



## PERTUSSIS (WHOOPIING COUGH)

CRUDE DATA	
Number of Cases	296
Annual Incidence <sup>a</sup>	
LA County	3.15
California <sup>b</sup>	5.29
United States <sup>b</sup>	9.12
Age at Diagnosis	
Mean	15.1 years
Median	11.0 years
Range	Birth – 83 years

<sup>a</sup>Cases per 100,000 population.

<sup>b</sup>Calculated from Final 2013 Reports of Nationally Notifiable Infectious Disease. MMWR 63(32):702-716.

### DESCRIPTION

Pertussis, commonly known as whooping cough, is a vaccine-preventable disease spread by close contact with the respiratory secretions of infected individuals. The clinical case definition for pertussis is a cough lasting at least two weeks with paroxysms of coughing, a inspiratory “whoop,” or post-tussive vomiting, without other apparent causes. Complications include pneumonia, seizures, and encephalopathy. Infants under one year of age are at highest risk for developing severe complications. Pertussis is confirmed by either positive *Bordetella pertussis* culture or PCR.

#### Immunization Recommendations:

- A pertussis-containing vaccine (DTaP) should be administered at 2, 4, 6, 15-18 months, and 4-6 years of age to provide protection against the disease.
- Immunity conferred by the pertussis component of the DTaP vaccine decreases over time, with some vaccinated individuals becoming susceptible to pertussis 5 to 10 years following their last dose. Two Tdap vaccines are licensed and are recommended for use in adolescents and adults.
- Since July 2011, the California school immunization law requires that all students entering the 7<sup>th</sup> grade be vaccinated with Tdap.

### 2013 TRENDS AND HIGHLIGHTS

- In 2013, a total of 296 pertussis cases (236 confirmed, 60 probable) (3.14 cases per 100,000) were reported to Los Angeles County (LAC), an increase of more than 90% from 2012 (Figures 1 and 2).
- Unlike previous years, the incidence trend peaking in the summer was not observed. Instead, the peak was observed from November to December, where over one-third of the cases in 2013 were reported. The number of cases reported from November to December was significantly higher compared to the previous five year average for those two months (Figure 7). The increase in cases is attributable to the school outbreaks that occurred from November to December, and marks the second year in a row in which school outbreaks occurred in the same time period. No deaths were reported.
- Similar to previous years, infants less than one year of age had the highest incidence rate (48.8 cases per 100,000) (Figure 3). However, infants continued to account for a smaller proportion of reported cases (19.9%) compared to a previous five year average of 36.3%. The highest proportion of cases was reported in the 5-14 and 15-34 year age groups, accounting in total for over half (55%) of all cases reported in 2013 and underscoring the importance of Tdap immunizations among adolescents and adults.
- Similar to previous years, Hispanics and whites accounted for the highest proportion of cases and age-adjusted incidence rates (Figure 4, Figure 5). Amongst all race/ethnicity groups, only whites had an age-adjusted incidence rate in 2013 that was greater than the previous five year average. The increase in age-adjusted incidence rates for whites is due to the increase in proportion of school age cases.
- In 2013 and for the fourth year in a row, SPA 2 had the highest proportion of reported cases (40.9%). In addition, SPA 2 also had the highest incidence rate amongst all SPAs (5.6 cases per 100,000) (Figure 6). From November to December, a total of five school outbreaks serving grade levels from middle to high school occurred in SPA 2. The increase in incidence may be attributable to the school outbreaks, which accounted for almost one-third of the cases reported in SPA 2 for the entire year and



reflects the morbidity that occurred during the fall and winter months in this region.

