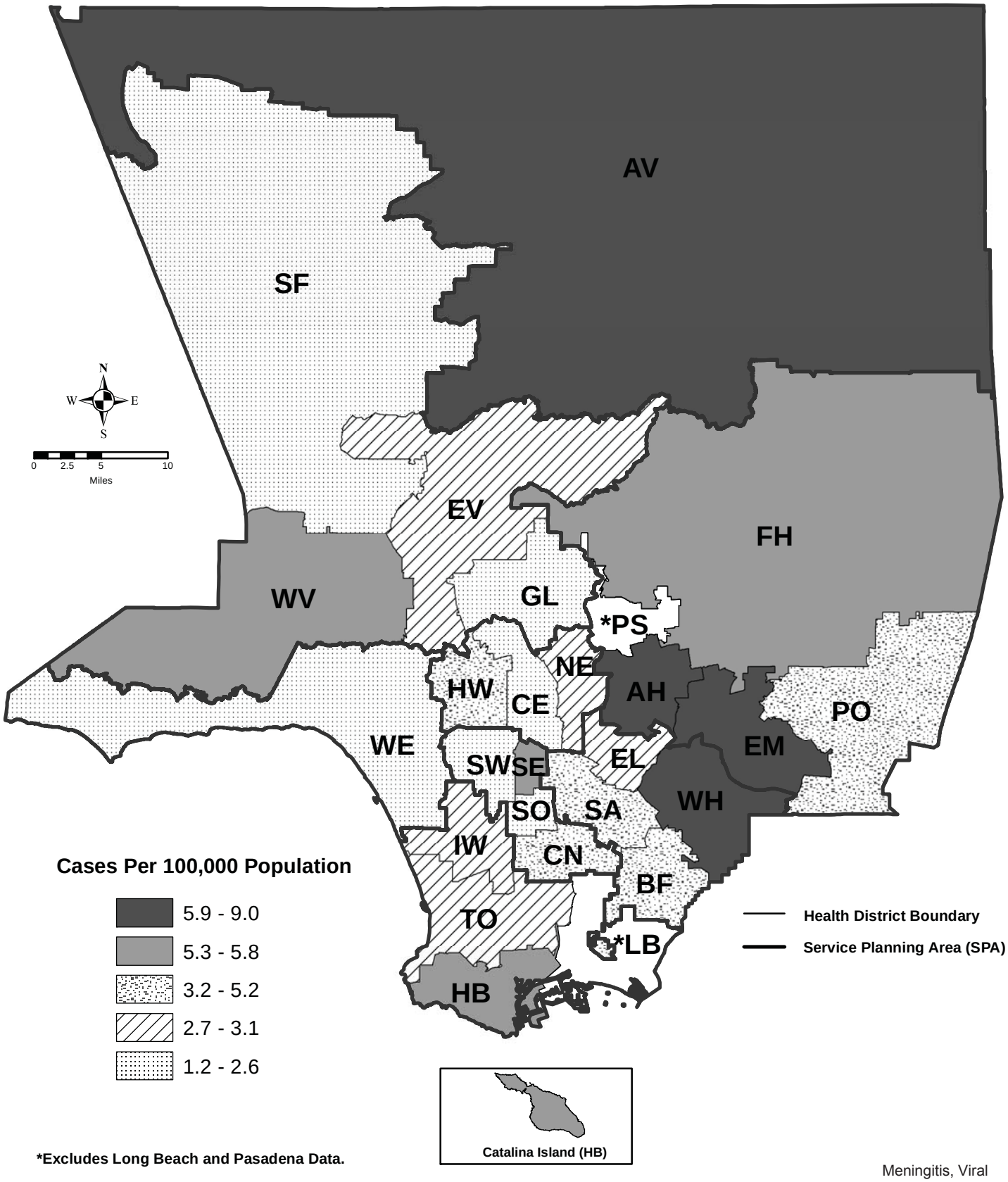


Figure 6. Percent Cases of Viral Meningitis by Etiology, LAC, 2014 (N=400)



Map 9. Meningitis, Viral
Rates by Health District, Los Angeles County, 2014*



*Excludes Long Beach and Pasadena Data.

MENINGITIS, VIRAL

CRUDE DATA	
Number of Cases	355
Annual Incidence[a]	
LA County	3.77
Age at Diagnosis	
Mean	30.8
Median	29
Range	0-90

[a]Cases per 100,000 population.

DESCRIPTION

Viruses are the major cause of aseptic meningitis syndrome, a term used to define any meningitis (infectious or noninfectious), particularly one with a cerebrospinal fluid lymphocytic pleocytosis, for which a cause is not apparent after initial evaluation and routine stains and cultures do not support a bacterial or fungal etiology. Viral meningitis can occur at any age but is most common among the very young. Symptoms are characterized by sudden onset of fever, severe headache, stiff neck, photophobia, drowsiness, confusion, nausea and vomiting and usually last from seven to ten days.

The most common cause of viral meningitis is the nonpolio enteroviruses which are not vaccine-preventable and account for 85% to 95% of all cases in which a pathogen is identified. Transmission of enteroviruses may be by the fecal-oral, respiratory or other route specific to the etiologic agent. Other viral agents that can cause viral meningitis include herpes simplex virus (HSV), varicella-zoster virus (VZV), mumps virus, lymphocytic choriomeningitis virus, human immunodeficiency virus, adenovirus, parainfluenza virus type 3, influenza virus, measles virus and arboviruses, such as West Nile virus (WNV). In most cases, only supportive measures are available; several are vaccine-preventable. Antiviral agents are available for HSV and VZV. Recovery is usually complete and associated with low mortality rates. Several are vaccine-preventable (VZV, mumps, influenza, measles).

Good personal hygiene, especially hand washing and avoiding contact with oral secretions of others, is the most practical and effective preventive measure.

2013 TRENDS AND HIGHLIGHTS

- In 2013, viral/aseptic meningitis incidence was 3.77 cases per 100,000, similar to the prior year. The incidence was as high as 9.6 per 100,000 in 2002 and has been declining since then (Figure 1).
- SPA 1 (Antelope Valley) continued to report the highest rate of viral meningitis in LAC, increasing from 4.6 cases per 100,000 in 2012 to 7.4 per 100,000 in 2013. However, SPA 1 documented its lowest rate since 2001 last year. From 2002 through 2011, SPA 1 recorded rates consistently over 10 cases per 100,000, much higher than the overall rate for LAC. The Varicella Active Surveillance Project, a study conducted since 1997 in the Antelope Valley and ended September 2012, likely contributed by enhancing reporting to LAC DPH. The rate may have risen again in 2013 due to a surge of West Nile Virus (WNV) associated meningitis in the SPA 1 region.
- The distribution of viral/aseptic meningitis by age groups remains similar to previous years with the <1 year old age group documenting the highest age-specific incidence rate at 35.6 per 100,000 (Figure 3).
- The etiologies of 115 cases were identified (32%). Of those, 52 (45%) were caused by WNV, 41 (36%) by an enterovirus, and 15 (13%) by HSV (Figure 6).
- One death (<1%) was reported; the etiology was not determined.

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

	2009 (N=399)			2010 (N=570)			2011 (N=317)			2012 (N=303)			2013 (N=355)		
	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000
Age Group															
<1	53	13.3	38.6	89	15.6	63.8	33	10.4	23.6	28	9.2	23.5	43	12.1	35.6
1-4	14	3.5	2.5	33	5.8	5.7	6	1.9	1.0	4	1.3	0.8	9	2.5	1.8
5-14	71	17.8	5.2	138	24.2	10.4	53	16.7	4.0	24	7.9	2.0	57	16.1	4.7
15-34	148	37.1	5.2	164	28.8	5.6	102	32.2	3.5	93	30.7	3.4	105	29.6	3.7
35-44	42	10.5	2.8	56	9.8	3.9	39	12.3	2.7	45	14.9	3.4	27	7.6	2.0
45-54	34	8.5	2.5	39	6.8	2.9	41	12.9	3.0	40	13.2	3.1	44	12.4	3.4
55-64	18	4.5	1.9	17	3.0	1.8	24	7.6	2.5	32	10.6	3.1	35	9.9	3.4
65+	19	4.8	1.8	33	5.8	3.1	18	5.7	1.7	37	12.2	3.3	31	8.7	2.8
Unknown	0	0.0		1	0.2					0	0.0		4	1.1	
Race/Ethnicity															
Asian	21	5.3	1.6	36	6.3	2.7	21	6.6	1.6	23	7.6	1.7	21	5.9	1.5
Black	23	5.8	2.7	64	11.2	7.5	37	11.7	4.3	36	11.9	4.7	26	7.3	3.3
Hispanic	208	52.1	4.4	259	45.4	5.5	147	46.4	3.1	131	43.2	2.9	158	44.5	3.4
White	80	12.5	2.7	112	19.6	3.9	78	24.6	2.7	86	28.4	3.2	88	24.8	3.3
Other	4	1.0		13	2.3		7	2.2		10	3.3		19	5.4	
Unknown	63	15.8		86	15.1		27	8.5		17	5.6		43	12.1	
SPA															
1	46	11.5	12.5	45	7.9	12.1	33	10.4	8.8	18	5.9	4.6	29	8.2	7.4
2	88	22.1	4.0	86	15.1	3.9	67	21.1	3.0	63	20.8	2.9	67	18.9	3.1
3	63	15.8	3.6	98	17.2	5.6	75	23.7	4.3	68	22.4	4.2	64	18.0	3.9
4	18	4.5	1.4	29	5.1	2.3	14	4.4	1.1	16	5.3	1.4	32	9.0	2.8
5	22	5.5	3.4	13	2.3	2.0	15	4.7	2.3	10	3.3	1.6	7	2.0	1.1
6	45	11.3	4.3	76	13.3	7.1	26	8.2	2.4	29	9.6	2.9	43	12.1	4.2
7	62	15.5	4.5	92	16.1	6.7	48	15.1	3.5	57	18.8	4.4	56	15.8	4.3
8	53	13.3	4.7	121	21.2	10.8	35	11.0	3.1	36	11.9	3.4	52	14.7	4.8
Unknown	2	0.5		10	1.8		4	1.3		6	2.0		5	1.4	

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

Figure 1. Incidence Rates of Viral Meningitis LAC, 2000-2013

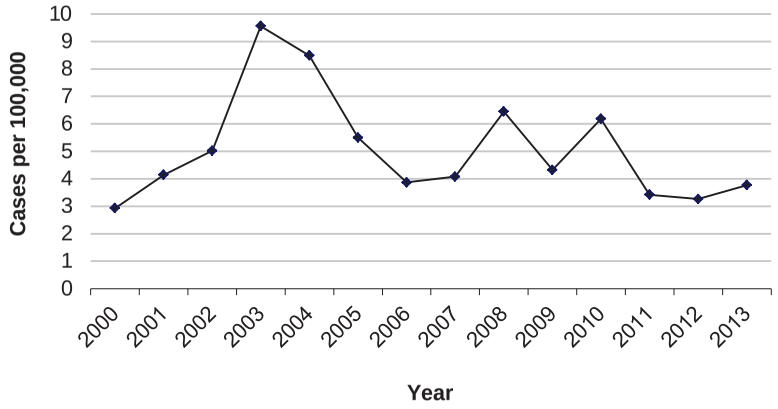


Figure 2. Incidence Rates of Viral Meningitis by SPA LAC, 2013 (N=355)

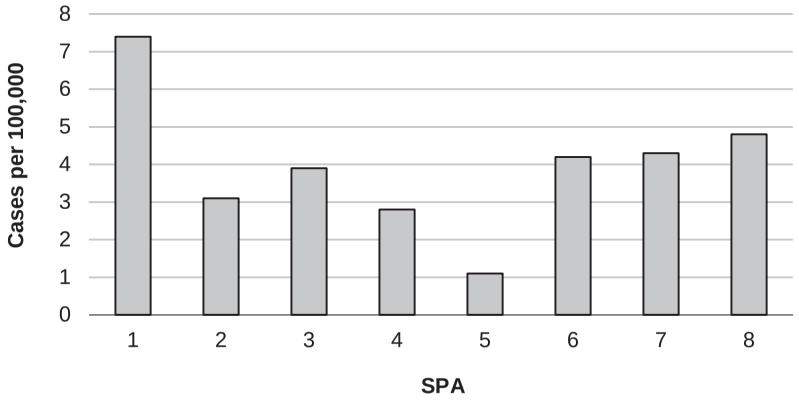


Figure 3. Incidence Rates of Viral Meningitis by Age Group LAC, 2013 (N=355)

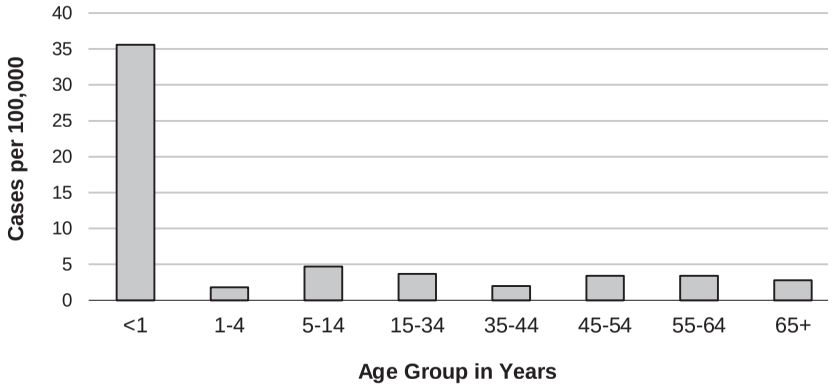


Figure 4. Reported Viral Meningitis Cases by Month of Onset LAC, 2013 (N=355)

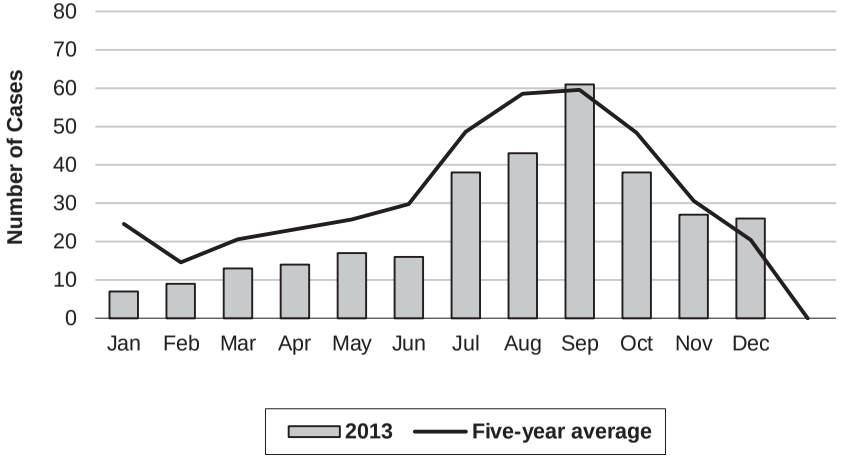


Figure 5. Incidence Rates of Viral Meningitis by Race/Ethnicity LAC, 2009-2013

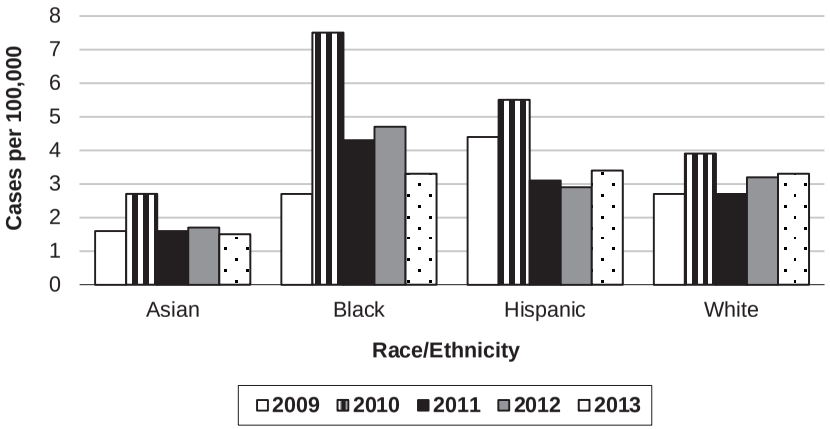
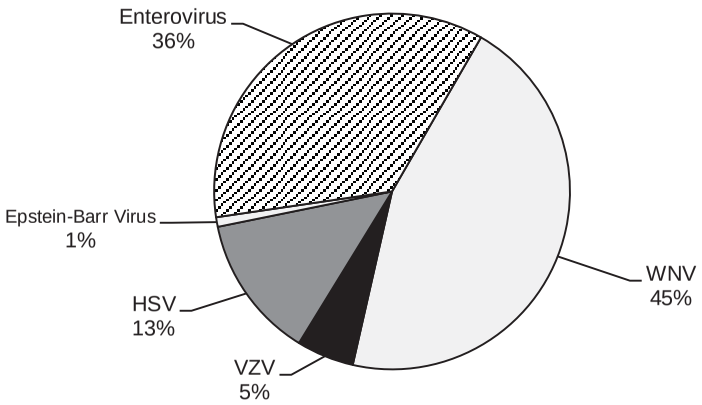
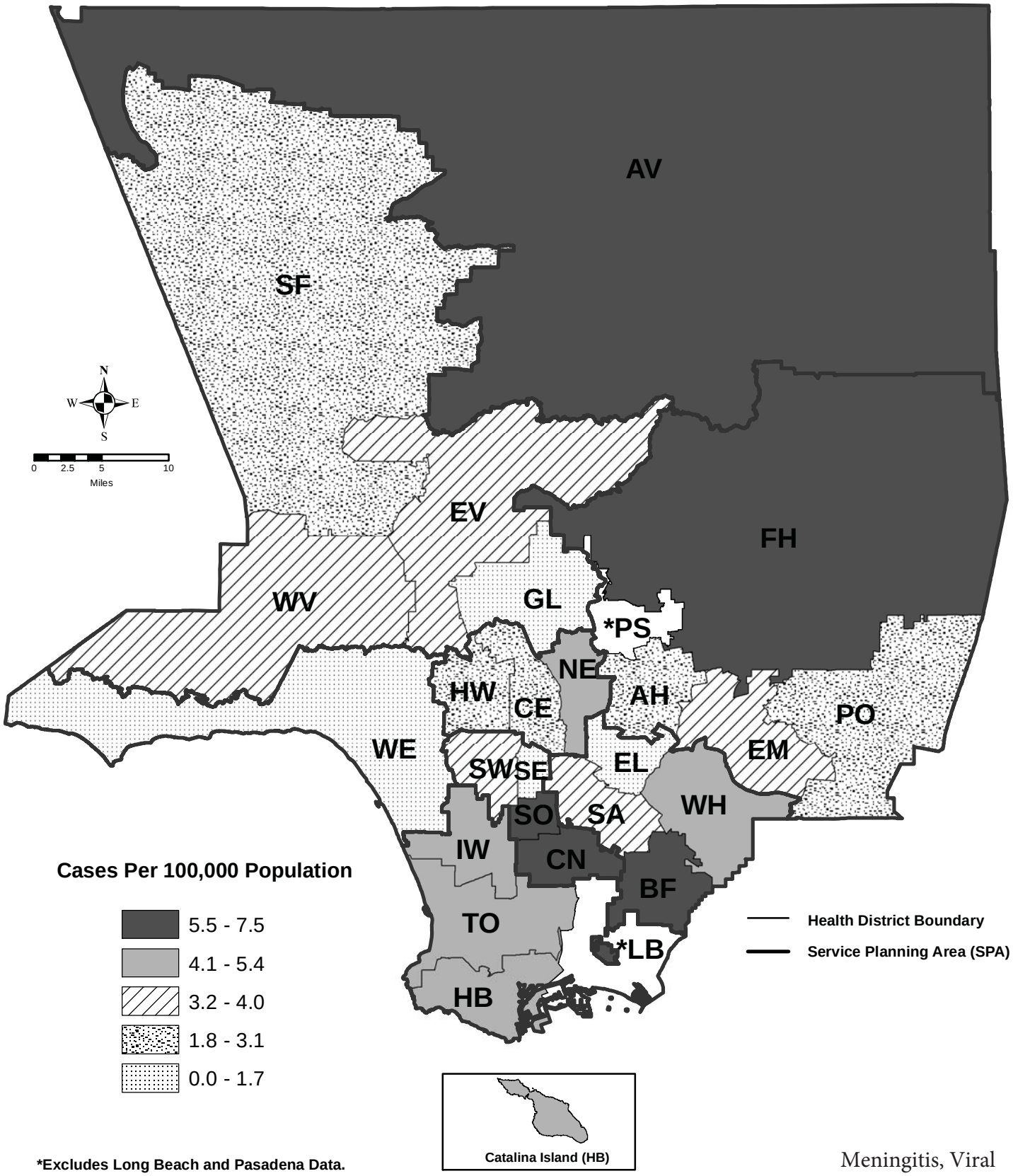


Figure 6. Percent Cases of Viral Meningitis by Etiology, LAC, 2013 (N=355)



Map 10. Meningitis, Viral
Rates by Health District, Los Angeles County, 2013*



*Excludes Long Beach and Pasadena Data.

MENINGITIS, VIRAL

CRUDE DATA	
Number of Cases	303
Annual Incidence[a]	
LA County	3.26
Age at Diagnosis	
Mean	35.8
Median	35
Range	0-88

[a]Cases per 100,000 population.

DESCRIPTION

Viruses are the major cause of aseptic meningitis syndrome, a term used to define any meningitis (infectious or noninfectious), particularly one with a cerebrospinal fluid lymphocytic pleocytosis, for which a cause is not apparent after initial evaluation and routine stains and cultures do not support a bacterial or fungal etiology. Viral meningitis can occur at any age but is most common among the very young. Symptoms are characterized by sudden onset of fever, severe headache, stiff neck, photophobia, drowsiness, confusion, nausea and vomiting and usually last from seven to ten days.

The most common cause of viral meningitis is the nonpolio enteroviruses which are not vaccine-preventable and account for 85% to 95% of all cases in which a pathogen is identified. Transmission of enteroviruses may be by the fecal-oral, respiratory or other route specific to the etiologic agent. Other viral agents that can cause viral meningitis include herpes simplex virus (HSV), varicella-zoster virus (VZV), mumps virus, lymphocytic choriomeningitis virus, human immunodeficiency virus, adenovirus, parainfluenza virus type 3, influenza virus, measles virus and arboviruses, such as West Nile virus (WNV). In most cases, only supportive measures are available; several are vaccine-preventable. Antiviral agents are available for HSV and VZV. Recovery is usually complete and associated with low mortality rates. Several are vaccine-preventable (VZV, mumps, influenza, measles).

Good personal hygiene, especially hand washing and avoiding contact with oral secretions of others, is the most practical and effective preventive measure.

2012 TRENDS AND HIGHLIGHTS

- In 2012, viral/aseptic meningitis incidence was 3.3 cases per 100,000, similar to the prior year. The incidence was as high as 9.6 per 100,000 in 2002 and has been declining since then (Figure 1).
- Though SPA 1 (Antelope Valley) continued to report the highest rate of viral meningitis in LAC (4.6 cases per 100,000), the rate was very similar to SPAs 3 and 7 (Figure 2). This is the lowest rate documented in SPA 1 since 2001. From 2002 through 2011, SPA 1 has recorded rates consistently over 10 cases per 100,000, much higher than the overall rate for LAC. The Varicella Active Surveillance Project, a study conducted since 1997 in the Antelope Valley and ended September 2012, likely contributed by enhancing reporting to LAC DPH.
- The incidence of viral/aseptic meningitis stratified by age groups remained similar to rates in 2011. The <1 year old age group remained the highest age-specific incidence rate at 23.5 per 100,000 (Figure 3).
- The etiologies of 88 cases were identified (29%). Of those, 67 (76%) were caused by WNV, 10 (12%) by an enterovirus, and 8 (9%) by HSV (Figure 6).
- Two deaths (<1%) were reported; their etiologies were not determined.

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

	2008 (N=597)			2009 (N=399)			2010 (N=570)			2011 (N=317)			2012 (N=303)		
	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000
Age Group															
<1	80	13.4	57.3	53	13.3	38.6	89	15.6	63.8	33	10.4	23.6	28	9.2	23.5
1-4	24	4.0	4.2	14	3.5	2.5	33	5.8	5.7	6	1.9	1.0	4	1.3	0.8
5-14	148	24.8	10.5	71	17.8	5.2	138	24.2	10.4	53	16.7	4.0	24	7.9	2.0
15-34	164	27.5	5.7	148	37.1	5.2	164	28.8	5.6	102	32.2	3.5	93	30.7	3.4
35-44	52	8.7	3.4	42	10.5	2.8	56	9.8	3.9	39	12.3	2.7	45	14.9	3.4
45-54	44	7.4	3.3	34	8.5	2.5	39	6.8	2.9	41	12.9	3.0	40	13.2	3.1
55-64	29	4.9	3.2	18	4.5	1.9	17	3.0	1.8	24	7.6	2.5	32	10.6	3.1
65+	51	8.5	5.0	19	4.8	1.8	33	5.8	3.1	18	5.7	1.7	37	12.2	3.3
Unknown	5	0.8		0	0.0		1	0.2					0	0.0	
Race/Ethnicity															
Asian	37	6.2	2.8	21	5.3	1.6	36	6.3	2.7	21	6.6	1.6	23	7.6	1.7
Black	43	7.2	5.0	23	5.8	2.7	64	11.2	7.5	37	11.7	4.3	36	11.9	4.7
Hispanic	275	46.1	5.9	208	52.1	4.4	259	45.4	5.5	147	46.4	3.1	131	43.2	2.9
White	121	20.3	4.2	80	12.5	2.7	112	19.6	3.9	78	24.6	2.7	86	28.4	3.2
Other	20	3.4		4	1.0		13	2.3		7	2.2		10	3.3	
Unknown	101	16.9		63	15.8		86	15.1		27	8.5		17	5.6	
SPA															
1	69	11.6	18.8	46	11.5	12.5	45	7.9	12.1	33	10.4	8.8	18	5.9	4.6
2	80	13.4	3.7	88	22.1	4.0	86	15.1	3.9	67	21.1	3.0	63	20.8	2.9
3	86	14.4	5.0	63	15.8	3.6	98	17.2	5.6	75	23.7	4.3	68	22.4	4.2
4	24	4.0	1.9	18	4.5	1.4	29	5.1	2.3	14	4.4	1.1	16	5.3	1.4
5	29	4.9	4.5	22	5.5	3.4	13	2.3	2.0	15	4.7	2.3	10	3.3	1.6
6	79	13.2	7.5	45	11.3	4.3	76	13.3	7.1	26	8.2	2.4	29	9.6	2.9
7	131	21.9	9.5	62	15.5	4.5	92	16.1	6.7	48	15.1	3.5	57	18.8	4.4
8	90	15.1	8.0	53	13.3	4.7	121	21.2	10.8	35	11.0	3.1	36	11.9	3.4
Unknown	9	1.5		2	0.5		10	1.8		4	1.3		6	2.0	

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

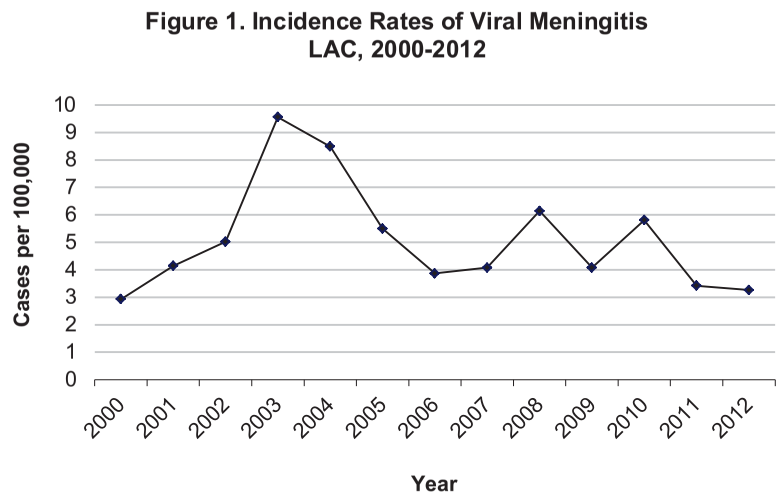


Figure 1. Incidence Rates of Viral Meningitis
LAC, 2000-2012
Cases per 100,000
0
1
2
3
4
5
6
7
8
9
10
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year

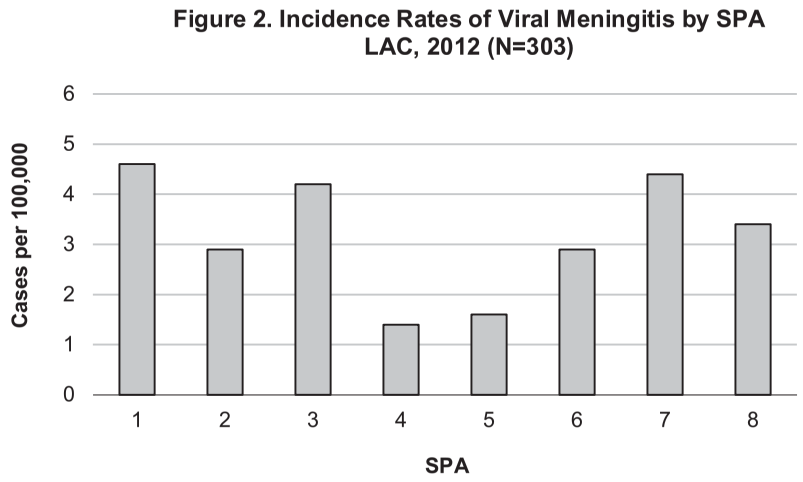


Figure 2. Incidence Rates of Viral Meningitis by SPA
LAC, 2012 (N=303)
Cases per 100,000
0
1
2
3
4
5
6
1
2
3
4
5
6
7
8
SPA

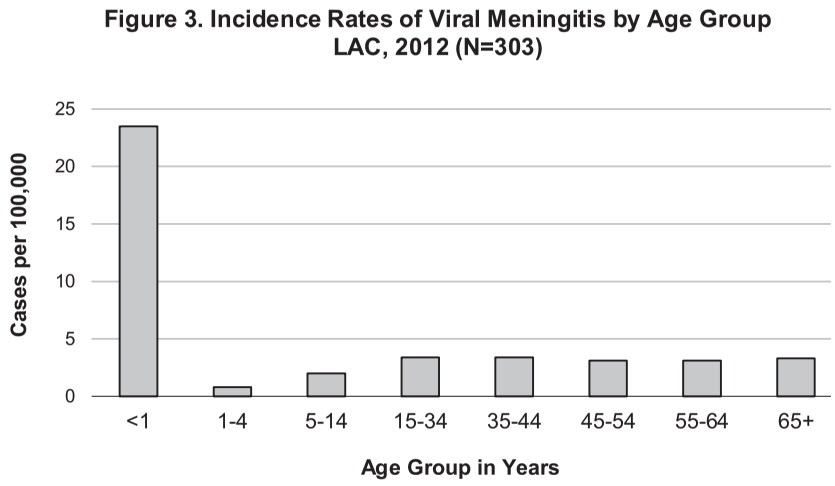


Figure 3. Incidence Rates of Viral Meningitis by Age Group
LAC, 2012 (N=303)
Cases per 100,000
0
5
10
15
20
25
<1
1-4
5-14
15-34
35-44
45-54
55-64
65+
Age Group in Years

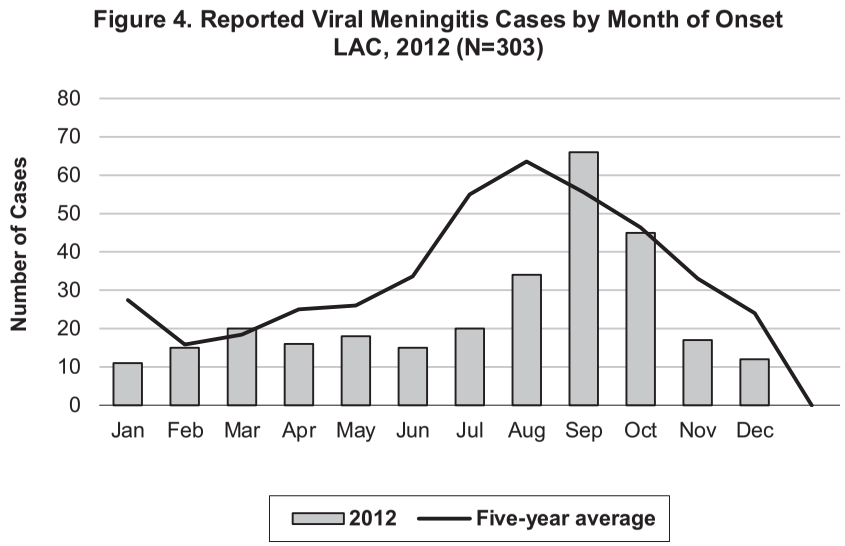


Figure 4. Reported Viral Meningitis Cases by Month of Onset
LAC, 2012 (N=303)
Number of Cases
0
10
20
30
40
50
60
70
80
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2012
Five-year average

Figure 5. Incidence Rates of Viral Meningitis by Race/Ethnicity LAC, 2008-2012

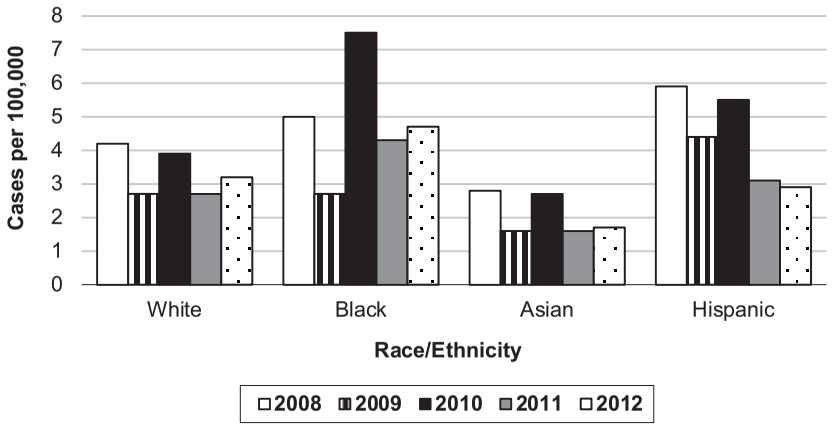
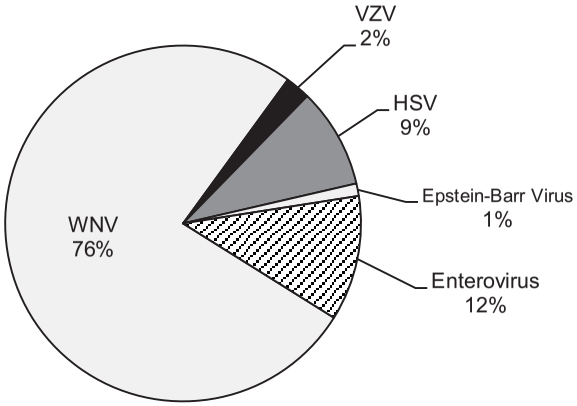
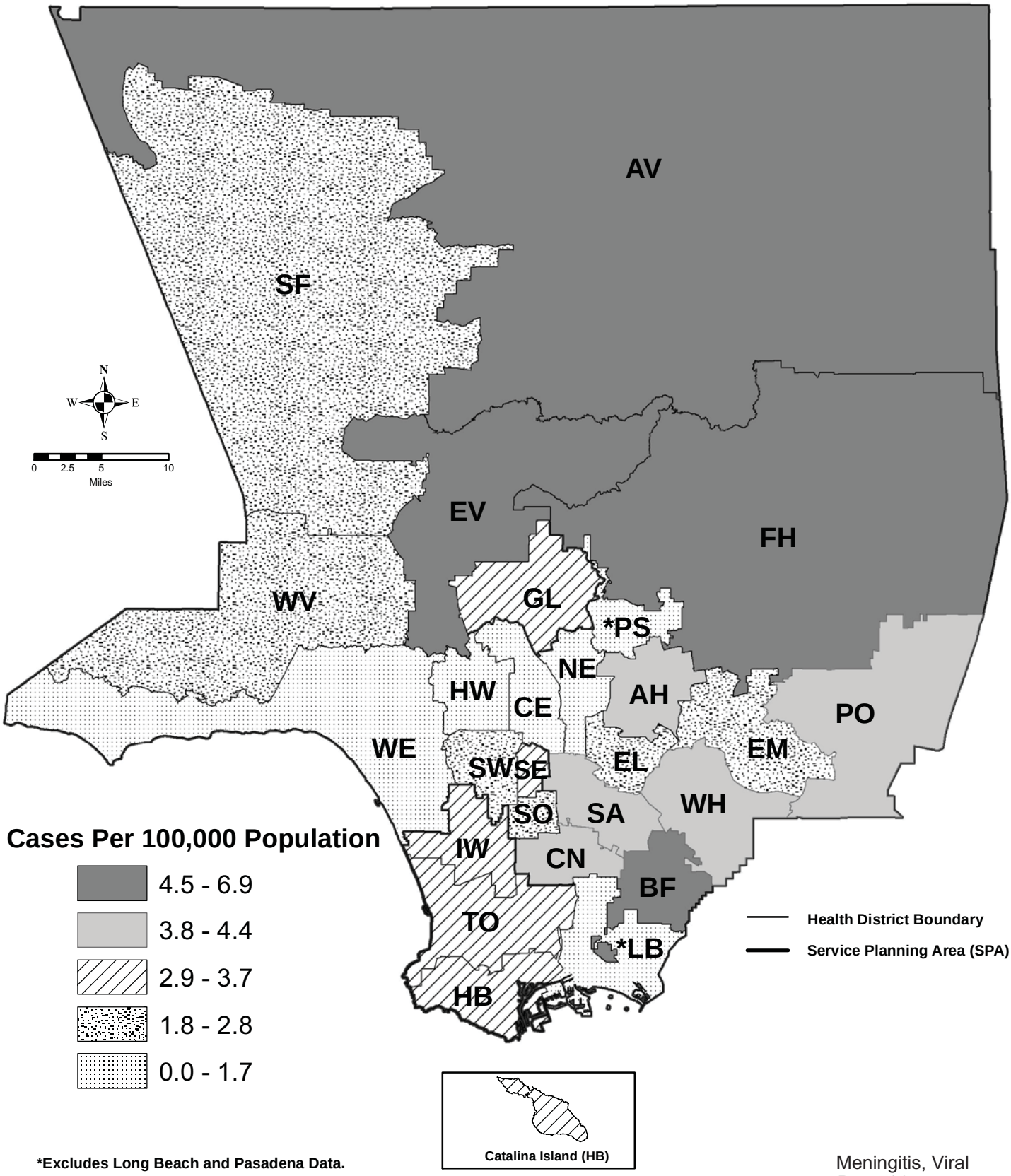


Figure 6. Percent Cases of Viral Meningitis by Etiology, LAC, 2012 (N=303)



Map 8. Viral Meningitis
Rates by Health District, Los Angeles County, 2012*



*Excludes Long Beach and Pasadena Data.

MENINGOCOCCAL DISEASE

CRUDE DATA	
Number of Cases	12
Annual Incidence[a]	
LA County	0.13
California[b]	0.23
United States[b]	0.18
Age at Diagnosis	
Mean	52.8
Median	51
Range	21-94

[a]Cases per 100,000 population.
[b]Calculated from Final 2012 Reports of Nationally Notifiable Infectious Disease. MMWR 62(33);669-682.

DESCRIPTION

Meningococcal disease occurs most often as meningitis, an infection of the cerebrospinal fluid (CSF), or meningococcemia, an infection of the bloodstream. It is transmitted through direct or droplet contact with nose or throat secretions of persons colonized in the upper respiratory tract with the *Neisseria meningitidis* bacterium. Common symptoms include sudden onset of fever, headache, nausea, vomiting, stiff neck, petechial rash and lethargy which can progress to overwhelming sepsis, shock and death within hours. Despite effective antibiotic therapy, the mortality rate remains between 10% and 15%. Long-term sequelae include significant neurologic or orthopedic complications such as deafness or amputation. Meningococcal disease affects all age groups but occurs most often in infants. Of the 13 serogroups, A, B, C, Y, and W-135 are responsible for causing nearly all cases of meningococcal disease.

For the purpose of surveillance, the Los Angeles County (LAC) Department of Public Health (DPH) defines reports of invasive meningococcal disease as confirmed when *N. meningitidis* has been isolated from a normally sterile site (e.g., blood or CSF). In the absence of a positive culture, reports are defined as probable if there is evidence of the bacteria in a normally sterile site by polymerase chain reaction (PCR) analysis or CSF antigen test. Reports are classified as suspected cases when they present with clinical diagnosis of purpura fulminans or demonstrate gram-negative diplococci by gram staining.[1]

Three vaccines are available in the US that protect against serogroups A, C, Y, and W-135 but not B. A quadrivalent unconjugated polysaccharide meningococcal vaccine (Menomune®) is licensed for persons > 55 years and for those ≥2 years old when quadrivalent conjugated-polysacharide vaccine are not available. Two quadrivalent conjugate vaccines, MenACWY-D (Menactra®) and MenACWY-CRM (Menveo®), are licensed for use in persons aged 2 to 55 years; MenACWY-D is also licensed for used in children age 9 through 23 months. Both vaccines are recommended for all adolescents between ages 11-18 years, preferably at 11 or 12 years, and for those between 2-55 years who are at increased risk for meningococcal disease. An additional booster dose is needed if the primary dose was given before 16 years old. Routine vaccination is recommended for college freshman living in dormitories, persons at increased risk for meningococcal disease. An additional conjugate vaccine, Hib-MenCY-TT (MenHibrix®), has been licensed for infants 6 weeks to 18 months old, but only protects against serogroups C and Y disease.[2]

Antimicrobial chemoprophylaxis of close contacts of sporadic cases of meningococcal disease remains the primary means for prevention of meningococcal disease among close contacts, who include: a) household members, b) daycare center contacts, and c) anyone directly exposed to the patient's oral secretions (e.g., through kissing, mouth-to-mouth resuscitation, endotracheal intubation, or endotracheal tube management). Because the rate of secondary disease for close contacts is highest during the first few days after onset of disease in the primary patient, antimicrobial chemoprophylaxis should be administered as soon as possible (ideally within 24 hours after the case is identified). Conversely, chemoprophylaxis administered >10 days after onset of illness in the index case-patient is probably of limited or no value. Prophylactic treatment and follow-up of close contacts are routinely handled by the LAC DPH Community Health Services.

2012 TRENDS AND HIGHLIGHTS

- The incidence of meningococcal disease declined by 60% from 0.38 cases per 100,000 in 2011 to 0.13 cases per 100,000 in 2012. The incidence rate has declined consistently since 2001 when there was a peak of 0.64 cases per 100,000 (Figure 1).
- There were no cases reported among persons less than 21 years old (Figure 2). The highest number of cases occurred among those 15 to 34 years old and 65 years and older. However, in a typical distribution curve for meningococcal disease the peak incidence occurs among infants <1 year old.

1. Centers for Disease Control and Prevention. National Notifiable Disease Surveillance System. Meningococcal Disease (Neisseria meningitidis), 2010 Case Definition. http://wwwn.cdc.gov/NNDSS/script/casedef.aspx?CondYrID=774&DatePub=1/1/2010 12:00:00 AM. Accessed: May 29, 2013.
2. Centers for Disease Control and Prevention. Morbidity and Mortality Weekly Report. Prevention and Control of Meningococcal Disease, Recommendations of the Advisory Committee on Immunization Practices (ACIP). 22 Mar 2013, 62 (2): 1-28.

- The monthly onset of disease did not follow the typical seasonal trend of peaks in the winter season. The highest numbers of cases usually occur in January and February. In 2012, the highest numbers of cases were recorded in December and May (Figure 4).
- Nearly all of the cases were culture-confirmed (n=11, 92%): 10 (83%) were cultured from blood and one from (8%) from cerebrospinal fluid (CSF). One case was probable by PCR. Of the culture-confirmed cases all cases had serogroup identified; 5 (42%) were serogroup C, 3 (25%) were serogroup B, and 3 (25%) were serogroup W-135. The probable case was serogroup Y. Serogroup W-135 accounted for more cases than usual (Figure 6).
- The case fatality rate, 33% (n=4), is much higher than what has been usually recorded for LAC. Three of the fatalities were serogroup C disease and one was serogroup W-135.
- Beginning mid-December 2012, three cases of serogroup C meningococcal disease occurred among males aged 30 to 51 years. Two were men who have sex with men (MSM), of which one was fatal. The third case had recent travel history to Tijuana, Mexico. These three cases became associated with two separate clusters that extended into 2013, one among MSM and the other among cases who reported travel to Tijuana or high risk contact with travelers to Tijuana. Molecular analysis showed that the strains affecting the two MSM were related, and strain affecting the traveler to Tijuana matched other cases associated with Tijuana. However, within each of the two clusters, none of the MSM or Tijuana cases had direct social links to each other.[3]

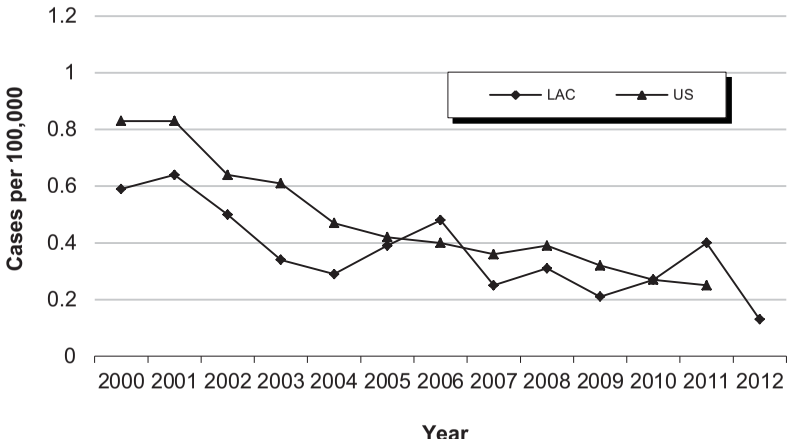
3. Centers for Disease Control and Prevention. Notes from the field: serogroupo C invasive meningococcal disease among men who have sex with men – New York City, 2010-2012. Morbidity and Mortality Weekly Report. 4 Jan 2013; 61(51): 1048.

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

	2008 (N=30)			2009 (N=21)			2010 (N=26)			2011 (N=37)			2012 (N=12)		
	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000
Age Group															
<1	3	10.0		1	4.8		2	7.7		0	0.0		0	0.0	
1-4	1	3.3		1	4.8		2	7.7		1	2.7		0	0.0	
5-14	6	20.0		1	4.8		1	3.8		1	2.7		0	0.0	
15-34	6	20.0		10	47.6		8	30.8		12	32.4		4	33.3	
35-44	5	16.7		0	0.0		4	15.3		10	27.0		0	0.0	
45-54	3	10.0		4	19.0		5	19.2		3	8.1		2	16.7	
55-64	4	13.3		4	19.0		1	3.8		5	13.5		2	16.7	
65+	2	6.7		0	0.0		3	11.5		5	13.5		4	33.3	
Unknown	0	0.0		0	0.0		0	0.0		0	0.0		0	0.0	
Race/Ethnicity															
Asian	1	3.3		0	0.0		1	3.8		4	10.8		2	16.7	
Black	4	13.3		4	19.0		7	26.9		12	32.4		2	16.7	
Hispanic	20	66.7		9	42.9		11	42.3		11	29.7		5	41.7	
White	4	13.3		7	33.3		7	26.9		10	27.0		3	25.0	
Other	0	0.0		0	0.0		0	0.0		0	0.0		0	0.0	
Unknown	1	3.3		1	4.8		0	0.0		0	0.0		0	0.0	
SPA															
1	2	6.6		1	4.8		1	3.8		1	2.7		0	0.0	
2	3	10.0		5	23.8		3	11.5		9	24.3		2	16.7	
3	4	13.3		1	4.8		3	11.5		2	5.4		0	0.0	
4	6	20.0		2	9.5		2	7.7		5	13.5		5	41.7	
5	5	16.7		2	9.5		2	7.7		1	2.7		2	16.7	
6	7	23.3		5	23.8		6	23.1		9	24.3		3	25.0	
7	2	6.7		2	9.5		3	11.5		4	10.8		0	0.0	
8	1	3.3		3	14.3		6	23.1		6	16.2		0	0.0	
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. Incidence Rates* of Meningococcal Disease LAC and US, 2000-2012



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

Figure 2. Meningococcal Disease Cases by Age Group, LAC, 2012 (N=12)

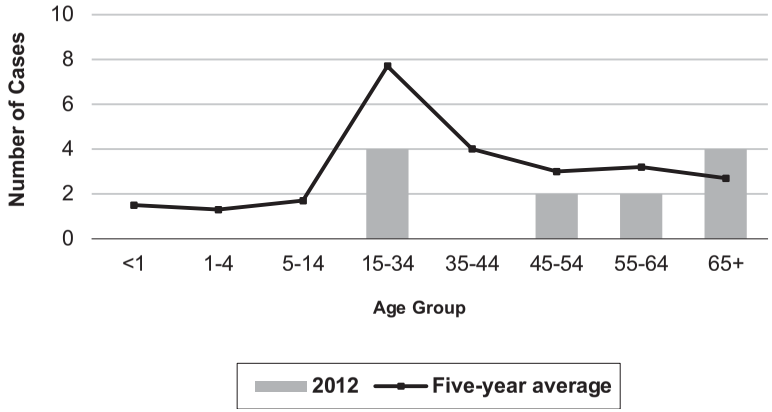
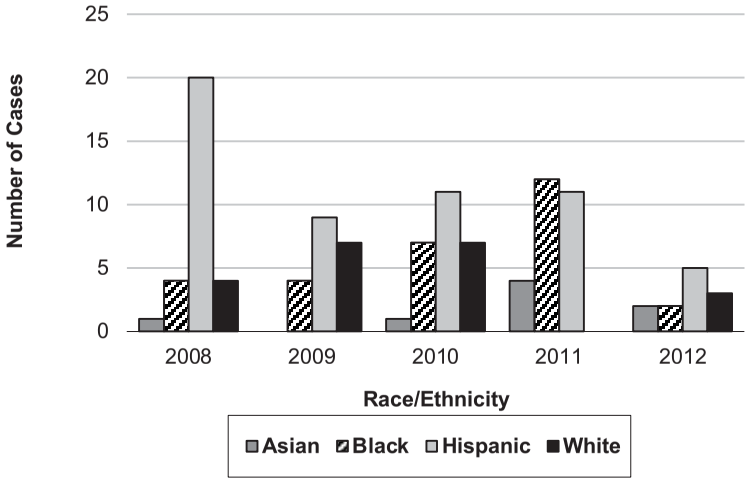


Figure 3. Meningococcal Disease Cases by Race/Ethnicity, LAC, 2008-2012



3. Centers for Disease Control and Prevention. Notes from the field: serogroupo C invasive meningococcal disease among men who have sex with men – New York City, 2010-2012. Morbidity and Mortality Weekly Report. 4 Jan 2013; 61(51): 1048.