- Among the 57 cases that had epidemiological linkages to other cases, over three-fourths resided in SPA 2 (n=36, 63.2%) and SPA 8 (n=11, 19.3%). The proportion of epidemiologically linked cases residing in SPA 2 increased over two-fold in comparison to 2012 (25.9%). In SPA 2, the vast majority of epidemiologically linked cases were attributable to the school outbreaks observed in the region.
- Of the total 296 cases, 52% (n=154) were either too young to be vaccinated (5.4%) or were not up-to-date with the immunization recommendations for their age (46.6%). Additionally, 9.1% (n=21) of the cases less than 18 years of age had personal belief exemption school vaccine waivers which is similar to the percentage reported in 2012 (8.8%) and 2011 (8.0%), but is more than twice the percentage reported in 2010 (4.2%) (Figure 8). The increasing proportion in the last three years is due in part to the rise of personal belief exemption rates throughout LAC.



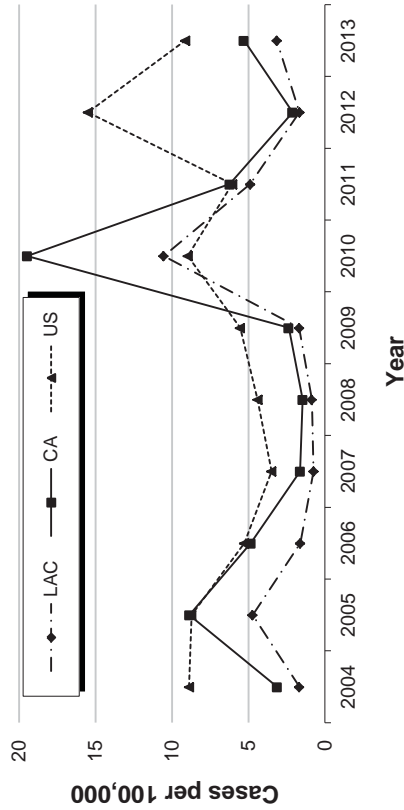
**Reported Pertussis Cases and Rates\* per 100,000 by Age Group, Race/Ethnicity, and SPA  
Los Angeles County, 2009-2013**

Age Group	2009 (N=156)			2010 (N=972)			2011 (N=453)			2012 (N=154)			2013 (N=296)		
	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000
<1	79	50.7	64.6	273	28.1	227.2	139	30.7	117.	30	19.5	25.2	59	19.9	48.8
1-4	10	6.4	2.0	158	16.2	32.6	73	16.1	15.1	22	14.3	4.6	33	11.2	6.8
5-14	18	11.5	1.4	304	31.3	24.6	133	29.4	11.0	53	34.4	4.4	88	29.7	7.3
15-34	20	12.8	0.7	122	12.5	4.4	48	10.6	1.7	23	14.9	0.8	75	25.3	2.6
35-44	9	5.8	0.7	40	4.1	3.0	26	5.7	2.0	8	5.2	0.6	15	5.1	1.1
45-54	12	7.7	0.9	28	2.9	2.2	14	3.1	1.1	6	3.9	0.5	13	4.4	1.0
55-64	5	3.2	0.5	24	2.5	2.5	9	2.0	0.9	6	3.9	0.6	6	2.0	0.6
65+	3	1.9	0.3	23	2.4	2.3	11	2.4	1.0	6	3.9	0.5	7	2.4	0.6
Unknown	0	0.0		0	0.0		0	0.0		0	0.0		0	0.0	
<b>Race/Ethnicity</b>															
Asian	10	6.4	0.8	32	3.3	2.4	17	3.8	1.3	8	5.2	0.6	8	2.7	0.6
Black	6	3.9	0.8	50	5.1	6.5	24	5.3	3.1	10	6.5	1.3	5	1.7	0.6
Hispanic	100	64.1	2.3	655	67.4	14.7	286	63.1	6.4	71	46.1	1.6	146	49.3	3.2
White	39	25.0	1.4	216	22.2	8.1	110	24.3	4.1	54	35.1	2.0	129	43.7	4.9
Other	1	0.6	5.5	2	0.2	11.4	0	0.0	-	1	0.6	5.6	1	0.3	5.6
Unknown	0	0.0		17	1.8		16	3.5		10	6.5		7	2.4	
<b>SPA</b>															
1	9	5.8	2.4	19	1.9	4.9	19	4.2	4.9	7	4.5	1.8	14	4.7	3.6
2	21	13.5	1.0	209	21.5	9.8	99	21.8	4.6	43	27.9	2.0	121	40.9	5.6
3	24	15.4	1.5	147	15.1	9.2	86	19.0	5.3	25	16.2	1.5	27	9.1	1.7
4	18	11.5	1.6	162	16.7	14.5	51	11.3	4.6	18	11.7	1.6	19	6.4	1.7
5	17	10.9	2.7	57	5.8	9.0	27	6.0	4.2	22	14.3	3.4	19	6.4	2.9
6	24	15.4	2.4	158	16.3	15.8	63	13.9	6.2	10	6.5	1.0	24	8.1	2.3
7	22	14.1	1.7	129	13.3	10.0	60	13.2	4.6	16	10.4	1.2	39	13.2	3.0
8	21	13.5	2.0	90	9.3	8.5	48	10.6	4.5	13	8.4	1.2	33	11.2	3.1
Unknown	0	0.0		1	0.1		0	0.0		0	0.0		0	0.0	