Figure 4. Reported Meningococcal Disease Cases by Month of Onset, LAC, 2012 (N=12)

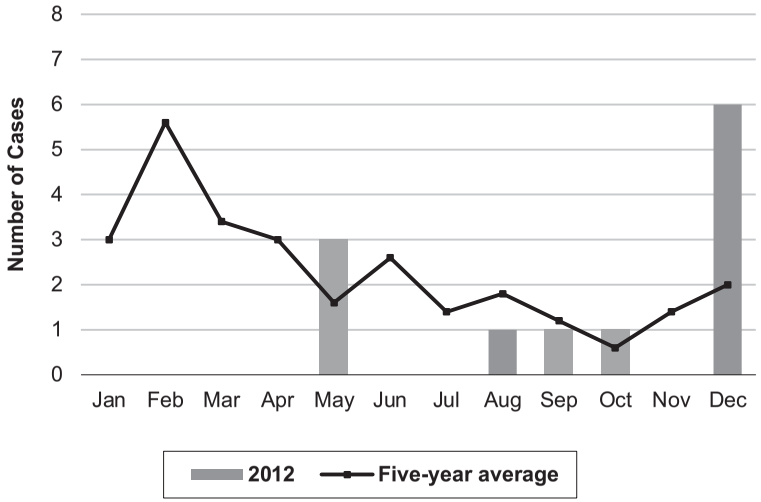


Figure 6. Meningococcal Disease by Serogroup LAC, 2008–2012

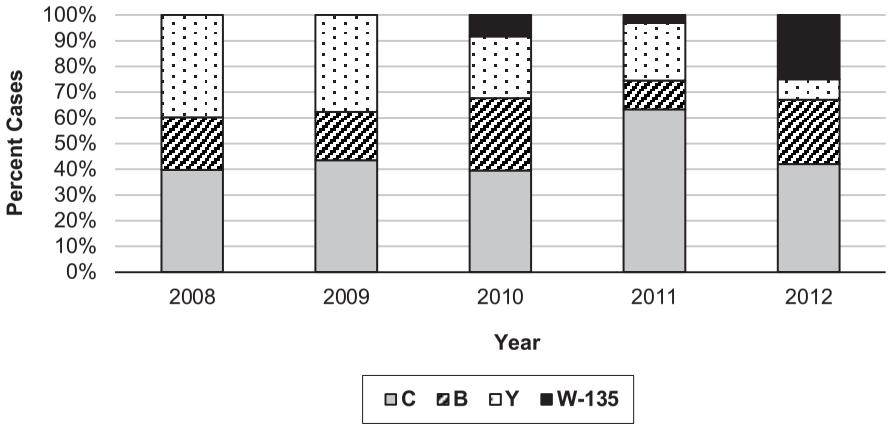
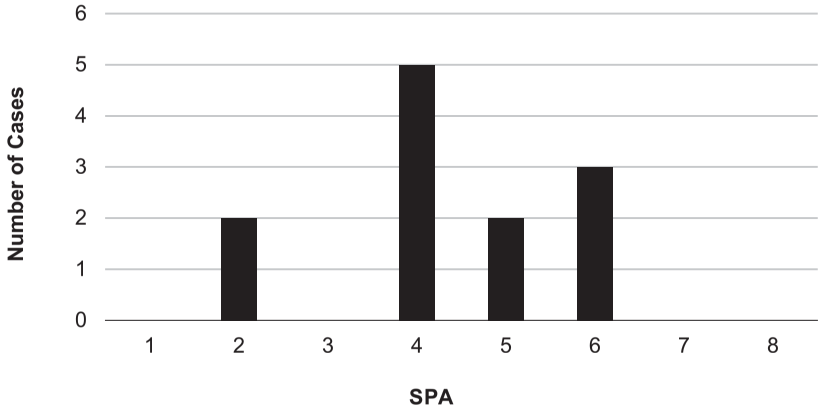


Figure 5. Meningococcal Disease Cases by SPA LAC, 2012 (N=12)



MENINGITIS, VIRAL

CRUDE DATA	
Number of Cases	317
Annual Incidence[a]	
LA County	3.23
Age at Diagnosis	
Mean	29.8
Median	27
Range	0-88

[a]Cases per 100,000 population.

DESCRIPTION

Viruses are the major cause of aseptic meningitis syndrome, a term used to define any meningitis (infectious or noninfectious), particularly one with a cerebrospinal fluid lymphocytic pleocytosis, for which a cause is not apparent after initial evaluation and routine stains and cultures do not support a bacterial or fungal etiology. Viral meningitis can occur at any age but is most common among the very young. Symptoms are characterized by sudden onset of fever, severe headache, stiff neck, photophobia, drowsiness, confusion, nausea and vomiting and usually last from seven to ten days.

The most common cause of viral meningitis is the nonpolio enteroviruses which are not vaccine-preventable and account for 85% to 95% of all cases in which a pathogen is identified. Transmission of enteroviruses may be by the fecal-oral, respiratory or other route specific to the etiologic agent. Other viral agents that can cause viral meningitis include herpes simplex virus (HSV), varicella-zoster virus, mumps virus, lymphocytic choriomeningitis virus, human immunodeficiency virus, adenovirus, parainfluenza virus type 3, influenza virus, measles virus and arboviruses, such as West Nile virus (WNV). In most cases, only supportive measures are available; several are vaccine-preventable. Antiviral agents are available for herpes simplex and varicella-zoster viruses. Recovery is usually complete and associated with low mortality rates. Several are vaccine-preventable (VZV, mumps, influenza, measles).

Good personal hygiene, especially hand washing and avoiding contact with oral secretions of others, is the most practical and effective preventive measure.

2011 TRENDS AND HIGHLIGHTS

- In 2011, viral/aseptic meningitis incidence decreased from 5.8 cases to 3.2 cases per 100,000 in 2010 (Figure 1).
- The incidence of viral/aseptic meningitis decreased across nearly all age groups in 2011 compared to 2010. The <1 year old age group decreased in incidence from 68.8 cases to 23.6 cases per 100,000 from 2010 to 2011, respectively, but maintained the highest age-specific incidence rate compared to other age groups.
- SPA 1 (Antelope Valley) continued to report the highest rates of viral meningitis in LAC (8.8 cases per 100,000 in 2011) (Figure 4). However, this is likely due to better public health reporting by the area's main hospital compared to other LAC acute care facilities. This may have resulted from the Varicella Active Surveillance Project (see Special Studies Reports).
- The incidence of viral/aseptic meningitis among blacks decreased from 7.5 cases to 4.3 cases per 100,000 in 2010 and 2011, respectively. Blacks had the highest incidence rate of viral/aseptic meningitis of race/ethnicity groups (Figure 6).
- Of the 49 cases (15%) in with an identified viral etiology, 21 (43%) were caused by WNV, 16 (33%) by an enterovirus, and 10 (20%) by HSV.
- Two deaths (<1%) were reported; their etiologies were not determined.

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

	2007 (N=395)			2008 (N=597)			2009 (N=399)			2010 (N=570)			2011 (N=317)		
	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000
Age Group															
<1	75	19.0	50.7	80	13.4	57.3	53	13.3	38.6	89	15.6	63.8	33	10.4	23.6
1-4	11	2.8	1.9	24	4.0	4.2	14	3.5	2.5	33	5.8	5.7	6	1.9	1.0
5-14	45	11.4	3.1	148	24.8	10.5	71	17.8	5.2	138	24.2	10.4	53	16.7	4.0
15-34	120	30.4	4.3	164	27.5	5.7	148	37.1	5.2	164	28.8	5.6	102	32.2	3.5
35-44	58	14.7	3.9	52	8.7	3.4	42	10.5	2.8	56	9.8	3.9	39	12.3	2.7
45-54	42	10.6	3.2	44	7.4	3.3	34	8.5	2.5	39	6.8	2.9	41	12.9	3.0
55-64	14	3.5	1.6	29	4.9	3.2	18	4.5	1.9	17	3.0	1.8	24	7.6	2.5
65+	29	7.3	2.9	51	8.5	5.0	19	4.8	1.8	33	5.8	3.1	18	5.7	1.7
Unknown	1	0.3		5	0.8		0	0.0		1	0.2				
Race/Ethnicity															
Asian	30	7.6	2.3	37	6.2	2.8	21	5.3	1.6	36	6.3	2.7	21	6.6	1.6
Black	28	7.1	3.3	43	7.2	5.0	23	5.8	2.7	64	11.2	7.5	37	11.7	4.3
Hispanic	179	45.3	3.9	275	46.1	5.9	208	52.1	4.4	259	45.4	5.5	147	46.4	3.1
White	108	27.3	3.7	121	20.3	4.2	80	12.5	2.7	112	19.6	3.9	78	24.6	2.7
Other	6	1.5	28.8	20	3.4	81.1	4	1.0		13	2.3		7	2.2	
Unknown	44	11.1		101	16.9		63	15.8		86	15.1		27	8.5	
SPA															
1	35	8.9	9.8	69	11.6	18.8	46	11.5	12.5	45	7.9	12.1	33	10.4	8.8
2	84	21.3	3.9	80	13.4	3.7	88	22.1	4.0	86	15.1	3.9	67	21.1	3.0
3	63	15.9	3.6	86	14.4	5.0	63	15.8	3.6	98	17.2	5.6	75	23.7	4.3
4	16	4.1	1.3	24	4.0	1.9	18	4.5	1.4	29	5.1	2.3	14	4.4	1.1
5	13	3.3	2.0	29	4.9	4.5	22	5.5	3.4	13	2.3	2.0	15	4.7	2.3
6	42	10.6	4.0	79	13.2	7.5	45	11.3	4.3	76	13.3	7.1	26	8.2	2.4
7	73	18.5	5.3	131	21.9	9.5	62	15.5	4.5	92	16.1	6.7	48	15.1	3.5
8	63	15.9	5.6	90	15.1	8.0	53	13.3	4.7	121	21.2	10.8	35	11.0	3.1
Unknown	6	1.5		9	1.5		2	0.5		10	1.8		4	1.3	

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

Figure 1. Incidence Rates of Viral Meningitis LAC, 1999-2011

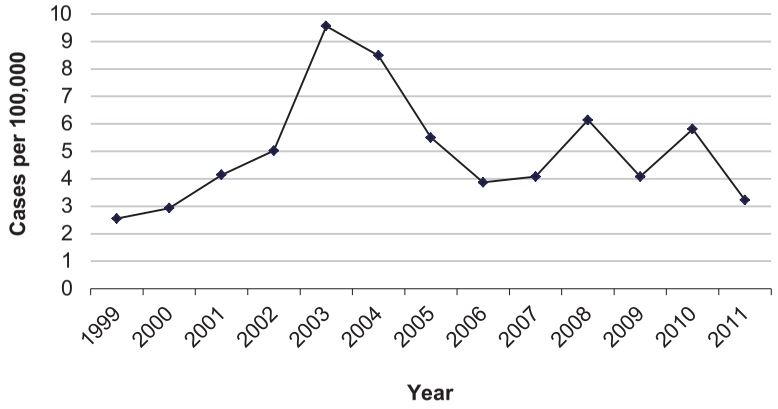


Figure 2. Incidence Rates of Viral Meningitis by Age Group LAC, 2011 (N=317)

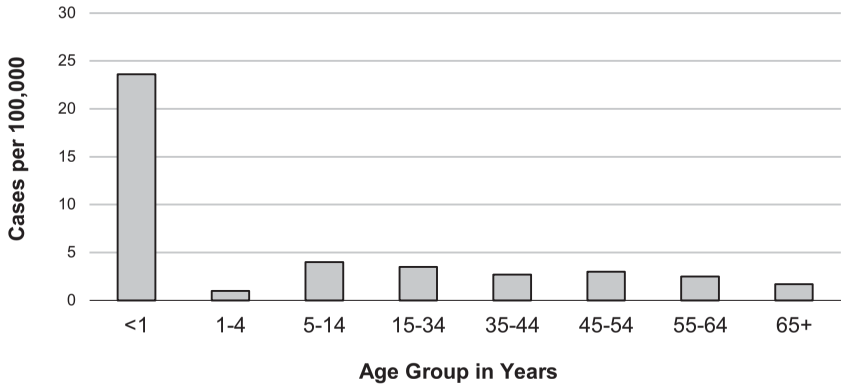


Figure 3. Percent Cases of Viral Meningitis by Race/Ethnicity, LAC, 2011 (N=317)

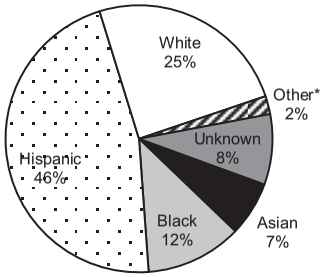
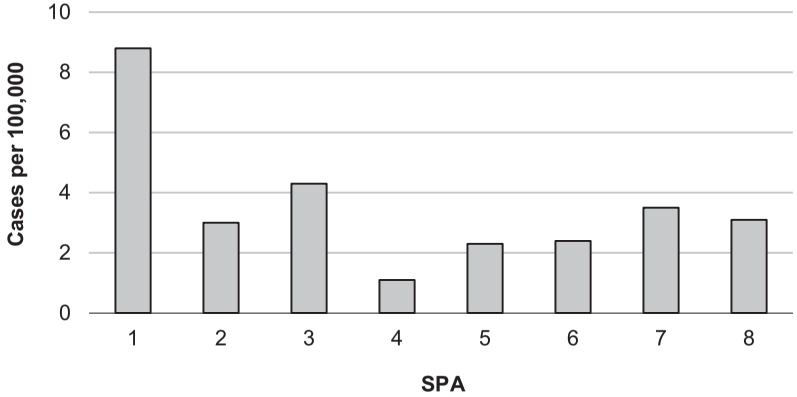


Figure 4. Incidence Rates of Viral Meningitis by SPA LAC, 2011 (N=317)



* Other includes Native American and any additional racial/ethnic group that cannot be categorized as Asian, black, Hispanic, or white.

Figure 5. Reported Viral Meningitis Cases by Month of Onset LAC, 2011 (N=317)

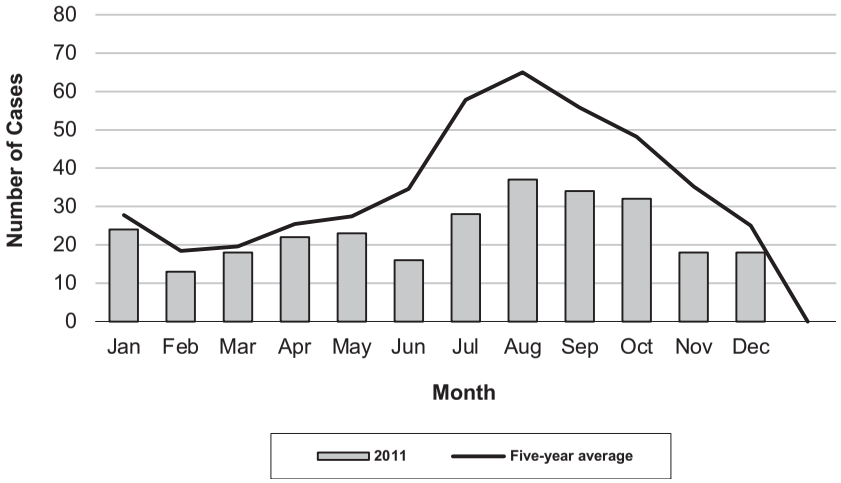
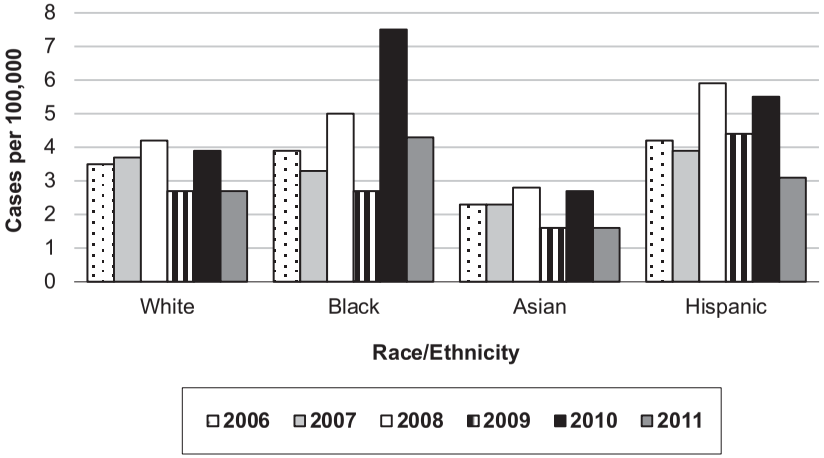
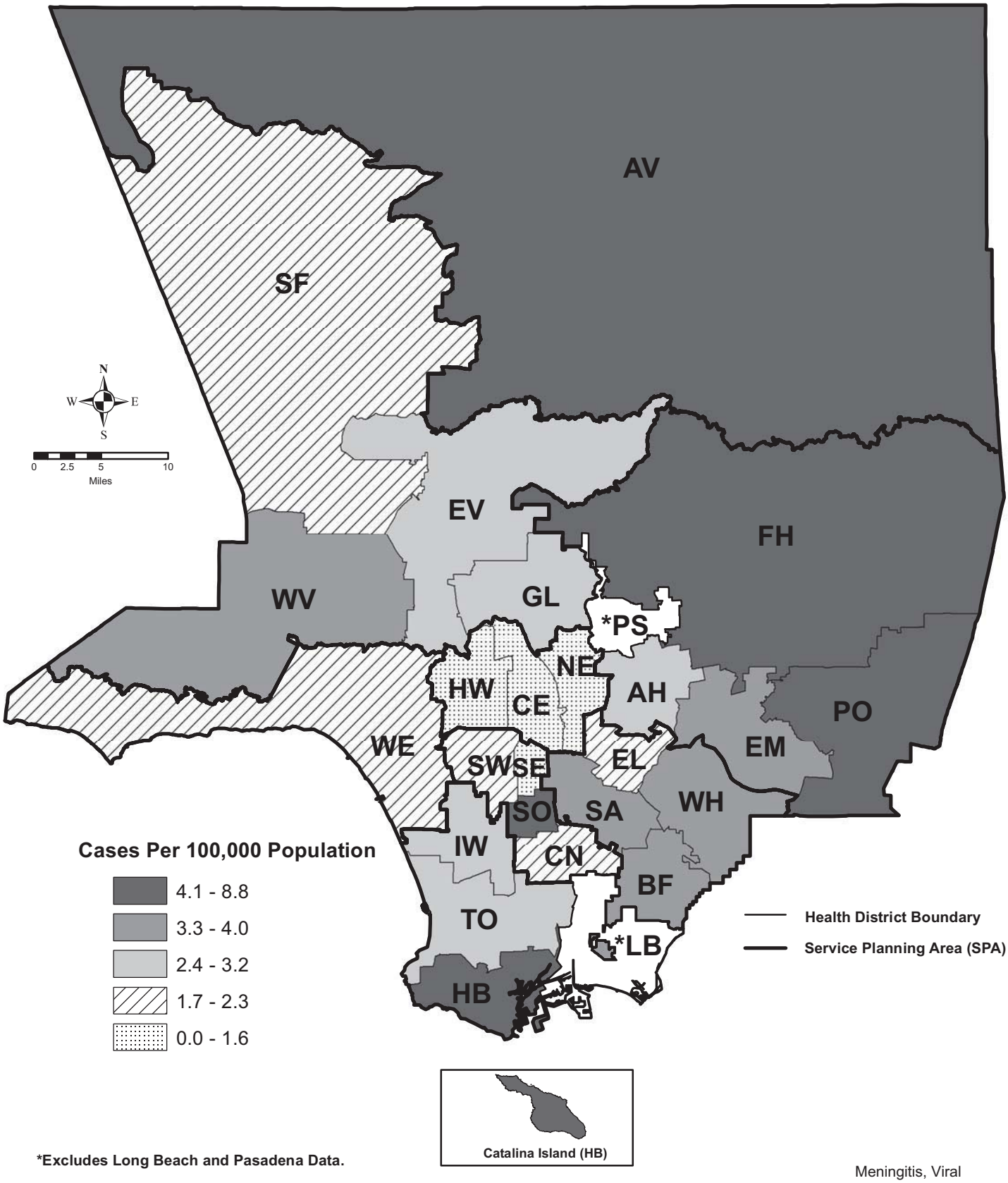


Figure 6. Incidence Rates of Viral Meningitis by Race/Ethnicity LAC, 2006-2011



Map 10. Meningitis, Viral
Rates by Health District, Los Angeles County, 2011*



*Excludes Long Beach and Pasadena Data.

MENINGITIS, VIRAL

CRUDE DATA	
Number of Cases	570
Annual Incidence[a]	
LA County	5.81
Age at Diagnosis	
Mean	22.8
Median	16
Range	0-92

[a]Cases per 100,000 population.

DESCRIPTION

Viruses are the major cause of aseptic meningitis syndrome, a term used to define any meningitis (infectious or noninfectious), particularly one with a cerebrospinal fluid lymphocytic pleocytosis, for which a cause is not apparent after initial evaluation and routine stains and cultures do not support a bacterial or fungal etiology. Viral meningitis can occur at any age but is most common among the very young. Symptoms are characterized by sudden onset of fever, severe headache, stiff neck, photophobia, drowsiness or confusion, nausea and vomiting and usually last from seven to ten days.

The most common cause of viral meningitis is the nonpolio enteroviruses which are not vaccine-preventable and account for 85% to 95% of all cases in which a pathogen is identified. Transmission of enteroviruses may be by the fecal-oral, respiratory or other route specific to the etiologic agent. Other viral agents that can cause viral meningitis include herpes simplex virus, varicella-zoster virus, mumps virus, lymphocytic choriomeningitis virus, human immunodeficiency virus, adenovirus, parainfluenza virus type 3, influenza virus, measles virus and arboviruses, such as West Nile virus (WNV). In most cases, supportive measures are the usual treatments for viral meningitis; several are vaccine-preventable; recovery is usually complete and associated with low mortality rates. Antiviral agents are available for viral meningitis associated with herpes simplex and varicella-zoster viruses.

Good personal hygiene, especially hand washing and avoiding contact with oral secretions of others, is the most practical and effective preventive measure.

2010 TRENDS AND HIGHLIGHTS

- In 2010, viral/aseptic meningitis incidence increased by 41% from 4.1 per 100,000 from 2009 to 5.8 cases per 100,000 (Figure 1).
- Viral/aseptic meningitis increased greatest among blacks in 2010 compared to other racial/ethnic groups, from 2.7 cases per 100,000 in 2009 to 7.5 per 100,000 in 2010 (Figure 6).
- SPA 1 (Antelope Valley) continually carries the highest rates of viral meningitis in LAC (12.1 per 100,000 in 2010) (Figure 4). This is most likely due to better reporting by the main hospital that serves the area rather than an effect of age group distribution. The proportion of SPA 1 that is <1 year of age is only slightly higher than LAC as a whole (1.7% versus 1.4%, respectively).
- Of the 78 cases (14%) in which an etiology was identified, 62 (79%) were caused by an enterovirus and 2 (<1%) by WNV.
- Three deaths (<1%) were reported; their etiologies were not determined.