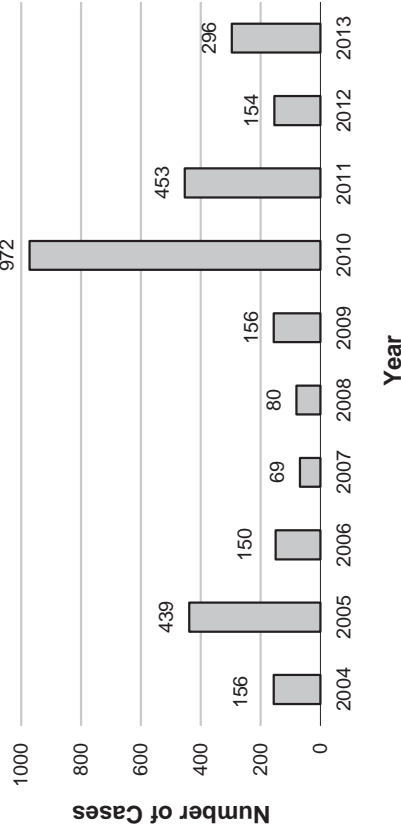
\* Rates calculated based on less than 19 cases or events are considered unreliable. A zero rate is reported with a dash ("-").



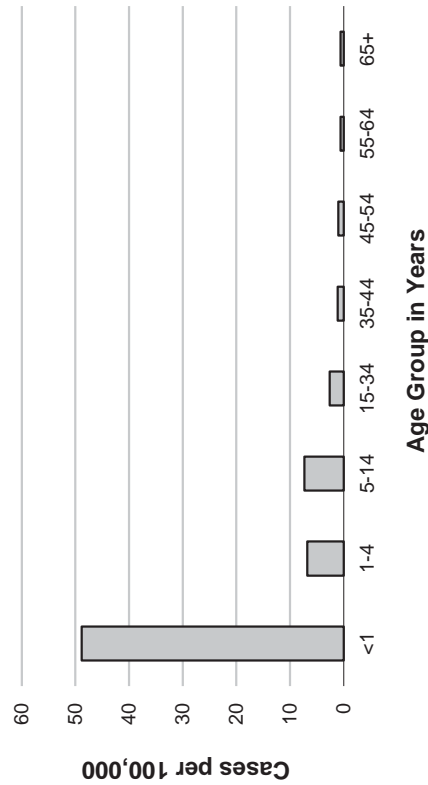
**Figure 1. Incidence Rates of Pertussis  
LAC, CA and US, 2009-2013**



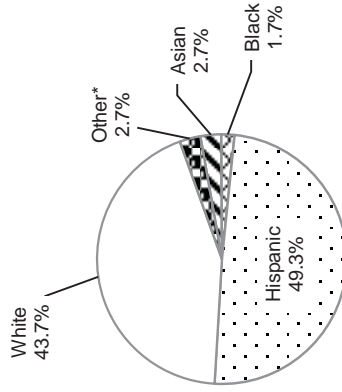
**Figure 2. Reported Cases of Pertussis  
LAC, 2004-2013**