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

	2006 (N=373)			2007 (N=395)			2008 (N=597)			2009 (N=399)			2010 (N=570)		
	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000
Age Group															
<1	71	19.0	49.0	75	19.0	50.7	80	13.4	57.3	53	13.3	38.6	89	15.6	63.8
1-4	14	3.8	2.4	11	2.8	1.9	24	4.0	4.2	14	3.5	2.5	33	5.8	5.7
5-14	47	12.6	3.2	45	11.4	3.1	148	24.8	10.5	71	17.8	5.2	138	24.2	10.4
15-34	111	29.8	4.0	120	30.4	4.3	164	27.5	5.7	148	37.1	5.2	164	28.8	5.6
35-44	53	14.2	3.5	58	14.7	3.9	52	8.7	3.4	42	10.5	2.8	56	9.8	3.9
45-54	42	11.3	3.2	42	10.6	3.2	44	7.4	3.3	34	8.5	2.5	39	6.8	2.9
55-64	23	6.2	2.6	14	3.5	1.6	29	4.9	3.2	18	4.5	1.9	17	3.0	1.8
65+	10	2.7	1.0	29	7.3	2.9	51	8.5	5.0	19	4.8	1.8	33	5.8	3.1
Unknown	2	0.5		1	0.3		5	0.8		0	0.0		1	0.2	
Race / Ethnicity															
Asian	29	7.8	2.3	30	7.6	2.3	37	6.2	2.8	21	5.3	1.6	36	6.3	2.7
Black	33	8.8	3.9	28	7.1	3.3	43	7.2	5.0	23	5.8	2.7	64	11.2	7.5
Hispanic	195	52.3	4.2	179	45.3	3.9	275	46.1	5.9	208	52.1	4.4	259	45.4	5.5
White	101	27.1	3.5	108	27.3	3.7	121	20.3	4.2	80	12.5	2.7	112	19.6	3.9
Other	5	1.3	17.5	6	1.5	28.8	20	3.4	81.1	4	1.0		13	2.3	
Unknown	10	2.7		44	11.1		101	16.9		63	15.8		86	15.1	
SPA															
1	45	12.1	12.9	35	8.9	9.8	69	11.6	18.8	46	11.5	12.5	45	7.9	12.1
2	72	19.3	3.4	84	21.3	3.9	80	13.4	3.7	88	22.1	4.0	86	15.1	3.9
3	78	20.9	4.5	63	15.9	3.6	86	14.4	5.0	63	15.8	3.6	98	17.2	5.6
4	23	6.2	1.8	16	4.1	1.3	24	4.0	1.9	18	4.5	1.4	29	5.1	2.3
5	10	2.7	1.6	13	3.3	2.0	29	4.9	4.5	22	5.5	3.4	13	2.3	2.0
6	31	8.3	3.0	42	10.6	4.0	79	13.2	7.5	45	11.3	4.3	76	13.3	7.1
7	59	15.8	4.3	73	18.5	5.3	131	21.9	9.5	62	15.5	4.5	92	16.1	6.7
8	52	13.9	4.7	63	15.9	5.6	90	15.1	8.0	53	13.3	4.7	121	21.2	10.8
Unknown	3	0.8		6	1.5		9	1.5		2	0.5		10	1.8	

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

Figure 1. Incidence Rates of Viral Meningitis LAC, 1999-2010

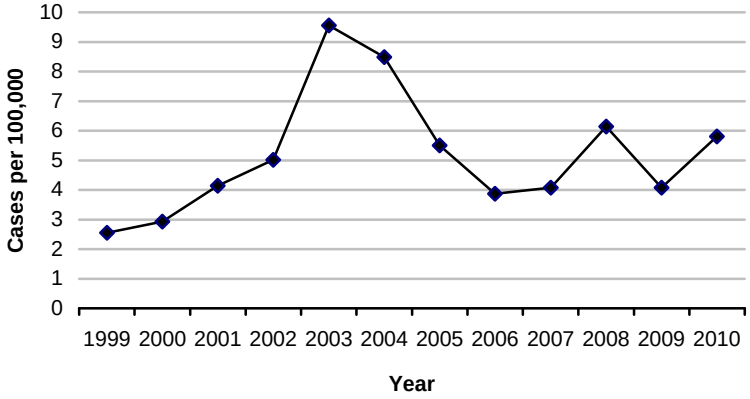


Figure 2. Incidence Rates of Viral Meningitis by Age Group LAC, 2010 (N=570)

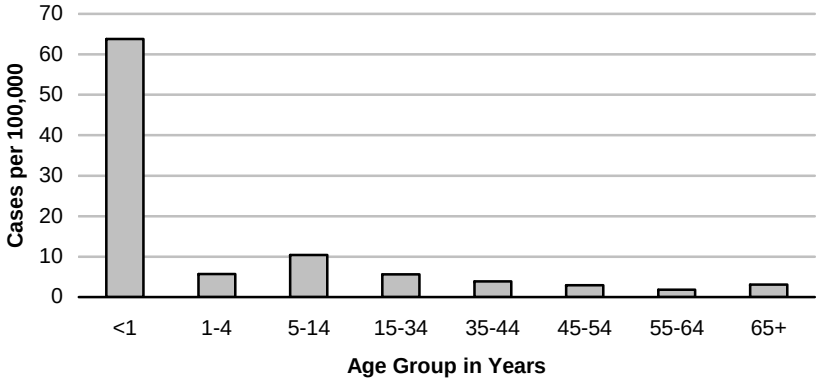


Figure 3. Percent Cases of Viral Meningitis by Race/Ethnicity, LAC, 2010 (N=570)

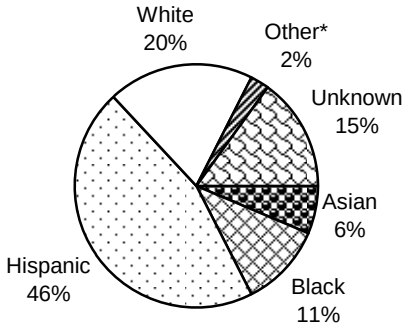
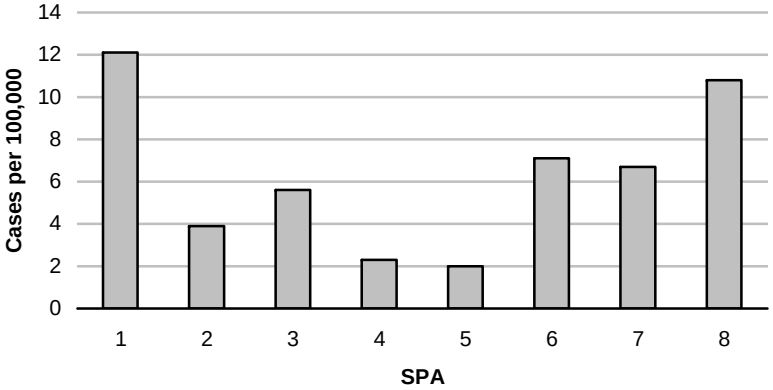


Figure 4. Incidence Rates of Viral Meningitis by SPA LAC, 2010 (N=570)



* Other includes Native American and any additional racial/ethnic group that cannot be categorized as Asian, black, Hispanic, or white.

Figure 5. Reported Viral Meningitis Cases by Month of Onset
LAC, 2010 (N=570)

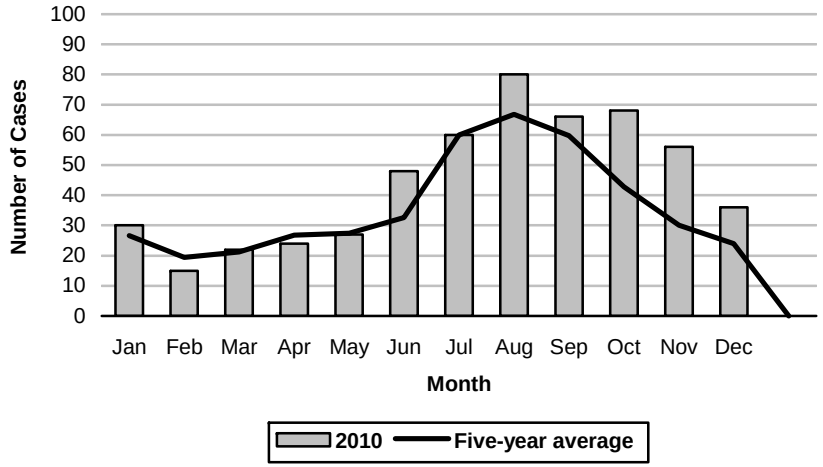
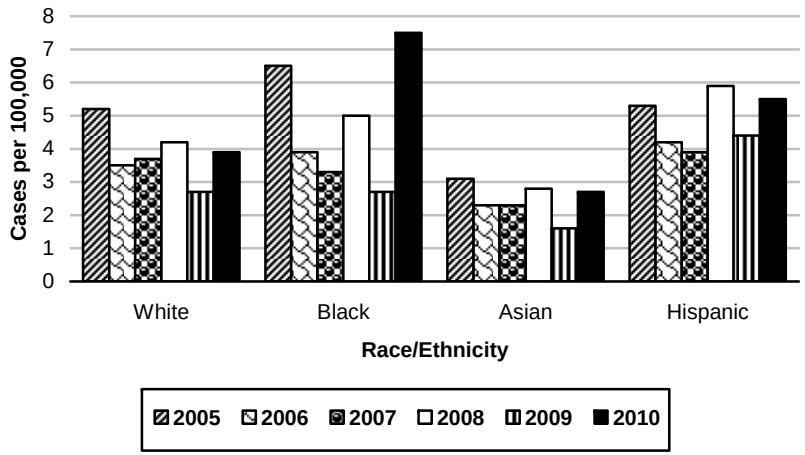


Figure 6. Incidence Rates of Viral Meningitis by Race/Ethnicity
LAC, 2005-2010



MENINGITIS, VIRAL

CRUDE DATA	
Number of Cases	399
Annual Incidence[a]	
LA County	4.1
Age at Diagnosis	
Mean	25.0
Median	21
Range	0-87

[a]Cases per 100,000 population.

DESCRIPTION

Viruses are the major cause of aseptic meningitis syndrome, a term used to define any meningitis (infectious or noninfectious), particularly one with a cerebrospinal fluid lymphocytic pleocytosis, for which a cause is not apparent after initial evaluation and routine stains and cultures do not support a bacterial or fungal etiology. Viral meningitis can occur at any age but is most common among the very young. Symptoms are characterized by sudden onset of fever, severe headache, stiff neck, photophobia, drowsiness or confusion, nausea and vomiting and usually last from seven to ten days.

The most common cause of viral meningitis is nonpolio enteroviruses which are not vaccine-preventable and account for 85% to 95% of all cases in which a pathogen is identified. Transmission of enteroviruses may be by the fecal-oral, respiratory or other route specific to the etiologic agent. Other viral agents that can cause viral meningitis include herpes simplex virus, varicella-zoster virus, mumps virus, lymphocytic choriomeningitis virus, human immunodeficiency virus, adenovirus, parainfluenza virus type 3, influenza virus, measles virus and arboviruses, such as West Nile virus (WNV). In most cases, supportive measures are the usual treatments for viral meningitis and several are vaccine-preventable; recovery is usually complete and associated with low mortality rates. Antiviral agents are available for viral meningitis associated with herpes simplex and varicella-zoster viruses.

Good personal hygiene, especially hand washing and avoiding contact with oral secretions of others, is the most practical and effective preventive measure.

2009 TRENDS AND HIGHLIGHTS

- In 2009, viral/aseptic meningitis incidence decreased by 33% to 4.1 per 100,000 compared to 6.1 cases per 100,000 in 2008; 2009 incidence rates were consistent with 2006 and 2007.(Figure 1). The spike seen in 2008 (6.1 per 100,000) was most likely due to a pediatric enterovirus active surveillance project that ran from late 2007 through 2008.
- Infants <1 year of age had the highest age- specific incidence rate, 38.6 cases per 100,000, compared to other age groups.
- SPA 1 (Antelope Valley) continually carries the highest rates of viral meningitis in LAC (12.5 per 100,000 in 2009). The reasons for the trend are unknown. Though the population of Antelope Valley has a high proportion of infants <1 year old (1.7%), it is not the highest. Two percent of the SPA 6 population is <1 year old.
- Of the 54 cases (14%) in which an etiology was identified, 36 (67%) were caused by an enterovirus and 9 (17%) by WNV.
- One death was reported; the etiology was not determined.

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

	2005 (N=530)			2006 (N=373)			2007 (N=395)			2008 (N=597)			2009 (N=399)		
	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000
Age Group															
<1	73	13.8	51.8	71	19.0	49.0	75	19.0	50.7	80	13.4	57.3	53	13.3	38.6
1-4	23	4.3	4.0	14	3.8	2.4	11	2.8	1.9	24	4.0	4.2	14	3.5	2.5
5-14	91	17.2	6.1	47	12.6	3.2	45	11.4	3.1	148	24.8	10.5	71	17.8	5.2
15-34	147	27.7	5.2	111	29.8	4.0	120	30.4	4.3	164	27.5	5.7	148	37.1	5.2
35-44	91	17.2	6.0	53	14.2	3.5	58	14.7	3.9	52	8.7	3.4	42	10.5	2.8
45-54	49	9.2	3.9	42	11.3	3.2	42	10.6	3.2	44	7.4	3.3	34	8.5	2.5
55-64	31	5.8	3.7	23	6.2	2.6	14	3.5	1.6	29	4.9	3.2	18	4.5	1.9
65+	23	4.3	2.4	10	2.7	1.0	29	7.3	2.9	51	8.5	5.0	19	4.8	1.8
Unknown	2	0.4		2	0.5		1	0.3		5	0.8		0	0	
Race / Ethnicity															
Asian	41	7.7	3.3	29	7.8	2.3	30	7.6	2.3	37	6.2	2.8	21	5.3	1.6
Black	56	10.6	6.6	33	8.8	3.9	28	7.1	3.3	43	7.2	5.0	23	5.8	2.7
Hispanic	250	47.2	5.5	195	52.3	4.2	179	45.3	3.9	275	46.1	5.9	208	52.1	4.4
White	155	29.2	5.3	101	27.1	3.5	108	27.3	3.7	121	20.3	4.2	80	12.5	2.7
Other	3	0.6	10.6	5	1.3	17.5	6	1.5	28.8	20	3.4	81.1	4	1.0	
Unknown	25	4.7		10	2.7		44	11.1		101	16.9		63	15.8	
SPA															
1	41	7.7	12.0	45	12.1	12.9	35	8.9	9.8	69	11.6	18.8	46	11.5	12.5
2	98	18.5	4.6	72	19.3	3.4	84	21.3	3.9	80	13.4	3.7	88	22.1	4.0
3	106	20.0	6.2	78	20.9	4.5	63	15.9	3.6	86	14.4	5.0	63	15.8	3.6
4	42	7.9	3.4	23	6.2	1.8	16	4.1	1.3	24	4.0	1.9	18	4.5	1.4
5	11	2.1	1.7	10	2.7	1.6	13	3.3	2.0	29	4.9	4.5	22	5.5	3.4
6	40	7.5	3.9	31	8.3	3.0	42	10.6	4.0	79	13.2	7.5	45	11.3	4.3
7	118	22.3	8.6	59	15.8	4.3	73	18.5	5.3	131	21.9	9.5	62	15.5	4.5
8	64	12.1	5.8	52	13.9	4.7	63	15.9	5.6	90	15.1	8.0	53	13.3	4.7
Unknown	10	1.9		3	0.8		6	1.5		9	1.5		2	0.5	

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

Figure 1. Incidence Rates of Viral Meningitis LAC, 1999-2009

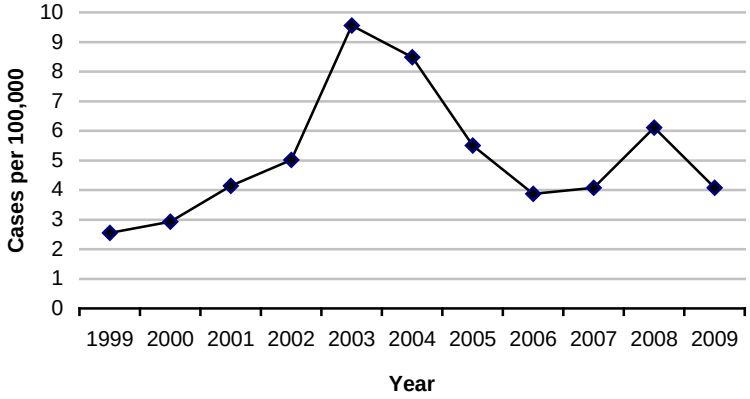


Figure 2. Incidence Rates of Viral Meningitis by Age Group LAC, 2009 (N=399)

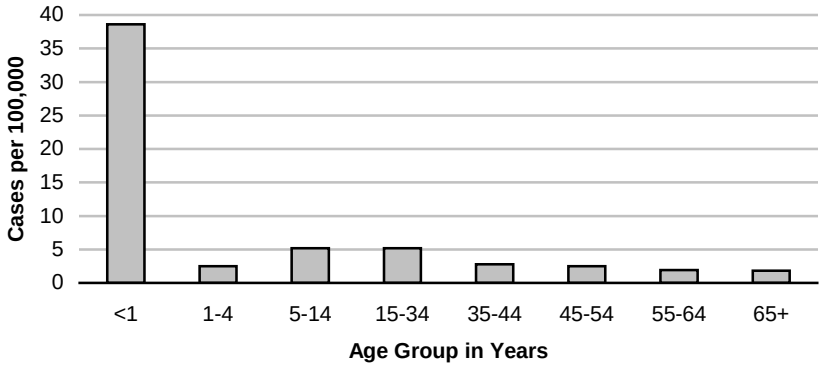


Figure 3. Percent Cases of Viral Meningitis by Race/Ethnicity, LAC, 2009 (N=399)

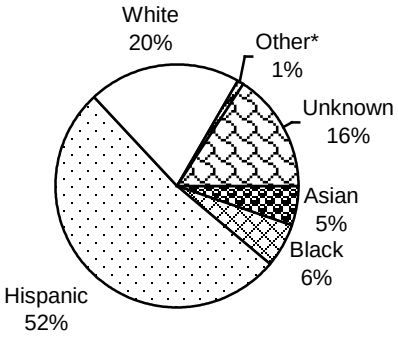
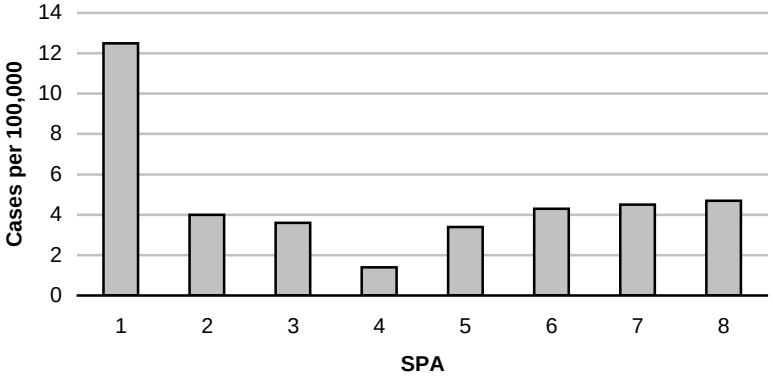


Figure 4. Incidence Rates of Viral Meningitis by SPA LAC, 2009 (N=399)



* Other includes Native American and any additional racial/ethnic group that cannot be categorized as Asian, black, Hispanic, or white.

Figure 5. Reported Viral Meningitis Cases by Month of Onset
LAC, 2009 (N=399)

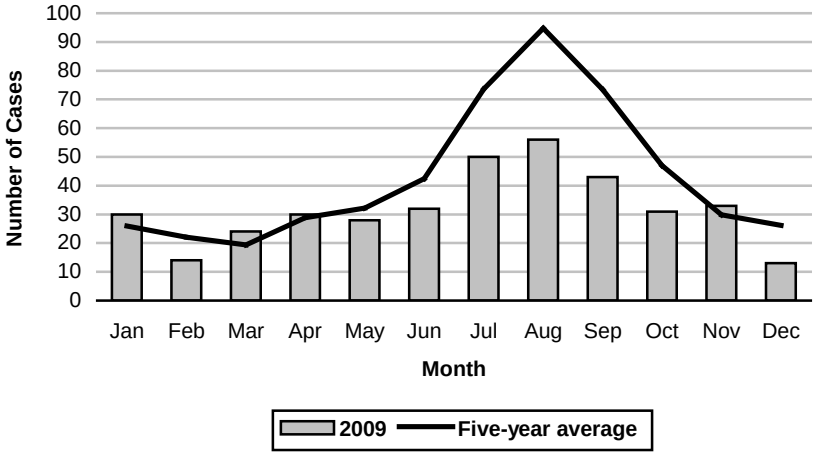
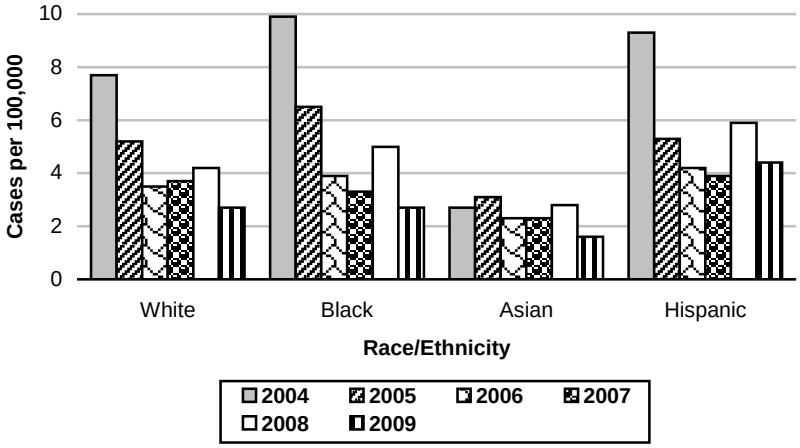
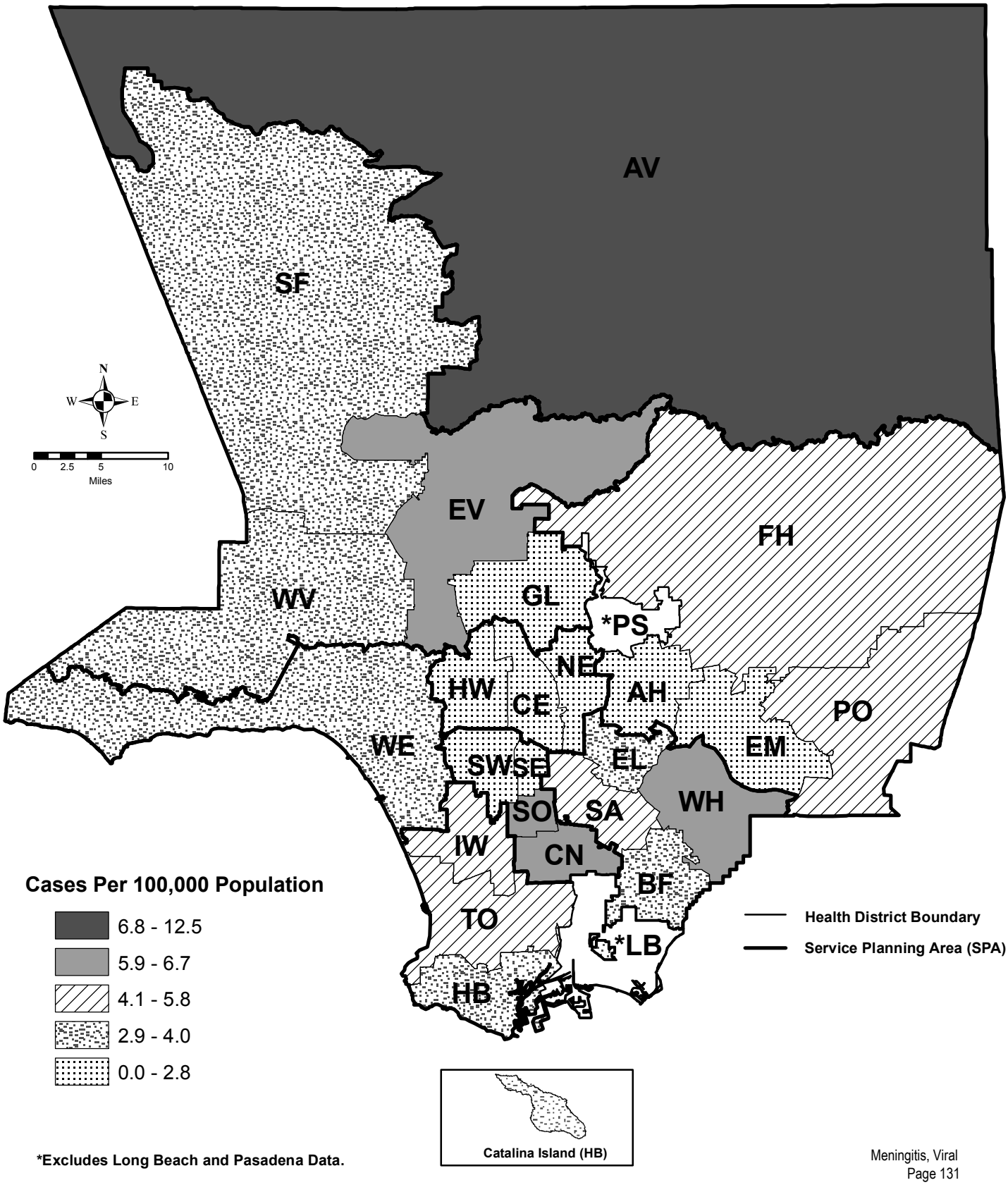


Figure 6. Incidence Rates of Viral Meningitis by Race/Ethnicity
LAC, 2004-2009



Map 9. Meningitis, Viral
Rates by Health District, Los Angeles County, 2009*



*Excludes Long Beach and Pasadena Data.

MENINGITIS, VIRAL

CRUDE DATA	
Number of Cases	597
Annual Incidence[a]	
LA County	6.1
Age at Diagnosis	
Mean	25.3
Median	18
Range	0-100

[a]Cases per 100,000 population.

DESCRIPTION

Viruses are the major cause of aseptic meningitis syndrome, a term used to define any meningitis (infectious or noninfectious), particularly one with a cerebrospinal fluid lymphocytic pleocytosis, for which a cause is not apparent after initial evaluation and routine stains and cultures do not support a bacterial or fungal etiology. Viral meningitis can occur at any age but is most common among the very young. Symptoms are characterized by sudden onset of fever, severe headache, stiff neck, photophobia, drowsiness or confusion, nausea and vomiting and usually last from 7 to 10 days.

Nonpolio enteroviruses, the most common cause of viral meningitis, are not vaccine-preventable and account for 85% to 95% of all cases in which a pathogen is identified. Transmission of enteroviruses may be by the fecal-oral, respiratory or other route specific to the etiologic agent. Other viral agents that can cause viral meningitis include herpes simplex virus, varicella-zoster virus, mumps virus, lymphocytic choriomeningitis virus, human immunodeficiency virus, adenovirus, parainfluenza virus type 3, influenza virus, measles virus and arboviruses, such as West Nile virus (WNV). In most cases, supportive measures are the usual treatments for viral meningitis; recovery is usually complete and associated with low mortality rates. Antiviral agents are available for viral meningitis associated with herpes simplex and varicella-zoster viruses.

Good personal hygiene, especially hand washing and avoiding contact with oral secretions of others, is the most practical and effective preventive measure.

2008 TRENDS AND HIGHLIGHTS

- In 2008, viral/aseptic meningitis incidence increased by approximately 33 % compared to 2007 (6.1 per 100,000 from 4.1 per 100,000) (Figure 1). This is most likely due to a pediatric enterovirus active surveillance project that began in late 2007, as the increase is seen specifically in younger age groups.
- Of the 157 (26%) cases in which an etiology was identified, 81 (52%) were caused by an enterovirus and 55 (35%) by WNV.
- Three deaths were reported; the etiologies were not determined.

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

	2004 (N=807)			2005 (N=530)			2006 (N=373)			2007 (N=395)			2008 (N=597)		
	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000
Age Group															
<1	85	10.5	59.7	73	13.8	51.8	71	19.0	49.0	75	19.0	50.7	80	13.4	57.3
1-4	37	4.6	6.4	23	4.3	4.0	14	3.8	2.4	11	2.8	1.9	24	4.0	4.2
5-14	192	23.8	12.9	91	17.2	6.1	47	12.6	3.2	45	11.4	3.1	148	24.8	10.5
15-34	202	25.0	7.2	147	27.7	5.2	111	29.8	4.0	120	30.4	4.3	164	27.5	5.7
35-44	112	13.9	7.5	91	17.2	6.0	53	14.2	3.5	58	14.7	3.9	52	8.7	3.4
45-54	78	9.7	6.3	49	9.2	3.9	42	11.3	3.2	42	10.6	3.2	44	7.4	3.3
55-64	51	6.3	6.4	31	5.8	3.7	23	6.2	2.6	14	3.5	1.6	29	4.9	3.2
65+	47	5.8	5.0	23	4.3	2.4	10	2.7	1.0	29	7.3	2.9	51	8.5	5.0
Unknown	3	0.4		2	0.4		2	0.5		1	0.3		5	0.8	
Race / Ethnicity															
Asian	33	4.1	2.7	41	7.7	3.3	29	7.8	2.3	30	7.6	2.3	37	6.2	2.8
Black	85	10.5	9.9	56	10.6	6.6	33	8.8	3.9	28	7.1	3.3	43	7.2	5.0
Hispanic	416	51.5	9.3	250	47.2	5.5	195	52.3	4.2	179	45.3	3.9	275	46.1	5.9
White	224	27.8	7.7	155	29.2	5.3	101	27.1	3.5	108	27.3	3.7	121	20.3	4.2
Other	9	1.1	32.4	3	0.6	10.6	5	1.3	17.5	6	1.5	28.8	20	3.4	81.1
Unknown	40	5.0		25	4.7		10	2.7		44	11.1		101	16.9	
SPA															
1	41	5.1	12.4	41	7.7	12.0	45	12.1	12.9	35	8.9	9.8	69	11.6	18.8
2	152	18.8	7.2	98	18.5	4.6	72	19.3	3.4	84	21.3	3.9	80	13.4	3.7
3	169	20.9	9.9	106	20.0	6.2	78	20.9	4.5	63	15.9	3.6	86	14.4	5.0
4	56	6.9	4.5	42	7.9	3.4	23	6.2	1.8	16	4.1	1.3	24	4.0	1.9
5	28	3.5	4.4	11	2.1	1.7	10	2.7	1.6	13	3.3	2.0	29	4.9	4.5
6	87	10.8	8.5	40	7.5	3.9	31	8.3	3.0	42	10.6	4.0	79	13.2	7.5
7	177	21.9	13.0	118	22.3	8.6	59	15.8	4.3	73	18.5	5.3	131	21.9	9.5
8	88	10.9	8.0	64	12.1	5.8	52	13.9	4.7	63	15.9	5.6	90	15.1	8.0
Unknown	9	1.1		10	1.9		3	0.8		6	1.5		9	1.5	

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

Figure 1. Incidence Rates of Viral Meningitis LAC, 1999-2008

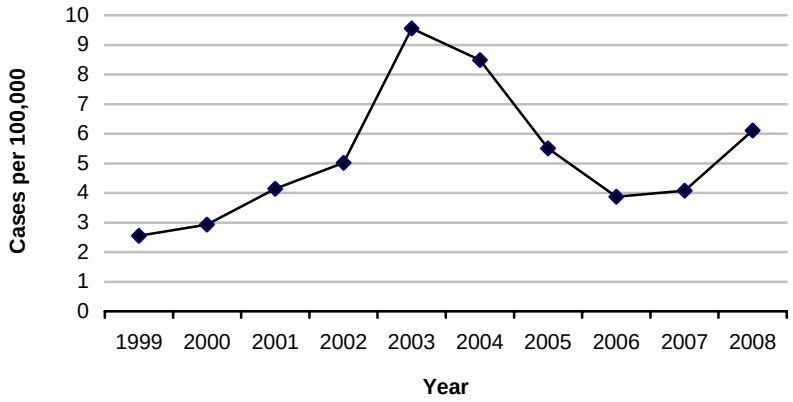


Figure 2. Incidence Rates of Viral Meningitis by Age Group LAC, 2008

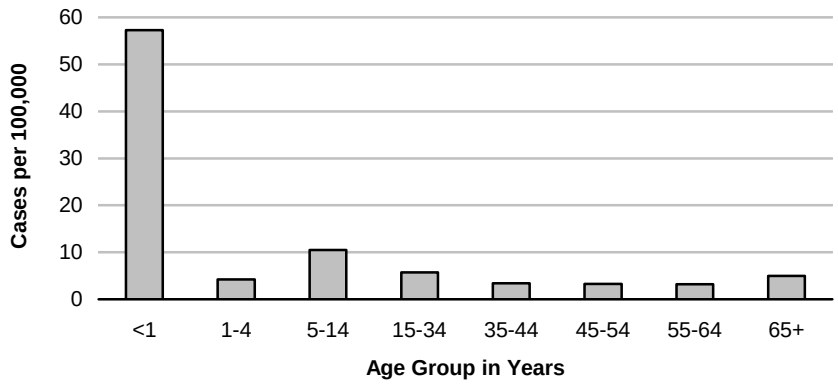


Figure 3. Percent Cases of Viral Meningitis by Race/Ethnicity, LAC, 2008

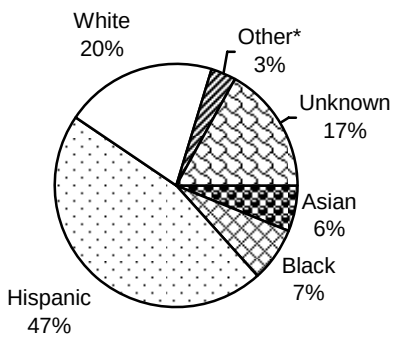
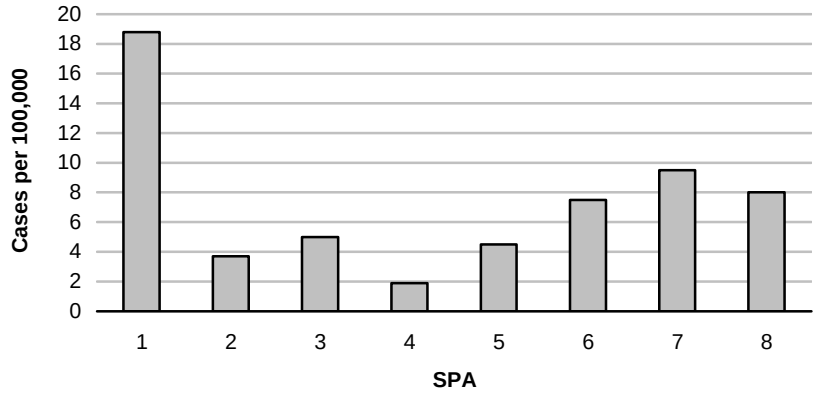


Figure 4. Incidence Rates of Viral Meningitis by SPA LAC, 2008



* Other includes Native American and any additional racial/ethnic group that cannot be categorized as Asian, black, Hispanic, or white.

Figure 5. Reported Viral Meningitis Cases by Month of Onset LAC, 2008

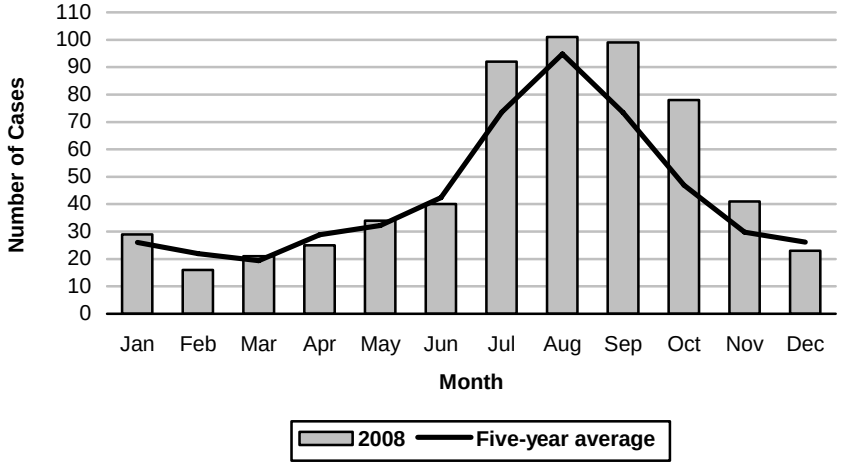
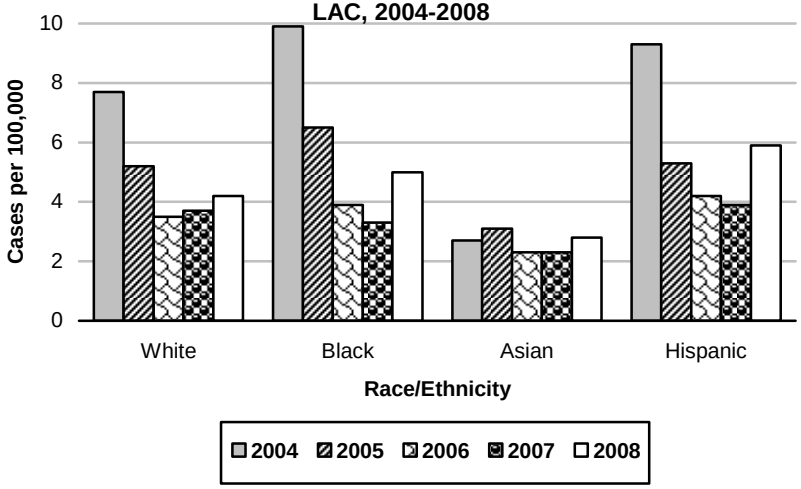
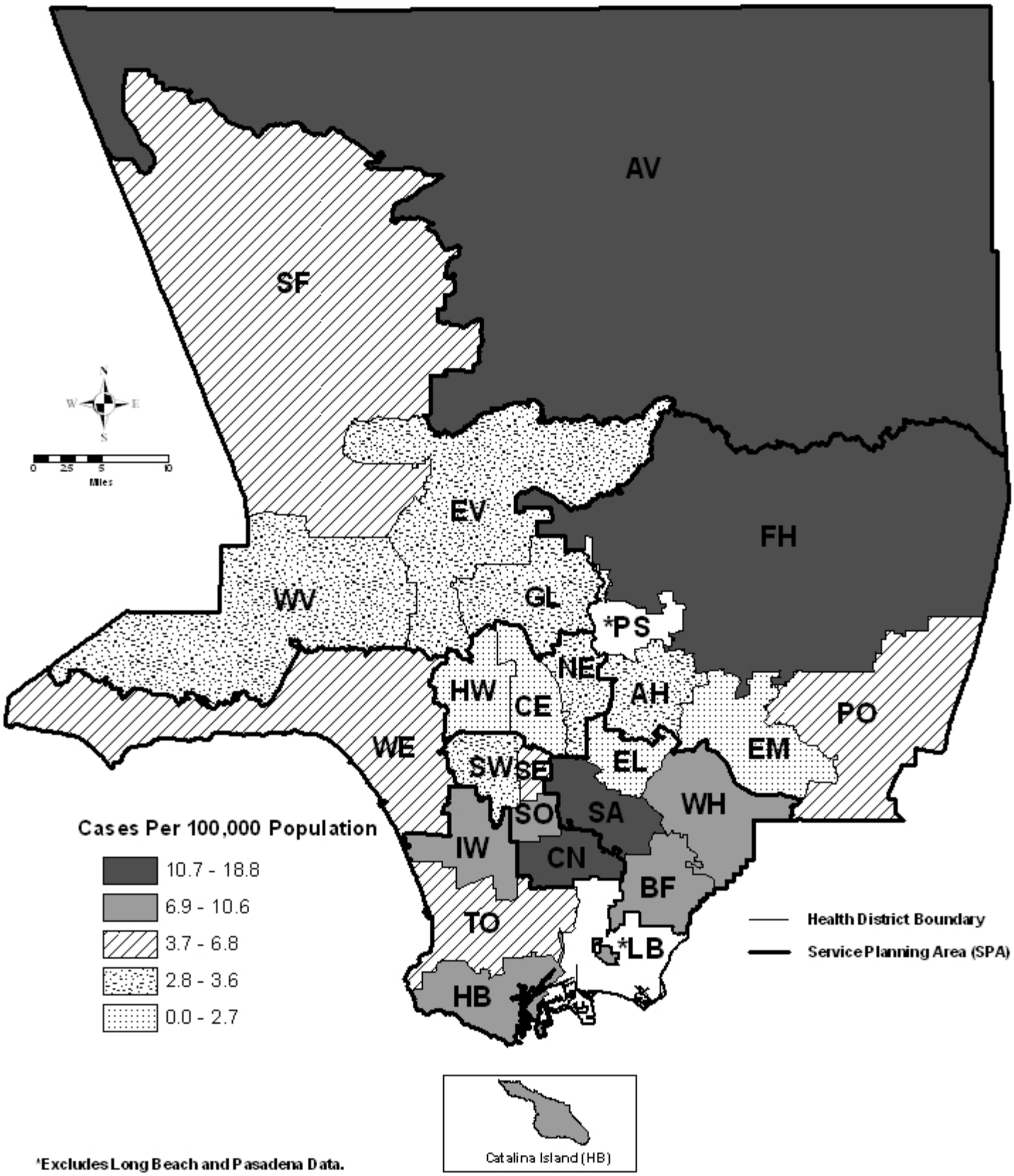


Figure 6. Incidence Rates of Viral Meningitis by Race/Ethnicity LAC, 2004-2008



Map 10. Meningitis, Viral
Rates by Health District, Los Angeles County, 2008*



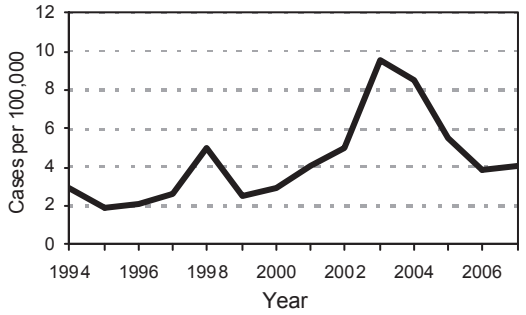
*Excludes Long Beach and Pasadena Data.

MENINGITIS, VIRAL

CRUDE DATA	
Number of Cases	395
Annual Incidence[a]	
LA County	4.1
United States	N/A
Age at Onset	
Mean	27
Median	25
Range	0–84 years

[a] Cases per 100,000 population.

Figure 1
Viral Meningitis
Incidence Rates by Year of Onset
LAC, 1994–2007



DESCRIPTION

Viruses are the major cause of aseptic meningitis syndrome, a term used to define any meningitis (infectious or noninfectious), particularly one with a cerebrospinal fluid lymphocytic pleocytosis, for which a cause is not apparent after initial evaluation and routine stains and cultures do not support a bacterial or fungal etiology. Viral meningitis can occur at any age but is most common among the very young. Symptoms are characterized by sudden onset of fever, severe headache, stiff neck, photophobia, drowsiness or confusion, nausea and vomiting and usually last from 7 to 10 days.

Nonpolio enteroviruses, the most common cause of viral meningitis, are not vaccine-preventable and account for 85% to 95% of all cases in which a pathogen is identified. Estimates from the Centers for Disease Control and Prevention (CDC) indicate that 10 to 15 million symptomatic enteroviral infections occur annually in the United States, which includes 30,000 to 75,000 cases of meningitis. Transmission of enteroviruses may be by the fecal-oral, respiratory or other route specific to the etiologic agent.

Other viral agents that can cause viral meningitis include herpes simplex virus, varicella-zoster virus, mumps virus, lymphocytic choriomeningitis virus, human immunodeficiency virus, adenovirus, parainfluenza virus type 3, influenza virus, measles virus and arboviruses, such as West Nile virus (WNV). Since its arrival in Southern California in 2003, WNV has become an important cause of viral meningitis, especially during the summer and fall among adults; and the appropriate diagnostic tests should be obtained.

Treatment for most forms of viral meningitis is supportive; recovery is usually complete and associated with low mortality rates. Antiviral agents are available for treatment of viral meningitis due to several herpes viruses: herpes simplex virus-1 (HSV-1), HSV-2, and varicella-zoster virus. Supportive measures, and to a lesser extent antiviral agents, are the usual treatments for viral meningitis.

DISEASE ABSTRACT

- The incidence of viral meningitis has continued to be low compared to the peak in 2003 (Figure 1).
- WNV infection contributed to 4% of all reported cases of viral meningitis.
- Heightened surveillance conducted in late 2007 probably contributed to increased identification of viral meningitis cases caused by enterovirus as well as the overall number of cases.

Trends: In 2007, there were a total of 395 reported cases of viral meningitis, representing an annual incidence of 4.1 per 100,000. Though this is a small increase compared to the previous year when 373 cases were reported at an incidence of 3.9 cases per 100,000, this is a marked decrease from previous years when incidence was as high as 9.6 cases per 100,000 (2003) (Figure 1).

Seasonality: Enteroviruses demonstrate a seasonality in temperate climates that typically peaks in the late summer and early fall. WNV follows a similar pattern. The onset of viral meningitis cases in LAC usually follow this trend closely, as seen in the five-year average in Figure 2 where around a hundred cases are seen each month from July through September. This trend is also seen in 2007, peaking in August with 59 cases (Figure 2).

Figure 2
Viral Meningitis
Cases by Month of Onset
LAC, 2007

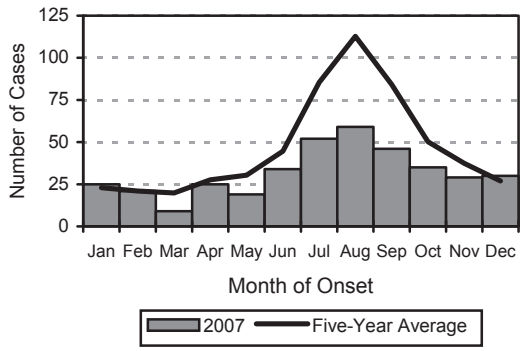


Figure 3
Viral Meningitis
Incidence Rates by Age Group
LAC, 2007 (N=395)

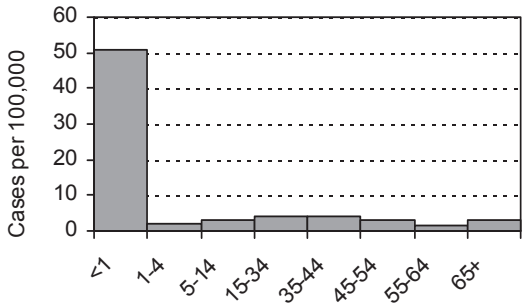
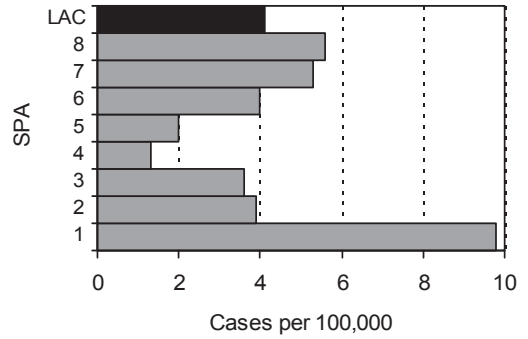


Figure 4
Viral Meningitis
Incidence Rates by SPA
LAC, 2007 (N=395)



Age: Infants less than 1 year old continued to have the highest age-group specific rate at 50.7 cases per 100,000 (Figure 3).

Sex: The male to female rate ratio of cases was 1:1.

Race/Ethnicity: The incidence rates across race and ethnicity groups ranged from 2.3 to 3.9 cases per 100,000, the lowest occurring in Asian/Pacific Islanders. The rates were similar among Hispanics, whites, and blacks (data not shown).

Location: The highest incidence of viral meningitis continued to occur in SPA 1 (9.8 per 100,000).

Clinical Presentation: The case fatality rate remained low; three deaths were reported in 2007 (less than one percent case fatality rate). Of the 70 cases in which an etiology was identified, 49 (70%) were caused by an enterovirus. More cases of WNV meningitis were reported (n=14, 20% among those with known etiologies) than in 2006. They accounted for 4% of all reported cases in 2007 but only 1% in 2006. The viral etiologies of 82% of cases in 2007 remain unknown.

COMMENTS

The highest incidence in LAC in 2007, as well as for previous years, occurred among children less than one and those with residence in SPA 1 (Antelope Valley). It is common for small children who are not yet toilet trained to transmit enteroviruses—the most frequently identified etiology of viral meningitis—to other children or to adults who change their diapers, as these viruses can be found in the stool of infected persons. Though SPA 1 has the smallest population (n=357,142) of all SPAs in LAC, it continually carries the highest rates of viral meningitis in LAC. Reasons for this trend are unknown.

In late 2007, an increased level of activity of coxsackie B1 virus, a type of enterovirus, was associated with severe neonatal disease and multiple deaths in LAC and other areas of the US. Though none of the deaths was associated with viral meningitis in LAC, this enterovirus can be associated with the syndrome as well as encephalitis, myelitis, and myopericarditis. It has an epidemic pattern of circulation, with increases usually lasting 2 to 3 years. As a result of the increase, LAC requested all hospitals in the county to report all enterovirus-positive cases of severe or fatal myocarditis, aseptic meningitis, or sepsis-like febrile illness that occurred among children during June through November 2007. Surveillance for viral meningitis is generally passive; this change in procedures may explain the slight rise in reported meningitis cases caused by enterovirus, as well as the overall number of viral meningitis cases for 2007. In 2006, only 4% of reported cases (n=15) had an etiology identified. Sixty percent of those cases (n=9) were caused by an enterovirus. This year, 18% (n=70) of reported cases had known etiologies and 70% (n=49) were enteroviruses. Active surveillance is being continued in 2008.

The emergence of WNV in LAC in 2003 and subsequent introduction of WNV surveillance have not markedly affected the trend in overall viral meningitis annual incidence rates. Since 2003, increased reporting of viral meningitis and testing for underlying WNV infection have been encouraged among health care providers and hospital infection control practitioners. However, the peak incidence of viral meningitis in LAC did not correspond with the peak incidence of WNV, which occurred in 2004. Further, WNV meningitis only contributed 10% of cases at its highest incidence in 2004 and has decreased considerably since then.

With passive surveillance, the number of cases reported annually is considered to be substantially lower than the actual burden of disease. Investigations are initiated only for outbreaks, not individual cases. Information about the causative agents of viral meningitis is rarely included with case reports because viral cultures and nucleic acid-based tests, such as PCR analysis of the cerebral spinal fluid, are not routinely performed at most medical facilities. Improvements in molecular testing capabilities should lead to faster diagnoses and more appropriate management of viral meningitis including less use of antibiotics plus fewer and shorter hospital admissions.

PREVENTION

Good personal hygiene, especially hand washing and avoiding contact with oral secretions of others, is the most practical and effective preventive measure.

ADDITIONAL RESOURCES

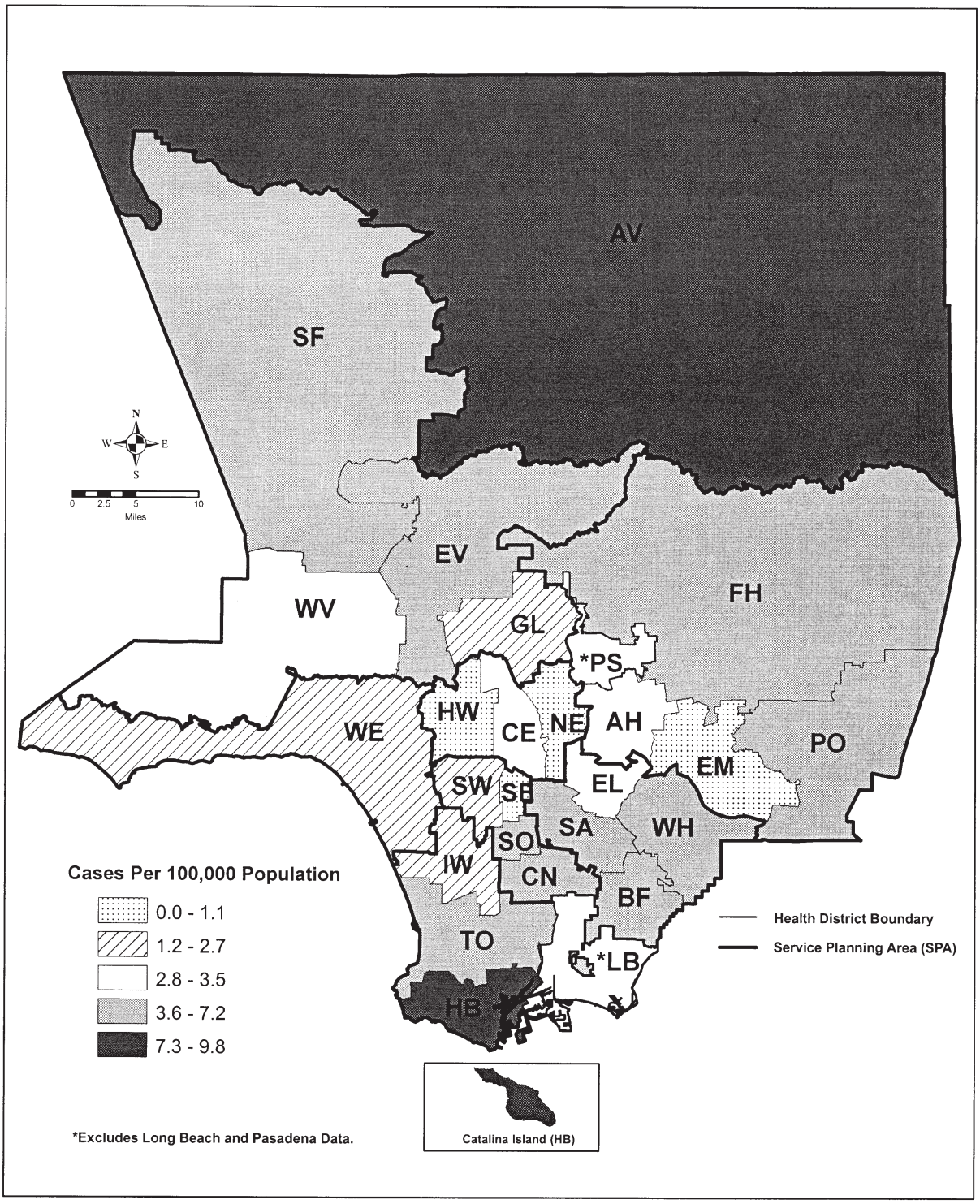
Centers for Disease Control and Prevention (2008). National Center for Immunization and Respiratory Diseases, Division of Bacterial Diseases, Viral (Aseptic) Meningitis at: http://www.cdc.gov/meningitis/viral/viral-faqs.htm

Centers for Disease Control and Prevention (2008). National Center for Immunization and Respiratory Diseases, Division of Viral Diseases, Non-Polio Enterovirus Infections at: http://www.cdc.gov/ncidod/dvrd/revb/enterovirus/non-polio_entero.htm

Centers for Disease Control and Prevention (2008). Increased detections and severe neonatal disease associated with coxsackievirus B1 infection—United States, 2007. *Morbidity and Mortality Weekly Report*, 57(20), 553-556. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5720a4.htm

Centers for Disease Control and Prevention (2003). Outbreaks of aseptic meningitis associated with echoviruses 9 and 30 and preliminary reports on enterovirus activity—United States, 2003. *Morbidity and Mortality Weekly Report*, 52(32), 761-764. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5232a1.htm

Map 10. Meningitis, Viral
Rates by Health District, Los Angeles County, 2007*

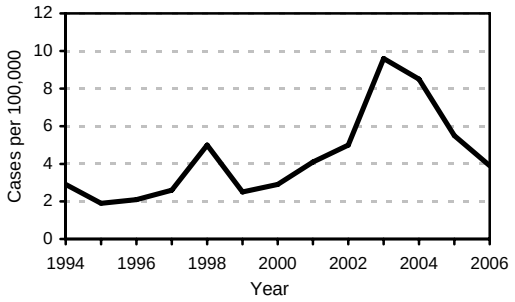


MENINGITIS, VIRAL

CRUDE DATA	
Number of Cases	373
Annual Incidence[a]	
LA County	3.9
United States	N/A
Age at Onset	
Mean	25
Median	24
Range	0–85 years

[a] Cases per 100,000 population.

Figure 1
Viral Meningitis
Incidence Rates by Year of Onset
LAC, 1994–2006



DESCRIPTION

Viruses are the major cause of aseptic meningitis syndrome, a term used to define any meningitis (infectious or noninfectious), particularly one with a lymphocytic pleocytosis, for which a cause is not apparent after initial evaluation and routine stains and cultures do not support a bacterial or fungal etiology. Viral meningitis can occur at any age but is most common among the very young. Symptoms are characterized by sudden onset of fever, severe headache, stiff neck, photophobia, drowsiness or confusion, nausea and vomiting and usually last from 7 to 10 days.

Nonpolio enteroviruses, the most common cause of viral meningitis, are not vaccine-preventable and account for 85% to 95% of all cases in which a pathogen is identified. Estimates from the Centers for Disease Control and Prevention (CDC) indicate that 10 to 15 million symptomatic enteroviral infections occur annually in the United States, which includes 30,000 to 75,000 cases of meningitis. Transmission of enteroviruses may be fecal-oral, respiratory or by another route specific to the etiologic agent.

Other viral agents that can cause viral meningitis include herpes simplex virus, varicella-zoster virus, mumps virus, lymphocytic choriomeningitis virus, human immunodefieciency virus, adenovirus, parainfluenza virus type 3, influenza virus, measles virus and arboviruses, such as West Nile virus (WNV). Since its arrival in Southern California in 2003, WNV should be considered an important cause of viral meningitis, especially during the summer and fall among adults; and the appropriate diagnostic tests should be obtained. Treatment for most forms of viral meningitis is supportive; recovery is usually complete and associated with low mortality rates. Antiviral agents are available for treatment of viral meningitis due to several herpes viruses: herpes simplex virus-1 (HSV-1), HSV-2, and varicella-zoster virus.

Supportive measures, and to a lesser extent antiviral agents, are the usual treatments for viral meningitis. Good personal hygiene, especially hand washing and avoiding contact with oral secretions of others, is the most practical and effective preventive measure.

DISEASE ABSTRACT

- The incidence of viral meningitis has continued to decrease since its peak in 2003 (Figure 1). The seasonal peak, usually very high, is seen only weakly this year (Figure 2).
- WNV infection contributed to fewer cases of viral meningitis in 2006 (1% of all cases) compared to 2005 (3%).
- No outbreaks were reported.

Trends: In 2006, there were a total of 373 cases of viral meningitis compared to 530 in 2005, representing a 30% decrease from 2005. The annual incidence also decreased, dropping from 5.5 per 100,000 in 2005 to 3.9 per 100,000 in 2006. This continues a decreasing trend from a peak incidence of 9.6 cases per 100,000 in 2003.

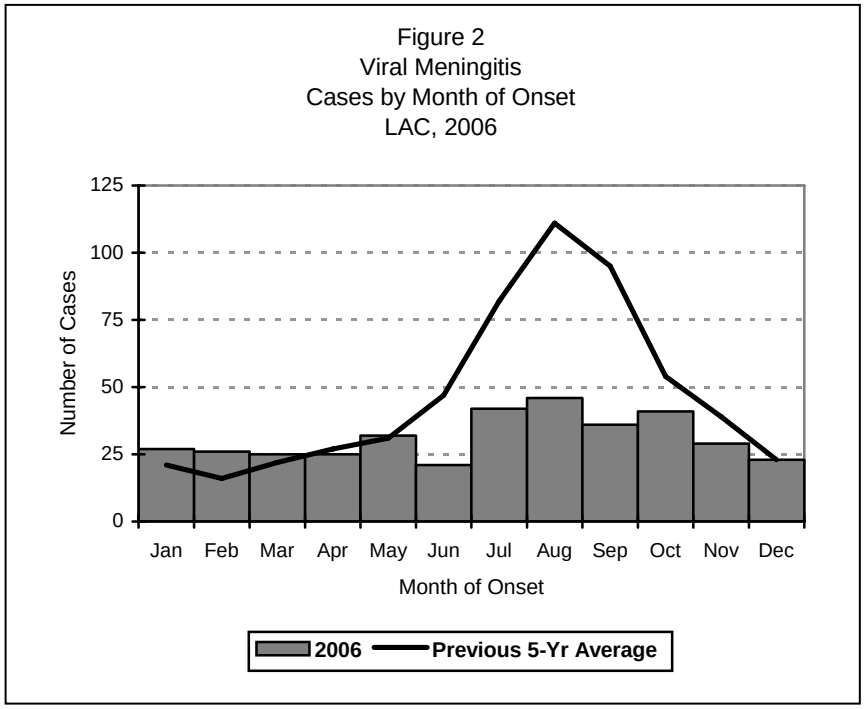
Seasonality: Enteroviruses demonstrate a seasonality in temperate climates that typically peaks in the late summer and early fall. WNV follows a similar pattern. The onset of viral meningitis cases in LAC usually follow this trend closely, as seen in the previous 5-year average in Figure 2 where approximately a hundred cases are seen each month from July through September. This trend appeared weakly in 2006, however, peaking in August with 46 cases (Figure 2).

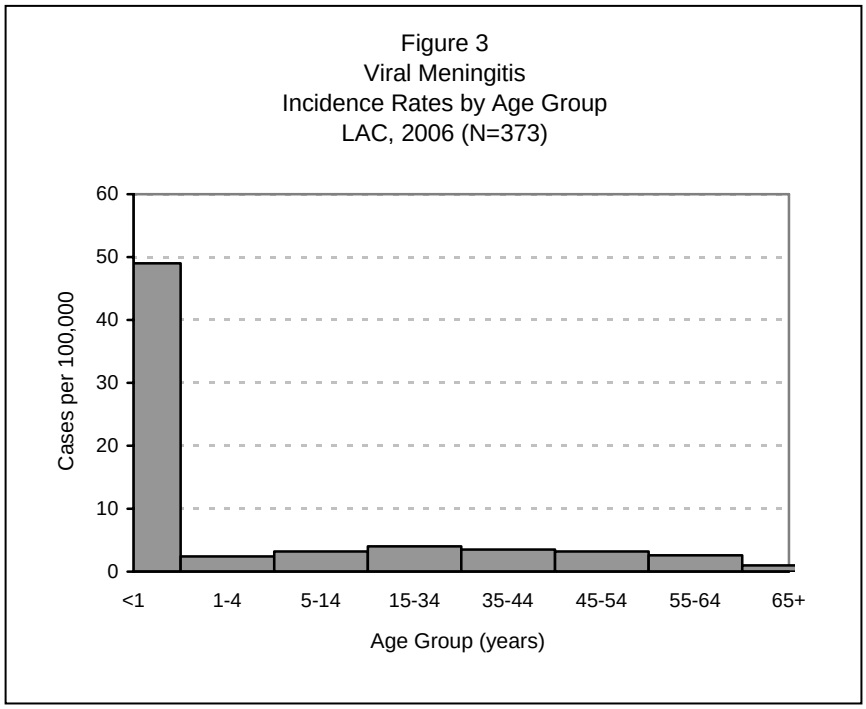
Age: Infants less than 1 year old continued to have the highest age-group specific rate at 49 cases per 100,000 (Figure 3).

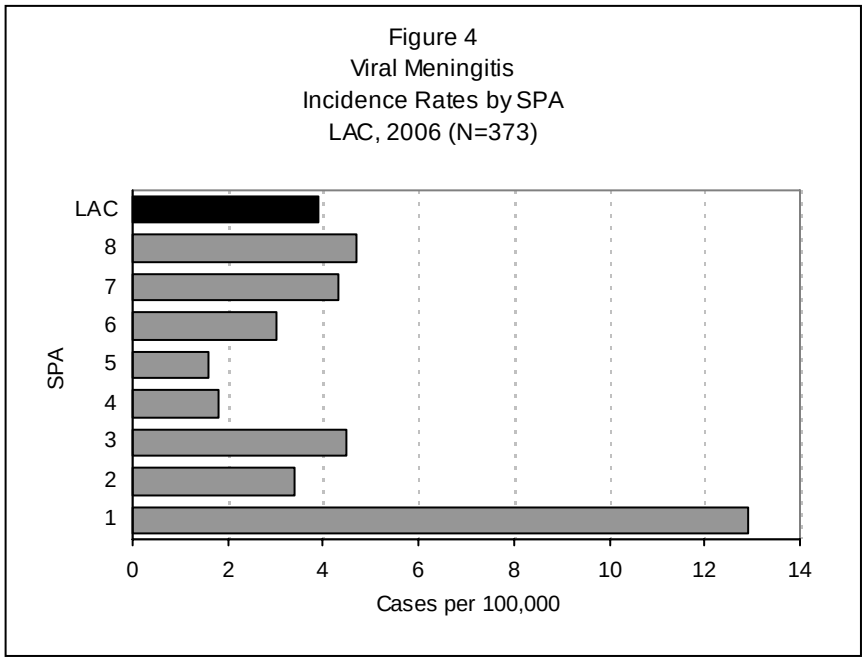
Sex: The male to female rate ratio of cases was nearly 1:1.

Race/Ethnicity: The incidence rates across race and ethnicity groups ranged from 2.3 to 4.2 cases per 100,000, the lowest occurring in Asian/Pacific Islanders. The rates were similar among Latinos, whites, and blacks (data not shown).

Location: The highest incidence of viral meningitis continued to occur in SPA 1 (13 per 100,000); the lowest in SPA 5 (1.6 per 100,000) (Figure 4). However, because SPA 5 had such a low case count (n=10), the calculated incidence rate is unstable.







Clinical Presentation: The case fatality rate remained low; only two deaths were reported in 2006 (less than one percent case fatality rate). Of the 15 cases in which an etiology was identified, 9 (60%) were caused by an enterovirus. WNV infection has been less prevalent as a cause of viral meningitis than in 2005. Only 27% of cases (n=4) in which an etiology was known, or 1% of all cases, were associated with WNV infection. However, the viral etiology is not investigated in all cases; the etiologies of 96% of cases in 2006 remain unknown.

COMMENTS

The highest incidence in LAC in 2006, as well as for previous years, occurred among children less than one and those with residence in SPA 1 (Antelope Valley). It is common for small children who are not yet toilet trained to transmit enteroviruses—the most frequently identified etiology of viral meningitis — to other children or to adults who change their diapers, as these viruses can be found in the stool of infected persons. Though SPA 1 has the smallest population (n=342,804) of all SPAs in LAC, it continually carries the highest rates of viral meningitis in LAC. Reasons for this trend are unknown.

The low incidence in 2006 continues a decreasing trend since a substantial peak in 2003. That peak coincided with national and regional outbreaks, including California, which occurred due to serotypes of enteroviruses that are associated with an epidemic circulation pattern. Individual enterovirus serotypes have different temporal patterns of circulation; and the changes in predominant serotypes can be accompanied by large-scale outbreaks. However, no predictable patterns exist for these serotypes or for viral meningitis in general. There is significant yearly variation and no long-term trends have been identified.

The emergence of WNV in LAC in 2003 and subsequent introduction of WNV surveillance have not markedly affected the trend in overall viral meningitis annual incidence rates. Since 2003, increased reporting of viral meningitis and testing for underlying WNV infection have been encouraged among health care providers and hospital infection control practitioners. However, the peak incidence of viral meningitis in LAC did not correspond with the peak incidence of WNV, which occurred in 2004. Further, WNV meningitis only contributed 10% of cases at its highest incidence in 2004 and has decreased considerably since then.

Because surveillance for viral meningitis is passive, the number of cases reported annually is considered to be substantially lower than the actual burden of disease. Investigations are initiated only for outbreaks, not individual cases. No outbreaks occurred in 2006. Information about the causative agents of viral meningitis is rarely included with case reports because viral cultures and nucleic acid-based tests, such as PCR analysis of the cerebral spinal fluid, are not routinely performed at most medical facilities. Improvements in molecular testing capabilities should lead to faster diagnoses and more appropriate management of viral meningitis including less use of inappropriate antibiotics and fewer and shorter hospital admissions.

ADDITIONAL RESOURCES

CDC. Respiratory and Enteric Viruses Branch, Viral (Aseptic) Meningitis at:
www.cdc.gov/ncidod/dvrd/revb/enterovirus/viral_meningitis.htm

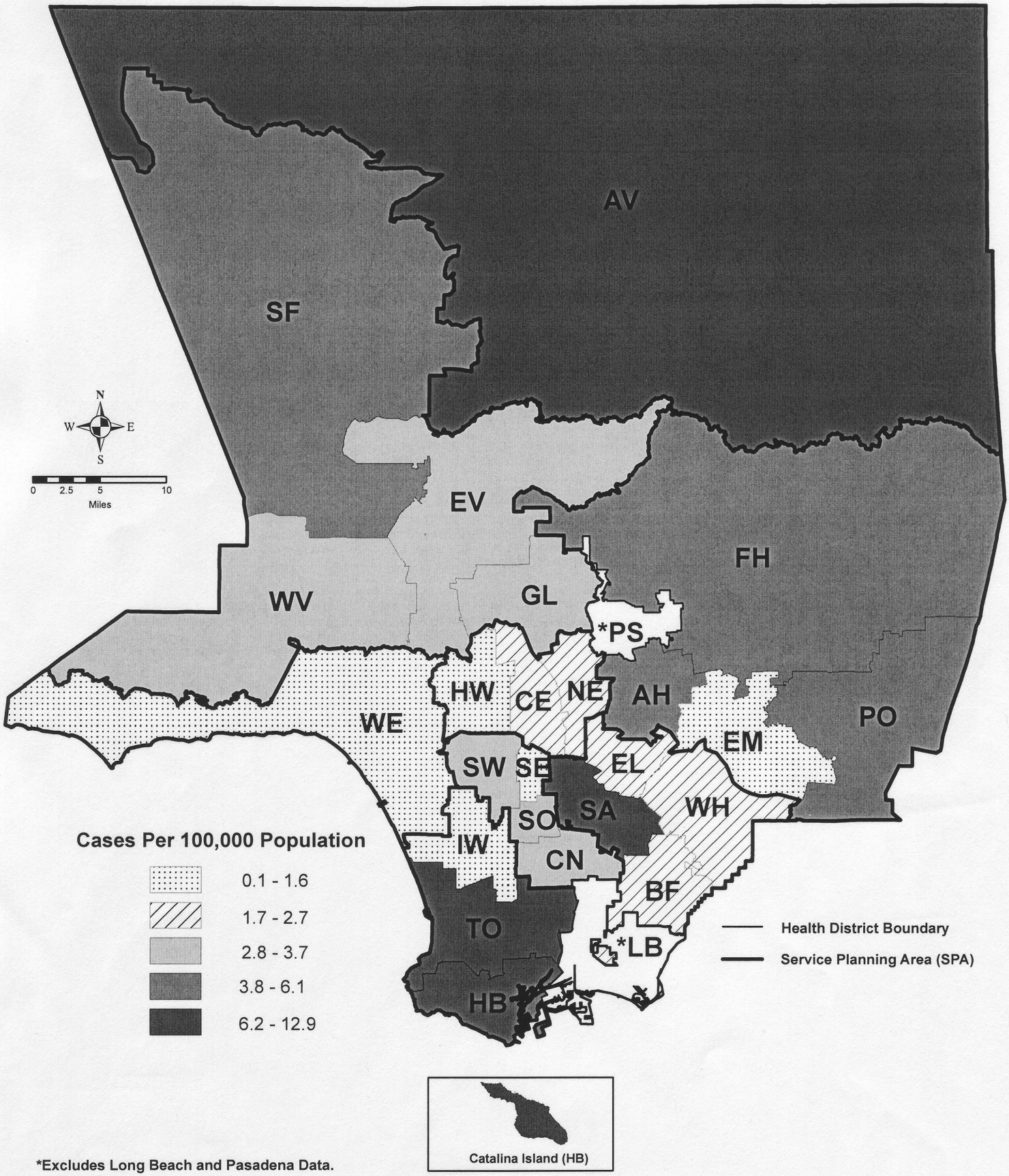
CDC. Respiratory and Enteric Viruses Branch, Non-Polio Enterovirus Infections at:
www.cdc.gov/ncidod/dvrd/revb/enterovirus/non-polio_entero.htm

Association of State and Territorial Directors of Health Promotion and Public Health Education, Infectious Facts, Viral Meningitis at: www.astdhpphe.org/infect/vmenin.html

CDC. Outbreaks of aseptic meningitis associated with echoviruses 9 and 30 and preliminary reports on enterovirus activity--United States, 2003. MMWR 2003; 52(32):761-764. Available at:
www.cdc.gov/mmwr/preview/mmwrhtml/mm5232a1.htm

CDC. Enterovirus surveillance--United States, 2002–2004. MMWR 2006; 55(6):153-156. Available at:
www.cdc.gov/mmwr/preview/mmwrhtml/mm5506a3.htm

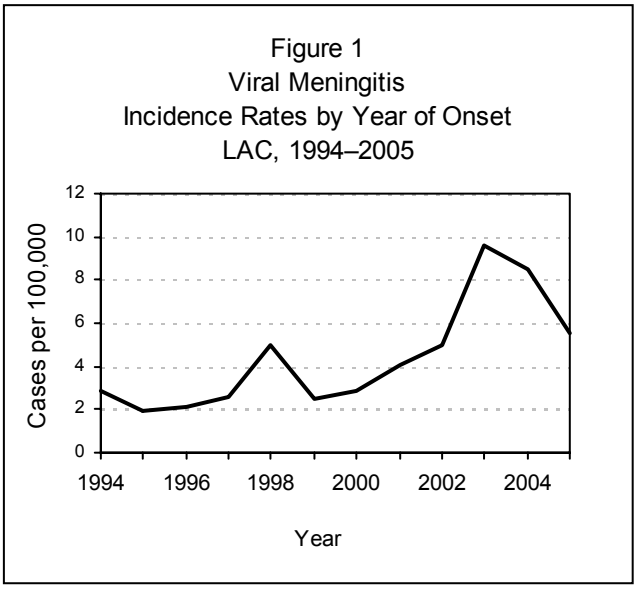
Map 8. Meningitis, Viral
Rates by Health District, Los Angeles County, 2006*



*Excludes Long Beach and Pasadena Data.

MENINGITIS, VIRAL

CRUDE DATA	
Number of Cases	530
Annual Incidence[a]	
LA County	5.5
United States[b]	N/A
Age at Diagnosis	
Mean	27
Median	25
Range	0–93 years
Case Fatality	
LA County	0.6%
United States[b]	N/A



[a] Cases per 100,000 population.
[b] Viral meningitis is not a nationally notifiable disease.

DESCRIPTION

Viruses are the major cause of aseptic meningitis syndrome, a term used to define any meningitis (infectious or noninfectious), particularly one with a lymphocytic pleocytosis, for which a cause is not apparent after initial evaluation and routine stains and cultures do not support a bacterial or fungal etiology. Viral meningitis can occur at any age but is most common among the very young. Symptoms are characterized by sudden onset of fever, severe headache, stiff neck, photophobia, drowsiness or confusion, nausea and vomiting and usually last from 7 to 10 days.

Nonpolio enteroviruses, the most common cause of viral meningitis, are not vaccine-preventable and account for 85% to 95% of all cases in which a pathogen is identified. Estimates from the Centers for Disease Control and Prevention (CDC) indicate that 10 to 15 million symptomatic enteroviral infections occur annually in the US, which includes 30,000 to 75,000 cases of meningitis. Transmission of enteroviruses may be fecal-oral, respiratory or by another route specific to the etiologic agent.

Other viral agents that can cause viral meningitis include: herpes, mumps, lymphocytic choriomeningitis, human immunodefieciency virus, adenovirus, parainfluenza virus type 3, influenza virus, measles and arboviruses, such as West Nile virus (WNV). Since the arrival of WNV in Southern California in 2003, this etiology should be considered an important cause of aseptic meningitis, especially in adults (during the summer and fall), and the appropriate diagnostic tests should be obtained. Prevention strategies and laboratory testing for WNV infections is detailed in a dedicated chapter. Treatment for most forms of viral meningitis is supportive; recovery is usually complete and associated with a low mortality rates. Antiviral agents are available for treatment of viral meningitis due to herpes viruses: Herpes Simplex Virus-1 (HSV-1), HSV-2, and varicella-zoster virus.

DISEASE ABSTRACT

- The incidence of viral meningitis has continued to decrease since its peak in 2003.

- WNV infection contributed to fewer cases of viral meningitis in 2005 (3% of cases) compared to 2004 (10% of cases), when the largest number of WNV cases were documented in LAC to date.
- Two outbreaks were reported. One outbreak involved 6 adult cases of viral meningitis with presumed enteroviral meningitis that were exposed to 10 children at a common daycare center with documented enteric echovirus infection; the second outbreak involved two elementary school children with enterovirus meningitis that had contact with the same tutor.

Trends: In 2005, there were a total of 530 cases of viral meningitis compared to 807 in 2004, representing a 34% decrease from 2004. The annual incidence also decreased with 8.5 and 5.5 cases per 100,000 in 2004 and 2005, respectively. This continues a decreasing trend from a peak incidence of 9.6 cases per 100,000 in 2003.

Seasonality: Enteroviruses demonstrate a seasonality in temperate climates that typically peaks in the late summer and early fall. WNV follows a similar pattern. In 2005, the onset of viral meningitis cases followed this trend closely, peaking in September with 90 cases (Figure 2).

Age: Infants less than 1 year old continued to have the highest age-group specific rate, 50.9 cases per 100,000 (Figure 3).

Sex: The male to female rate ratio of cases was nearly 1:1.

Race/Ethnicity: The incidence rates across race and ethnicity groups ranged from 3.3 to 6.5 cases per 100,000, the lowest occurring in Asian/Pacific Islanders. The rates were similar among Latinos, Whites, and Blacks.

Location: The highest incidence of viral meningitis occurred in SPA 1 (12 per 100,000); the lowest in SPA 5 (1.7 per 100,000) (Figure 4). However, because SPA 5 had such a low case count (N=11), the incidence rate is unstable.

Clinical Presentation: The case fatality rate remained low; only 3 deaths were reported in 2005 (<1% case fatality rate). WNV infection was less prevalent this year, compared to 2004, as a cause of aseptic meningitis. Only 3% of cases (n=15) were associated with WNV meningitis (See WNV chapter for more details).

Figure 2
Viral Meningitis
Cases by Month of Onset
LAC, 2005

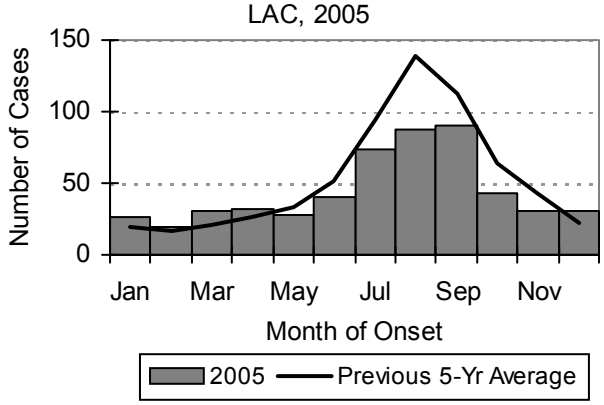


Figure 3
Viral Meningitis
Incidence Rates by Age Group
LAC, 2005 (n=525)

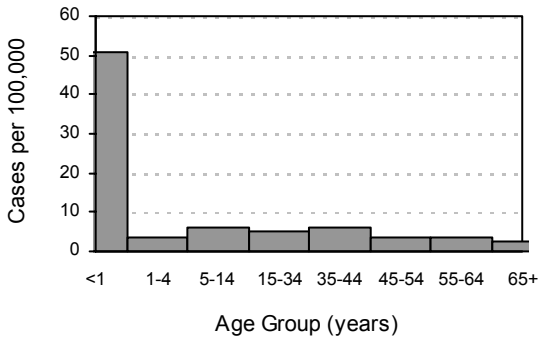
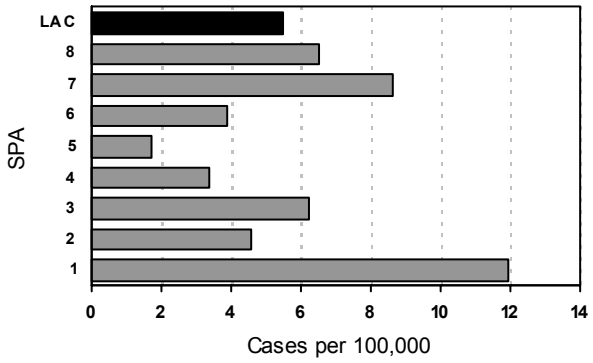


Figure 4
Viral Meningitis
Incidence Rates by SPA
LAC, 2005 (n=528)



COMMENTS

Surveillance for viral meningitis is passive and only outbreaks, not individual cases, are investigated. Two outbreaks were investigated in 2005. The first occurred in late spring among children from a daycare center and their parents. Ten children and six adults fell ill; however, only one had enterovirus identified in cerebral spinal fluid (CSF) by polymerase chain reaction (PCR) and four children in the daycare center had stool cultures that identified echovirus, one of the five subgenera in the enterovirus family. Health education was implemented and hand hygiene was emphasized at the daycare center. Two cases of meningitis occurred in the fall in a second viral meningitis outbreak. The two children, one of whom was an out of county case, had contact with the same tutor. No etiology was identified.

The number of cases reported annually is considered to be substantially lower than the actual burden of disease. The low incidence in 2005 continues a decreasing trend since a substantial peak in 2003. That peak coincided with national and regional outbreaks, including California, which occurred due to serotypes of enteroviruses that are associated with an epidemic circulation pattern. Individual enterovirus serotypes have different temporal patterns of circulation; and the changes in predominant serotypes can be accompanied by large-scale outbreaks. However, no predictable patterns exist for these serotypes or for viral meningitis in general. There is significant yearly variation and no long-term trends have been identified.

Reporting bias introduced by WNV surveillance may contribute to fluctuations in annual incidence rates. From 2003 to 2005, increased reporting of viral meningitis and testing for underlying WNV infection was encouraged among health care providers and hospital infection control practitioners. However, the peak incidence of viral meningitis did not correspond with the peak incidence of WNV, which occurred in 2004.

Information about the causative agents of viral meningitis is rarely included with case reports because viral cultures and nucleic acid based- tests, such as PCR analysis of the cerebral spinal fluid, is not routinely performed at most medical facilities. When an etiology is determined, enteroviruses are the most frequently identified agent. Improvements in molecular testing capabilities should lead to faster diagnoses and more appropriate management of viral meningitis such as less use of inappropriate antibiotics and fewer and shorter hospital admissions.

Supportive measures, and to a lesser extent antiviral agents, are the usual treatments for viral meningitis. Good personal hygiene, especially hand washing and avoiding contact with oral secretions of others, is the most practical and effective preventive measure.

ADDITIONAL RESOURCES

CDC. Respiratory and Enteric Viruses Branch, Viral (Aseptic) Meningitis at:
www.cdc.gov/ncidod/dvrd/virlmen.htm

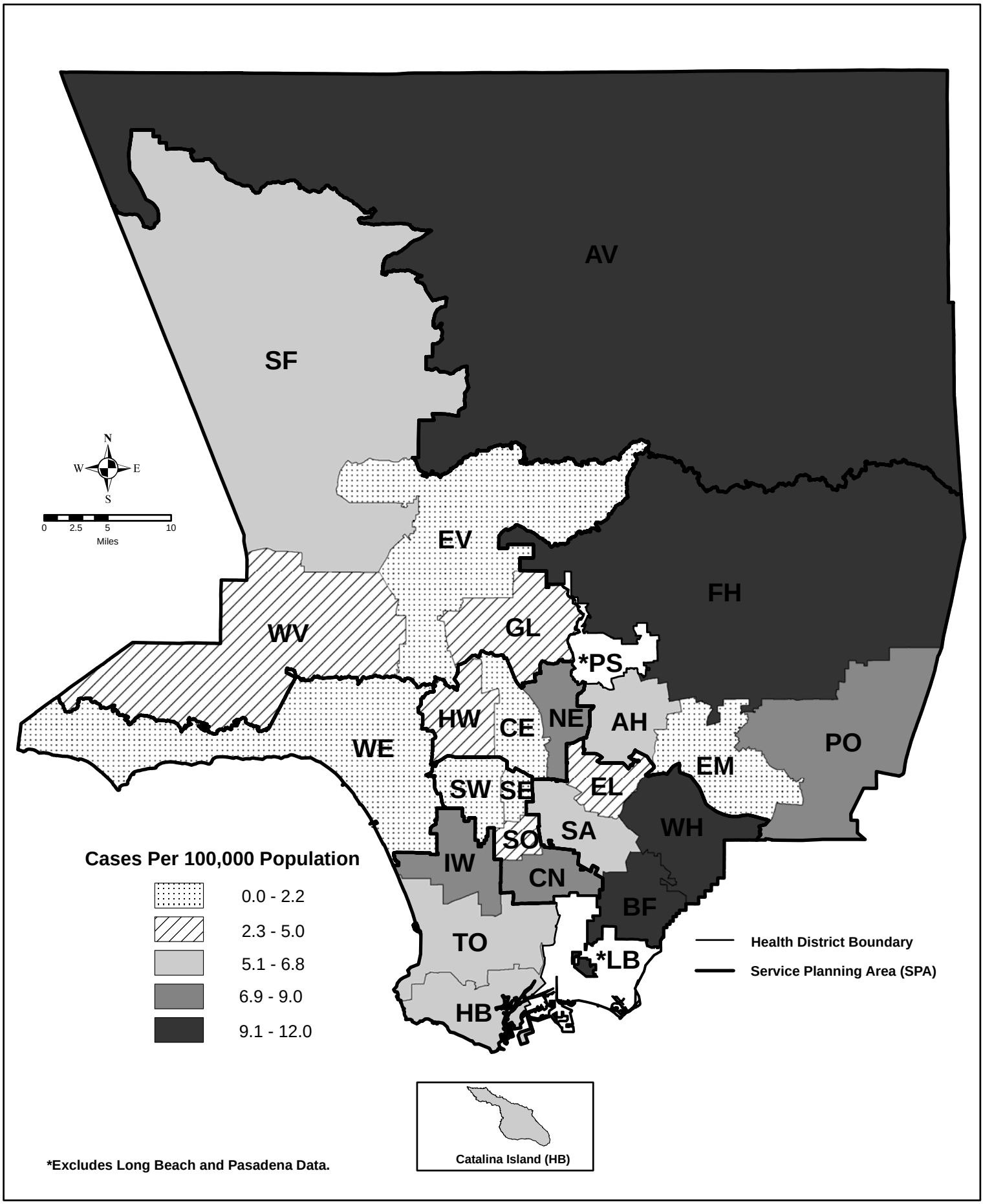
CDC. Respiratory and Enteric Viruses Branch, Non-polio Enterovirus Infections at:
www.cdc.gov/ncidod/dvrd/revb/enterovirus/non-polio_entero.htm

Association of State and Territorial Directors of Health Promotion and Public Health Education, Infectious Facts, Viral Meningitis at: www.astdhpphe.org/infect/vmenin.html

CDC. Outbreaks of Aseptic Meningitis Associated with Echoviruses 9 and 30 and Preliminary Reports on Enterovirus Activity—United States, 2003. MMWR 2003; 32:761-763. Available at:
www.cdc.gov/mmwr/preview/mmwrhtml/mm5232a1.htm

CDC. Enterovirus Surveillance —United States, 2002–2004. MMWR 2006; 55:153-156. Available at:
www.cdc.gov/mmwr/preview/mmwrhtml/mm5506a3.htm

Map 9. Meningitis, Viral
Rates by Health District, Los Angeles County, 2005*



*Excludes Long Beach and Pasadena Data.

MENINGITIS, VIRAL

CRUDE DATA	
Number of Cases	807
Annual Incidence[a]	
LA County	8.5
United States	N/A
Age at Diagnosis	
Mean	27
Median	24
Range	<0–90 years
Case Fatality	1
LA County	<1.0%
United States	N/A

[a] Cases per 100,000 population.

Figure 1
Viral Meningitis
Incidence Rates by Year of Onset
LAC, 1994–2004

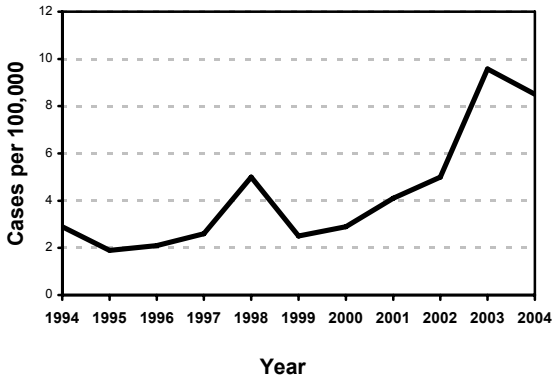
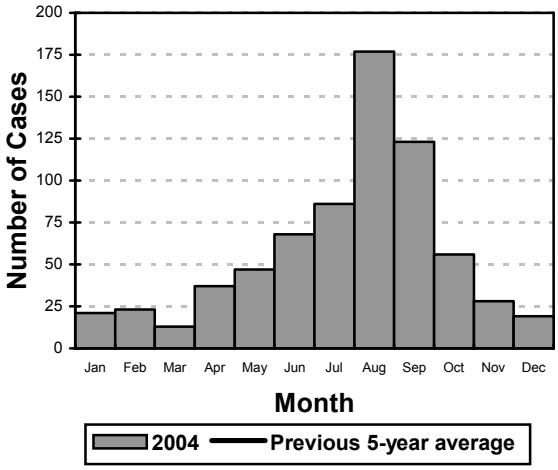


Figure 2
Viral Meningitis
Cases by Month of Onset,
LAC, 2004



DESCRIPTION

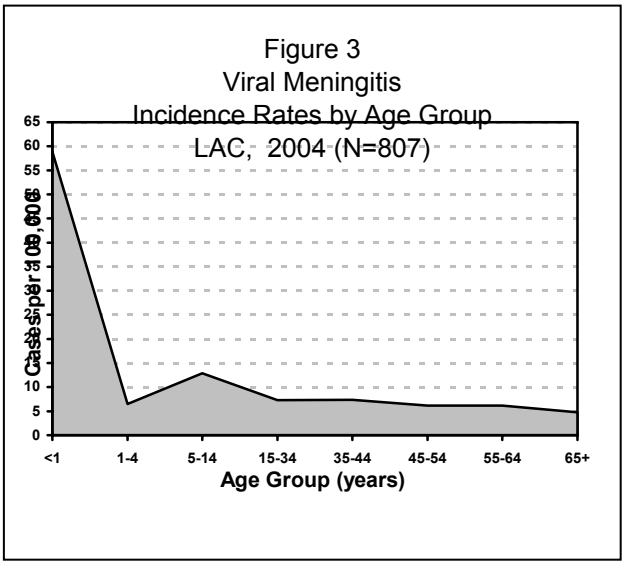
Viral meningitis, also referred to as aseptic meningitis, is a clinical syndrome in which no etiologic agent is identified on bacterial culture or examination of cerebrospinal fluid. Viral meningitis can occur at any age but is most common among the very young. Symptoms are characterized by sudden onset of fever, severe headache, stiff neck, photophobia, drowsiness or confusion, nausea and vomiting and usually last from 7 to 10 days. Enteroviruses, the etiologic agents most commonly associated with viral meningitis, are not vaccine-preventable (except for polioviruses) and account for 85% to 95% of all cases in which a pathogen is identified. Estimates from the Centers for Disease Control and Prevention (CDC) indicate that 10 to 15 million symptomatic enteroviral infections occur annually in the US, which includes 30,000 to 75,000 cases of meningitis. Transmission of enteroviruses may be fecal-oral, respiratory or by another route specific to the etiologic agent. Since the arrival of West Nile Virus (WNV) in Southern California in 2003, this etiology should be considered as an important cause of aseptic meningitis, especially in adults, and the appropriate diagnostic tests should be obtained. Prevention strategies and laboratory testing for WNV infections is detailed in a dedicated chapter. Treatment for enteroviral and WNV-associated viral meningitis is supportive; recovery is usually complete and associated with a low mortality rates. Antiviral agents are for treatment of viral meningitis due to for herpes viruses.

DISEASE ABSTRACT

- In 2004, there were a total of 807 cases of viral meningitis compared to 899, representing a 10% decrease from 2003.
- The annual incidence decreased from 9.6 to 8.5 cases per 100,000 in 2003 and 2004, respectively.
- The summer seasonal case increase continued later into the year compared with the previous 5-year average (Figure 2).
- West Nile virus, an arboviral infection, was an important cause of aseptic meningitis in 2004. Eighty-two (10%) cases were associated with WNV meningitis (See WNV section for details).
- Infants less than 1 year old had the highest age-group specific rate, 58.9 per 100,000, of any age group (Figure 3). In contrast to 2004, in 2003, 15-34 year olds had the highest age specific incidence rates for viral meningitis, 10.8 per 100,000.
- The case fatality rate remained low; only 1 death was reported in 2004.
- There was one outbreak reported in a junior high school involving 4 cases of viral meningitis. The etiology was determined to be enterovirus by PCR analysis of the cerebral spinal fluid. All students recovered without sequelae.

COMMENTS

Surveillance for viral meningitis is passive and only outbreaks, not individual cases, are investigated. The number of cases reported annually is considered to be significantly lower than the actual burden of disease. In 2004, the overall viral meningitis incidence rate of 8.5 cases per 100,000 was less than that reported in 2003, 9.6 per 100,000. Reporting bias may contribute to fluctuations in annual incidence rates. From 2003 to 2004, increased reporting of viral meningitis and testing for underlying WNV infection was encouraged among health care providers and hospital infection control practitioners, which could account for an increased viral meningitis incidence rates during those years.



Information about the causative agents of viral meningitis is rarely included with case reports because viral cultures and nucleic acid based- tests such as PCR analysis of the cerebral spinal fluid is not routinely performed at most medical facilities. When an etiology is determined, enteroviruses, is the most frequently identified agent. Improvements in molecular testing capabilities should lead to faster diagnoses and more appropriate management of viral meningitis such as less use of inappropriate antibiotics and fewer and shorter hospital admissions.

Supportive measures, and to a lesser extent antiviral agents, are the usual treatments for viral meningitis. Good personal hygiene, especially handwashing and avoiding contact with oral secretions of others, is the most practical and effective preventive measure.

ADDITIONAL RESOURCES

Tunkel AR, Scheld WM. Acute Meningitis. In Mandell, Douglas, and Bennett's Principles and Practices of Infectious Diseases 6th Edition. Elsevier, Churchill Livingstone, 2005, 1083-1085.

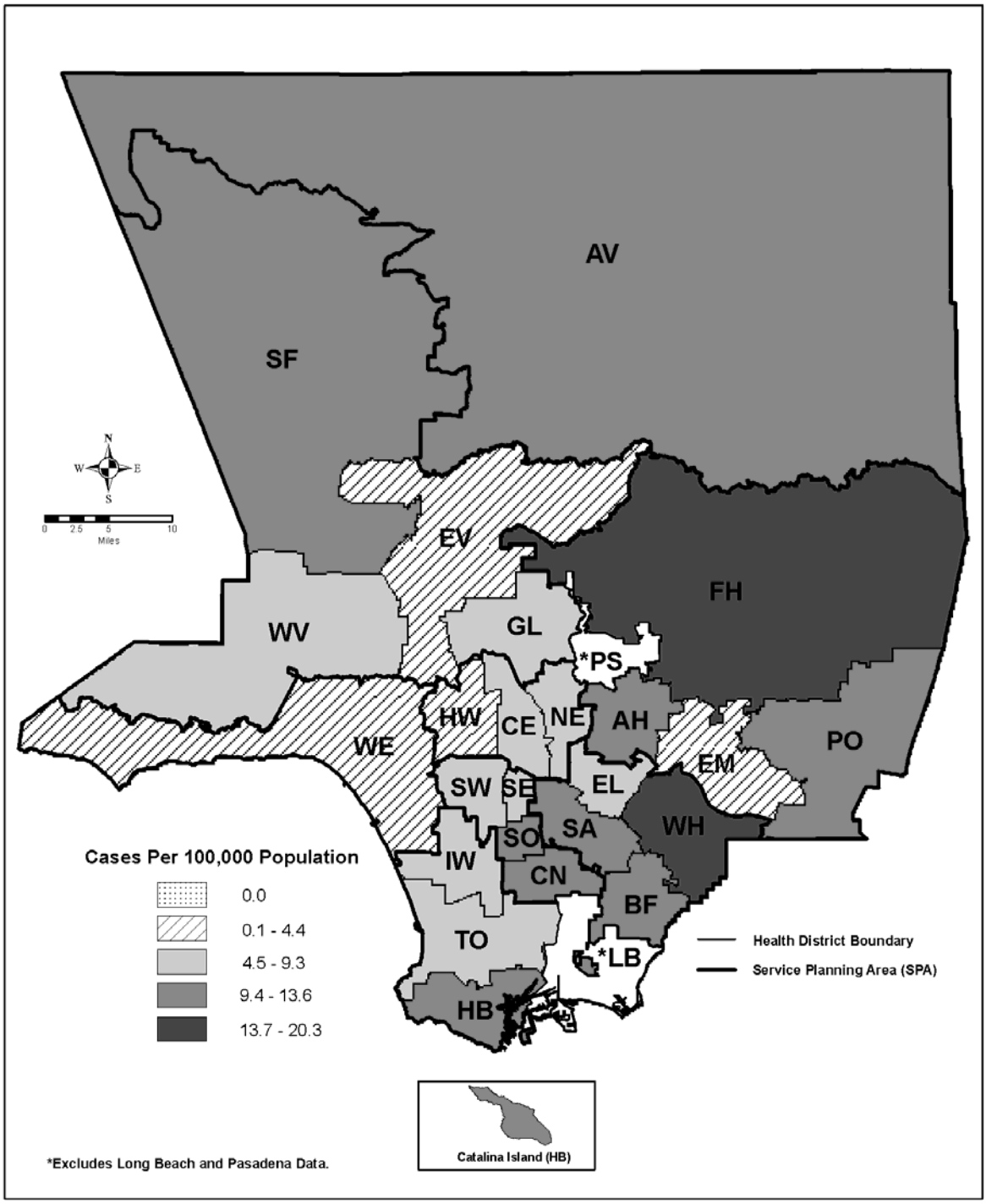
CDC. Respiratory and Enteric Viruses Branch, Viral (Aseptic) Meningitis at:
www.cdc.gov/ncidod/dvrd/virlmen.htm

CDC. Respiratory and Enteric Viruses Branch, Non-polio Enterovirus Infections at:
www.cdc.gov/ncidod/dvrd/entrvirs.htm

Association of State and Territorial Directors of Health Promotion and Public Health Education, Infectious Facts, Viral Meningitis at: www.astdhpphe.org/infect/vmenin.html

CDC. Outbreaks of Aseptic Meningitis Associated with Echoviruses 9 and 30 and Preliminary Reports on Enterovirus Activity—United States, 2003. MMWR 2003; 32:761-763. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5232a1.htm

Map 9. Meningitis, Viral
Rates by Health District, Los Angeles County, 2004*

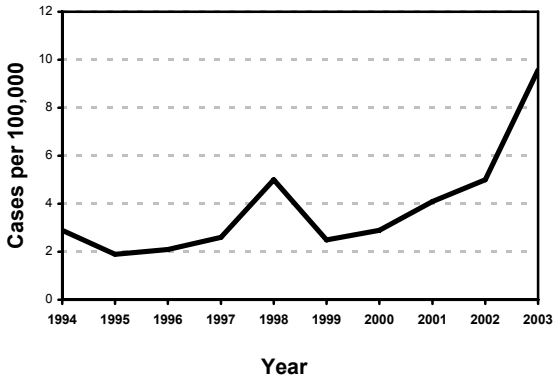


MENINGITIS, VIRAL

CRUDE DATA	
Number of Cases	899
Annual Incidence	
LA County	9.57
United States	N/A
Age at Diagnosis	
Mean	21
Median	17
Range	<0–87 years
Case Fatality	
LA County	1.3%
United States	N/A

[a] Cases per 100,000 population.

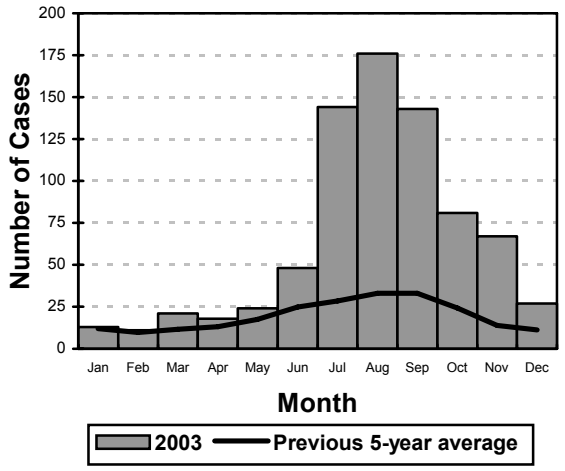
Figure 1
Viral Meningitis
Incidence Rates by Year of Onset
LAC, 1993–2003



DESCRIPTION

Viral meningitis, also referred to as aseptic meningitis, is a clinical syndrome in which no etiologic agent is identified on bacterial culture or examination of cerebrospinal fluid. Viral meningitis can occur at any age but is most common among the very young. Symptoms, which usually last from 7 to 10 days, are characterized by sudden onset of fever, severe headache, stiff neck, photophobia, drowsiness or confusion, nausea and vomiting. Treatment is usually supportive although antiviral agents may be helpful; recovery is usually complete. Enteroviruses, the etiologic agents commonly associated with viral meningitis, are not vaccine-preventable (except for polioviruses). Transmission of enteroviruses may be fecal-oral, respiratory or by another route specific to the etiologic agent.

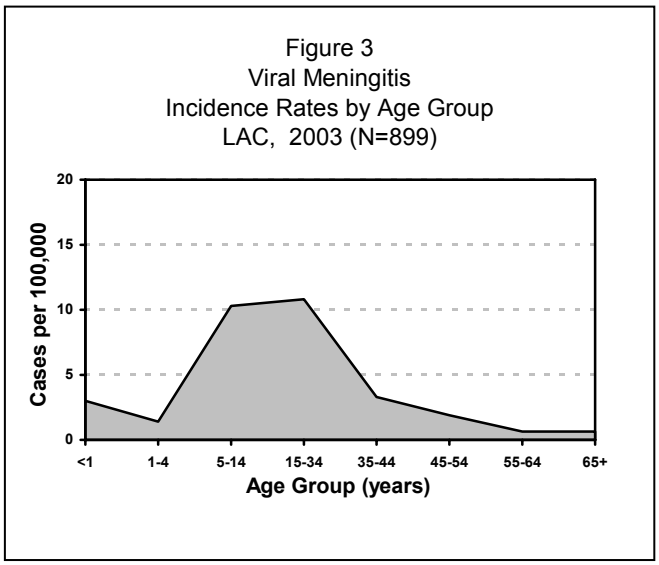
Figure 2
Viral Meningitis
Cases by Month of Onset,
LAC, 2003



DISEASE ABSTRACT

- In 2003, there were 899 cases of viral meningitis compared to 466 (93% increase) in 2002.
- The annual incidence was 9.6 per 100,000 compared to 5.0 per 100,000 in 2002 (Figure 1).
- The summer seasonal increase continued later into the year compared with the previous 5-year average (Figure 2).
- Arboviral infections such as West Nile virus, can present as aseptic meningitis.
- No unusual viral etiologies, associated cases, or clusters were reported in 2003.
- The highest age-group specific rate (10.8 per 100,000) was for those between the ages of 15-34 (Figure 3), as opposed to the previous year where infants under one year old were primarily affected (incident rate 34.4 per 100,000).

COMMENTS



Surveillance for viral meningitis is passive and only outbreaks, not individual cases, are investigated. The number of cases reported annually is considered to be significantly lower than the actual burden of disease. During the period of January 1, 2003 and August 7, the state of California's rate for aseptic meningitis was 8.0 per 100,000 population, reflecting a slight increase compared to previous years where the annual rate ranged from 4.5-7.3 (1999-2003). LAC saw an even larger increase in 2003. Ninety-three percent more cases of aseptic meningitis were reported resulting in 9.6 cases per 100,000 compared to 5 cases per 100,000 in 2002. The large increase could be explained by the re-emergence of two Enterovirus serotypes, E9 and E30, which had not been predominant since 1995 and 1998, respectively. It is probable that a large cohort had not been exposed to these serotypes and was susceptible to infection. Nationally, outbreaks of aseptic meningitis in 2003 have been associated with E9 and E30, E9 being predominant in the eastern US and E30 being predominant in the West. Reporting bias may also be partially responsible for the increase in cases. Increased surveillance for West Nile Virus was encouraged among health care providers and hospitals in 2003, which could account for an increase in reporting and diagnosis of aseptic meningitis.

Information about the causative agents of viral meningitis is rarely included with case reports because viral cultures and nucleic acid tests are not routinely performed at most medical facilities. When an etiology is determined, an enterovirus, most of which are transmitted through the fecal-oral route, is the most frequently identified agent. Improvements in molecular testing capabilities should lead to faster diagnoses and changes in the management of viral meningitis such as less use of inappropriate antibiotics.

Supportive measures, and to a lesser extent antiviral agents, are the usual treatments for viral meningitis. Good personal hygiene, especially handwashing and avoiding contact with oral secretions of others, is the most practical and effective preventive measure.

ADDITIONAL RESOURCES

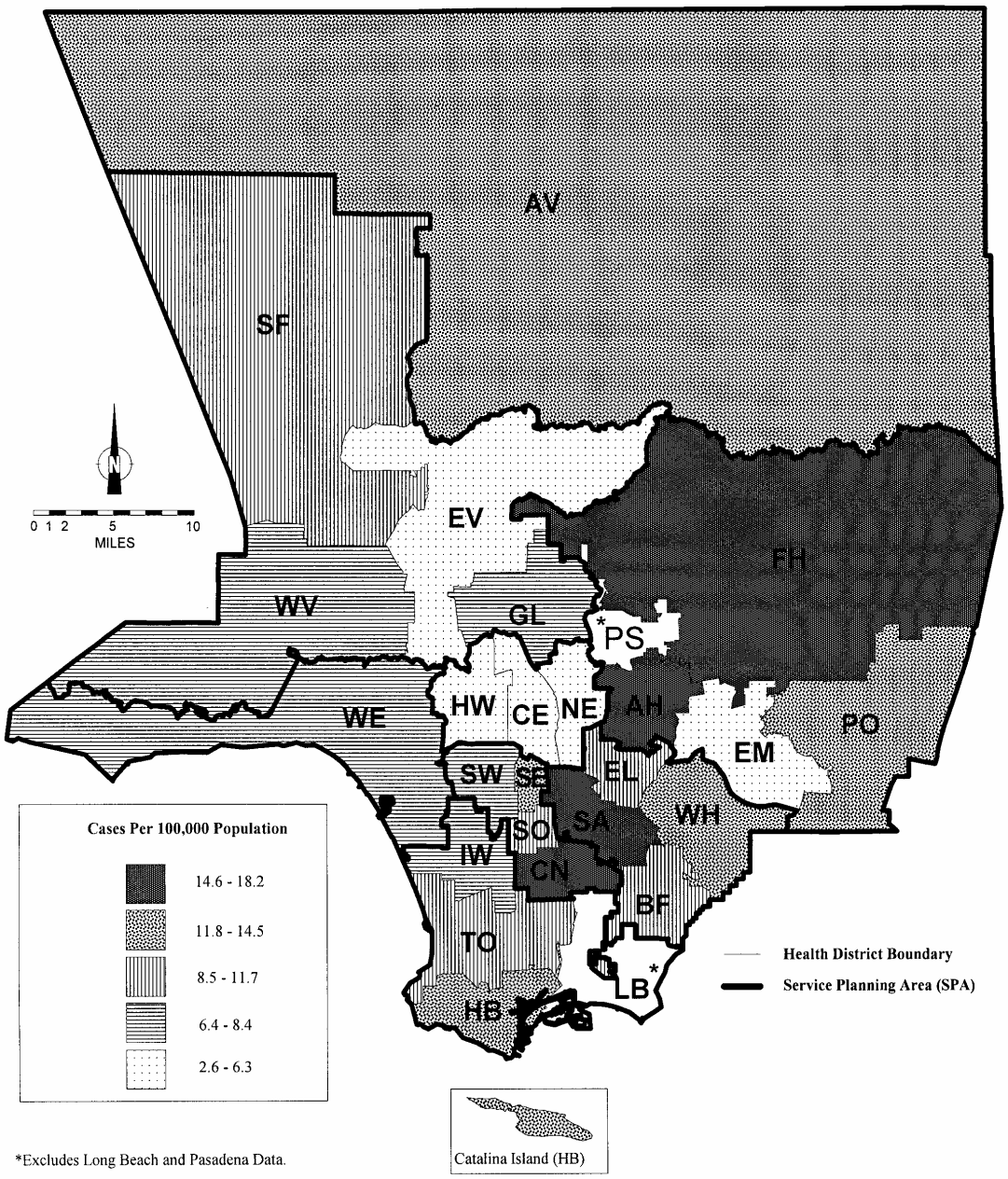
CDC. Respiratory and Enteric Viruses Branch, Viral (Aseptic) Meningitis at: www.cdc.gov/ncidod/dvrd/virlmen.htm

CDC. Respiratory and Enteric Viruses Branch, Non-polio Enterovirus Infections at: www.cdc.gov/ncidod/dvrd/entrvirs.htm

Association of State and Territorial Directors of Health Promotion and Public Health Education, Infectious Facts, Viral Meningitis at: www.astdhpphe.org/infect/vmenin.html

CDC. Outbreaks of Aseptic Meningitis Associated with Echoviruses 9 and 30 and Preliminary Reports on Enterovirus Activity—United States, 2003. MMWR 2003; 32: 761-763. Available at: www.cdc.gov/mmwr/preview/mmwrhtml/mm5232a1.htm

MAP 8. Meningitis, Viral
Rates by Health District, Los Angeles County, 2003*



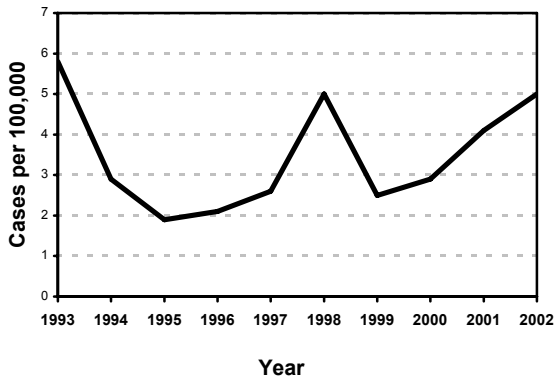
*Excludes Long Beach and Pasadena Data.

MENINGITIS, VIRAL

CRUDE DATA	
Number of Cases	466
Annual Incidence	
LA County	5.0
United States	N/A
Age at Diagnosis	
Mean	24
Median	22
Range	<1–84 years
Case Fatality	
LA County	1.3%
United States	N/A

[a] Cases per 100,000 population.

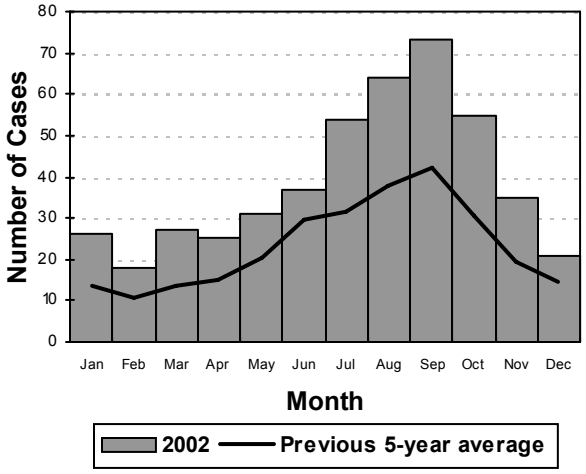
Figure 1
Viral Meningitis
Incidence Rates by Year of Onset
LAC, 1993–2002



DESCRIPTION

Viral meningitis, also referred to as aseptic meningitis, is a clinical syndrome in which no etiologic agent is identified on bacterial culture or examination of cerebrospinal fluid. While no often performed, enterovirus is the virus most often detected in CSF culture. Transmission may be fecal-oral, respiratory or by another route specific to the etiologic agent. Viral meningitis can occur at any age but is most common among the very young. Symptoms, which usually last from 7 to 10 days, are characterized by sudden onset of fever, severe headache, stiff neck, photophobia, drowsiness or confusion, nausea and vomiting. Treatment is usually supportive although antiviral agents may be available; recovery is usually complete. Enteroviruses, the etiologic agents commonly associated with viral meningitis, are not vaccine-preventable (except for polioviruses).

Figure 2
Viral Meningitis
Cases by Month of Onset,
LAC, 2002



DISEASE ABSTRACT

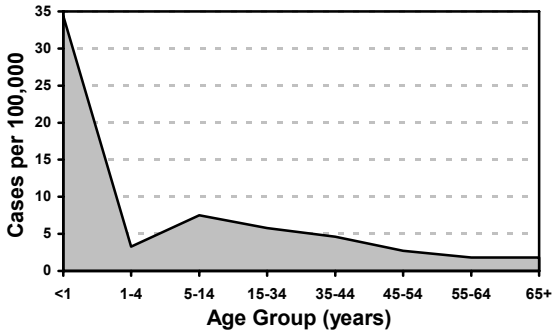
- In 2002, there were 466 cases of viral meningitis compared to 378 (19% increase) in 2001.
- The annual incidence was 5.0 per 100,000 compared to 4.2 per 100,000 in 2001.
- The summer seasonal increase continued later into the year compared with the previous 5-year average (Figure 2).
- Arboviral infections such as West Nile virus, can present as aseptic meningitis.
- One case of aseptic meningitis was confirmed as West Nile virus infection by CSF and serum (see special report for more details).

- No unusual viral etiologies, associated cases, or clusters were reported in 2002.
- The highest age-group specific rate (34.4 per 100,000) continued to be seen in infants aged less than 1 year (Figure 3).

COMMENTS

Surveillance for viral meningitis is passive and only outbreaks, not individual cases, are investigated. The number of cases reported annually is considered to be significantly lower than the actual burden of disease. In 2002, there was a 19% increase in the number of cases reported. In 2002, there were 5 cases per 100,000 compared to 4.2 cases per 100,000 in 2001. Reasons for the increase, whether actual, or the result of improved reporting or other unknown factors, were not apparent. A similar unexplained increase was seen in 1998.

Figure 3
Viral Meningitis
Incidence Rates by Age Group
LAC, 2002 (N=466)



Information about the causative agents of viral meningitis is rarely included with case reports because viral cultures and nucleic acid tests are not routinely performed at most medical facilities. When an etiology is determined, an enterovirus, most of which are transmitted through the fecal-oral route, is the most frequently identified agent. Improvements in molecular testing capabilities should lead to faster diagnoses and changes in the management of viral meningitis such as less use of inappropriate antibiotics.

Supportive measures, and to a lesser extent antiviral agents, are the usual treatments for viral meningitis. Good personal hygiene, especially handwashing and avoiding contact with oral secretions of others, is the most practical and effective preventive measure.

Of particular interest in 2002 is the recognition that arboviral infection, especially WNV, presents as aseptic meningitis. In 2002, one adult female had confirmed WNV as the underlying etiology of her meningitis. She recovered fully. This was the only case documented in the state of California (see special report for more details).

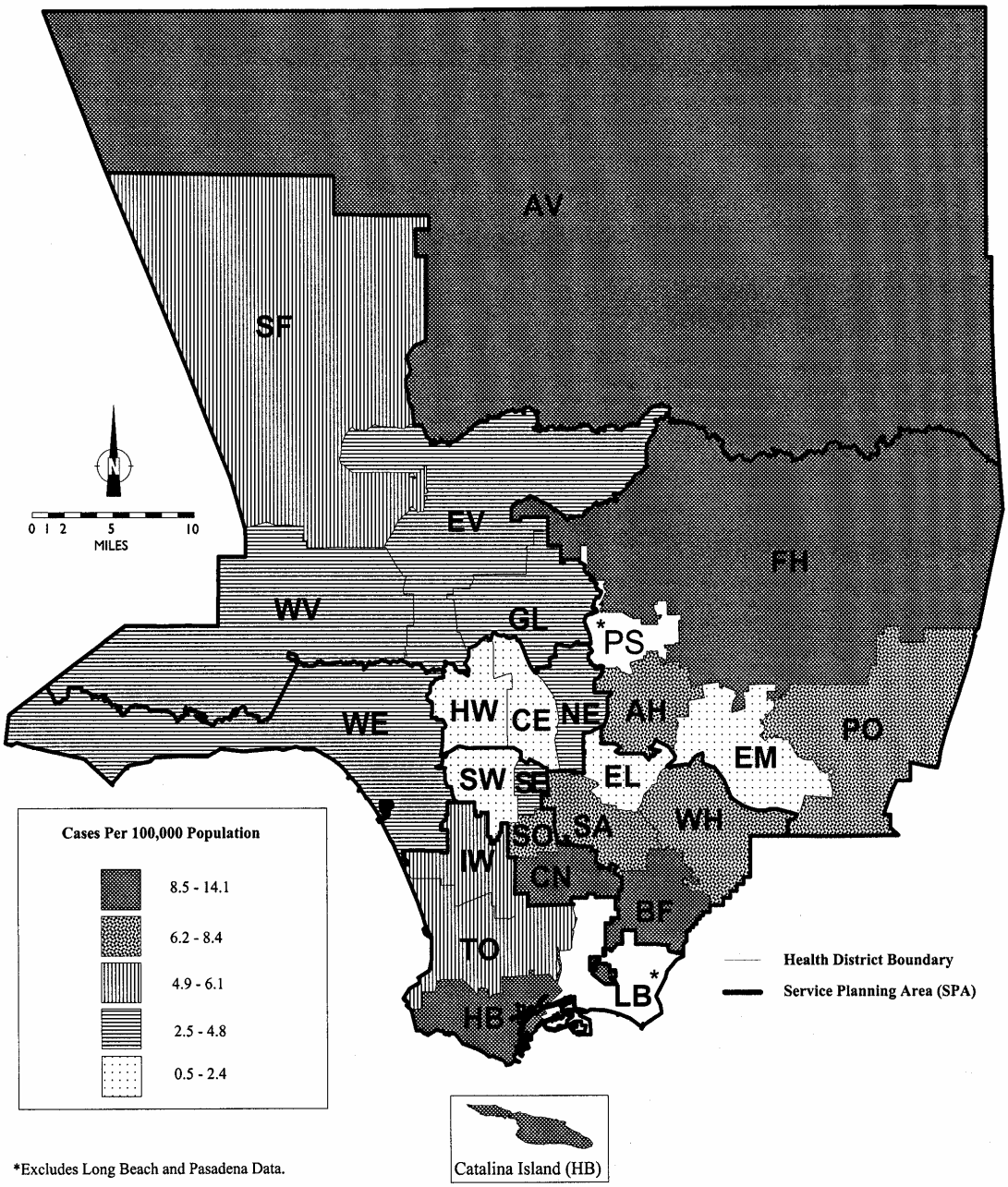
ADDITIONAL RESOURCES

CDC, Respiratory and Enteric Viruses Branch, Viral (Aseptic) Meningitis at:
www.cdc.gov/ncidod/dvrd/virlmen.htm

CDC, Respiratory and Enteric Viruses Branch, Non-polio Enterovirus Infections at:
www.cdc.gov/ncidod/dvrd/entrvirs.htm

Association of State and Territorial Directors of Health Promotion and Public Health Education, Infectious Facts, Viral Meningitis at: www.astdhpphe.org/infect/vmenin.html

MAP 9. Meningitis, Viral
Rates by Health District, Los Angeles County, 2002*

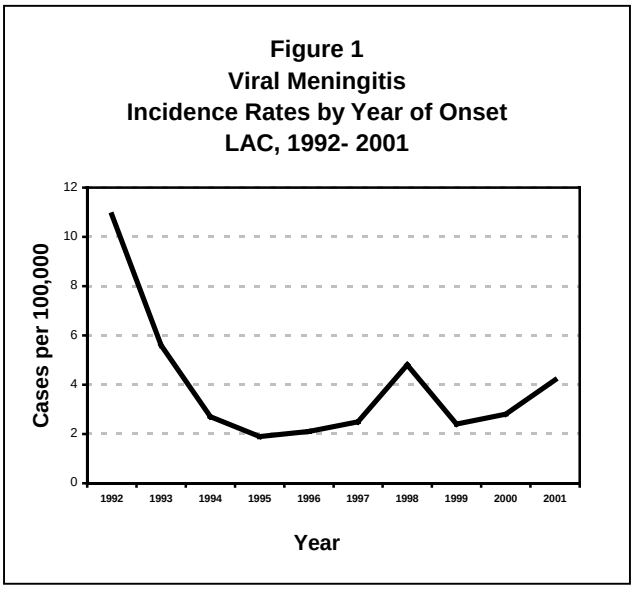


*Excludes Long Beach and Pasadena Data.

MENINGITIS, VIRAL

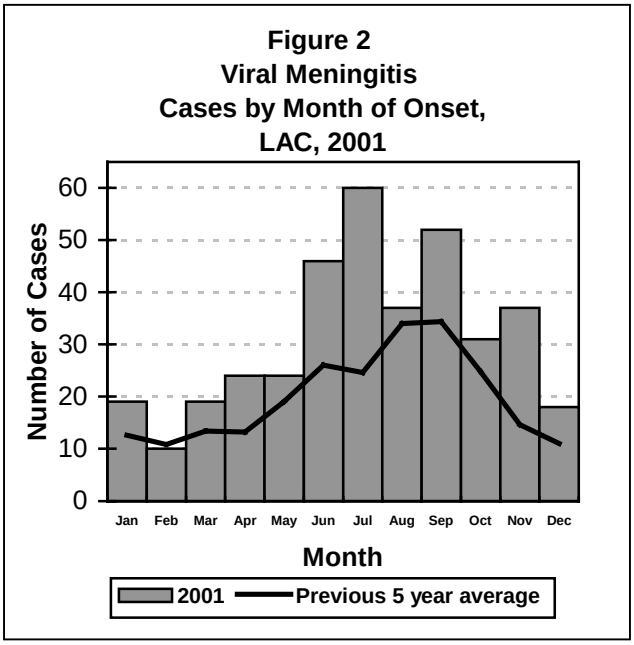
CRUDE DATA	
Number of Cases	378
Annual Incidence[a]	
LA County	4.2
United States	N/A
Age at Diagnosis	
Mean	20
Median	14
Range	<1-100 years
Case Fatality	
LA County	N/A
United States	N/A

[a] Cases per 100,000 population.



DESCRIPTION

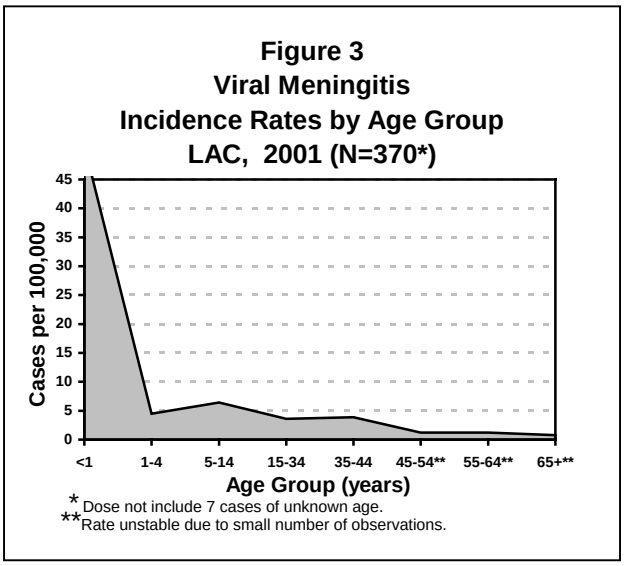
Viral meningitis, also referred to as aseptic meningitis, is a clinical syndrome in which no etiologic agent is identified on bacterial culture or examination of cerebrospinal fluid. When viral culture is done, an enterovirus is the organism most often detected. Transmission may be fecal-oral, respiratory or by another route specific to the etiologic agent. Viral meningitis can occur at any age but is most common among the very young. Symptoms, which usually last from 7 to 10 days, are characterized by sudden onset of fever, severe headache, stiff neck, photophobia, drowsiness or confusion, nausea and vomiting. Treatment is usually supportive although antiviral agents may be available; recovery is usually complete. Enteroviruses, the etiologic agents commonly associated with viral meningitis, are not vaccine-preventable [except for polioviruses].



DISEASE ABSTRACT

- In 2001, reports of viral meningitis increased by 45% from 2000.
- The summer seasonal increase continued later into the year compared with the previous 5 year average (Figure 2).

- No unusual viral etiologies, associated cases, or clusters were reported in 2001.
- The highest age-group specific rate (50.8 per 100,000) continued to be seen in infants aged less than1 year (Figure 3).



COMMENTS

Surveillance for viral meningitis is passive and only outbreaks, not individual cases, are investigated. The number of cases reported annually is considered to be significantly lower than the actual burden of disease. In 2001, there was a 45% increase in the number of cases reported. Reasons for the increase, whether real, or the result of improved reporting or other unknown factors, were not apparent. A similar unexplained increase was seen in 1998.

Information about the causative agents of viral meningitis is rarely included with case reports because viral cultures and RT-PCR tests are not routinely performed. When an etiology is determined, an enterovirus, most of which are transmitted through the fecal-oral route, is the most frequently identified agent. Improvements in molecular testing capabilities should lead to faster diagnoses and changes in the management of viral meningitis.

Supportive measures, and to a lesser extent antiviral agents, are the usual treatments for viral meningitis. Good personal hygiene, especially handwashing and avoiding contact with oral secretions of others, is the most practical and effective preventive measure.

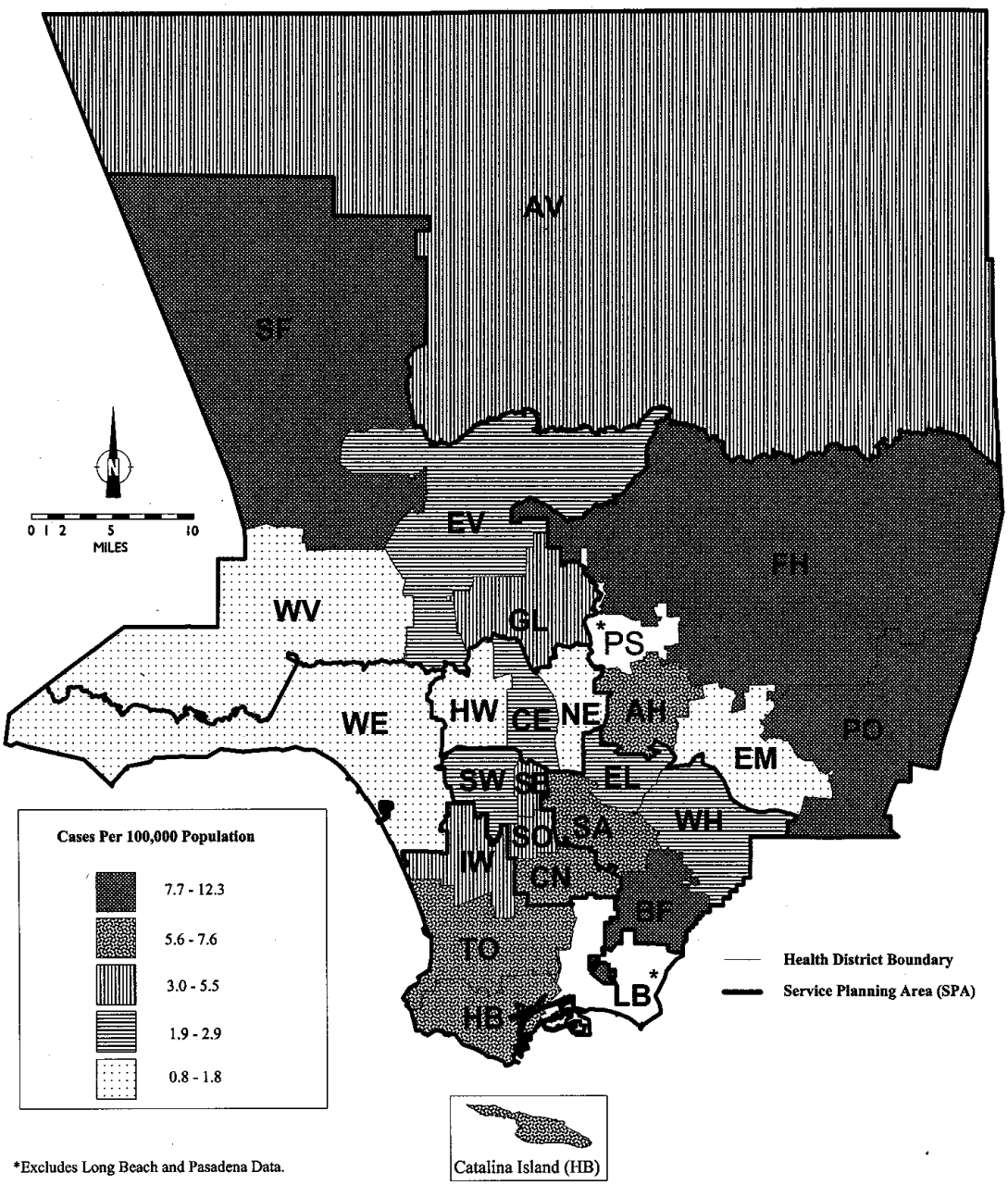
ADDITIONAL RESOURCES

CDC, Respiratory and Enteric Viruses Branch, Viral (Aseptic) Meningitis at: www.cdc.gov/ncidod/dvrd/virlmen.htm

CDC, Respiratory and Enteric Viruses Branch, Non-polio Enterovirus Infections at: www.cdc.gov/ncidod/dvrd/entrvirs.htm

Association of State and Territorial Directors of Health Promotion and Public Health Education, Infectious Facts, Viral Meningitis at: www.astdhpphe.org/infect/vmenin.html

MAP 5. Meningitis, Viral
Rates by Health District, Los Angeles County, 2001*



*Excludes Long Beach and Pasadena Data.