**Figure 3. Incidence Rates of Pertussis by Age Group  
LAC, 2013 (N=296)**



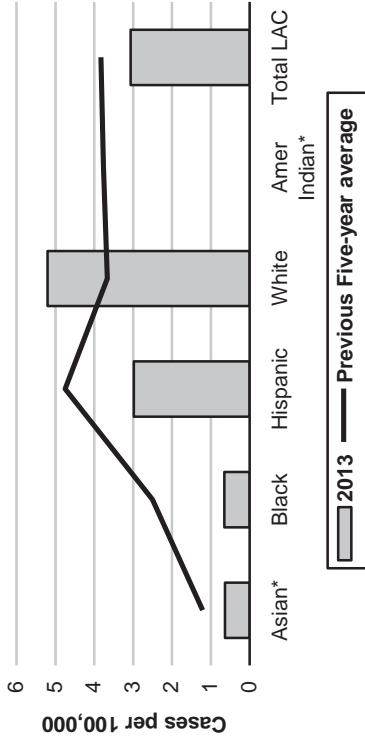
**Figure 4. Percent Cases of Pertussis by Race/Ethnicity  
LAC, 2013 (N=296)**



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

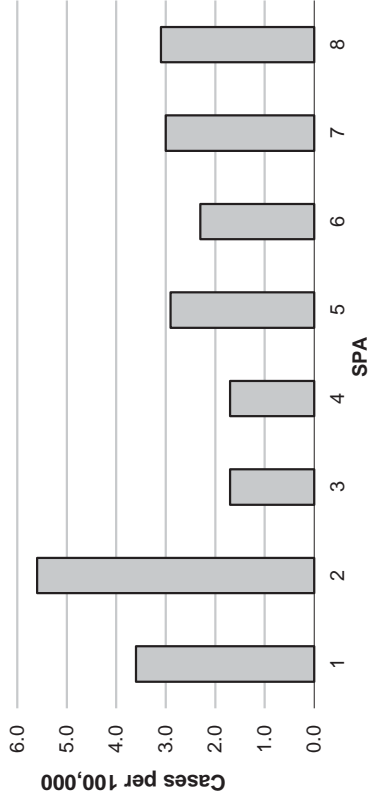


**Figure 5. Age-Adjusted Incidence Rates of Pertussis by Race/Ethnicity, LAC, 2013 (N=296) vs. Previous Five-Year Average**

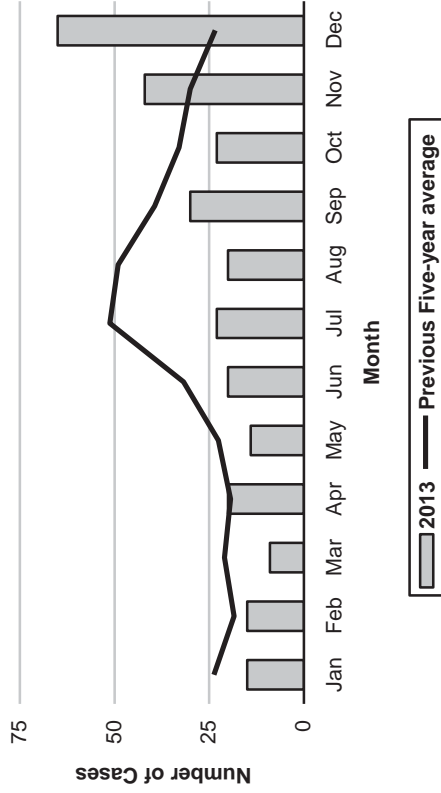


\* Incidence rates based on <19 cases are considered unreliable.

**Figure 6. Incidence Rates of Pertussis by SPA LAC, 2013 (N=296)**



**Figure 7. Reported Pertussis Cases by Month of Onset LAC, 2013 (N=296) vs. Previous Five-year Average**



**Figure 8. Vaccination Status of Reported Pertussis Cases, LAC, 2013**

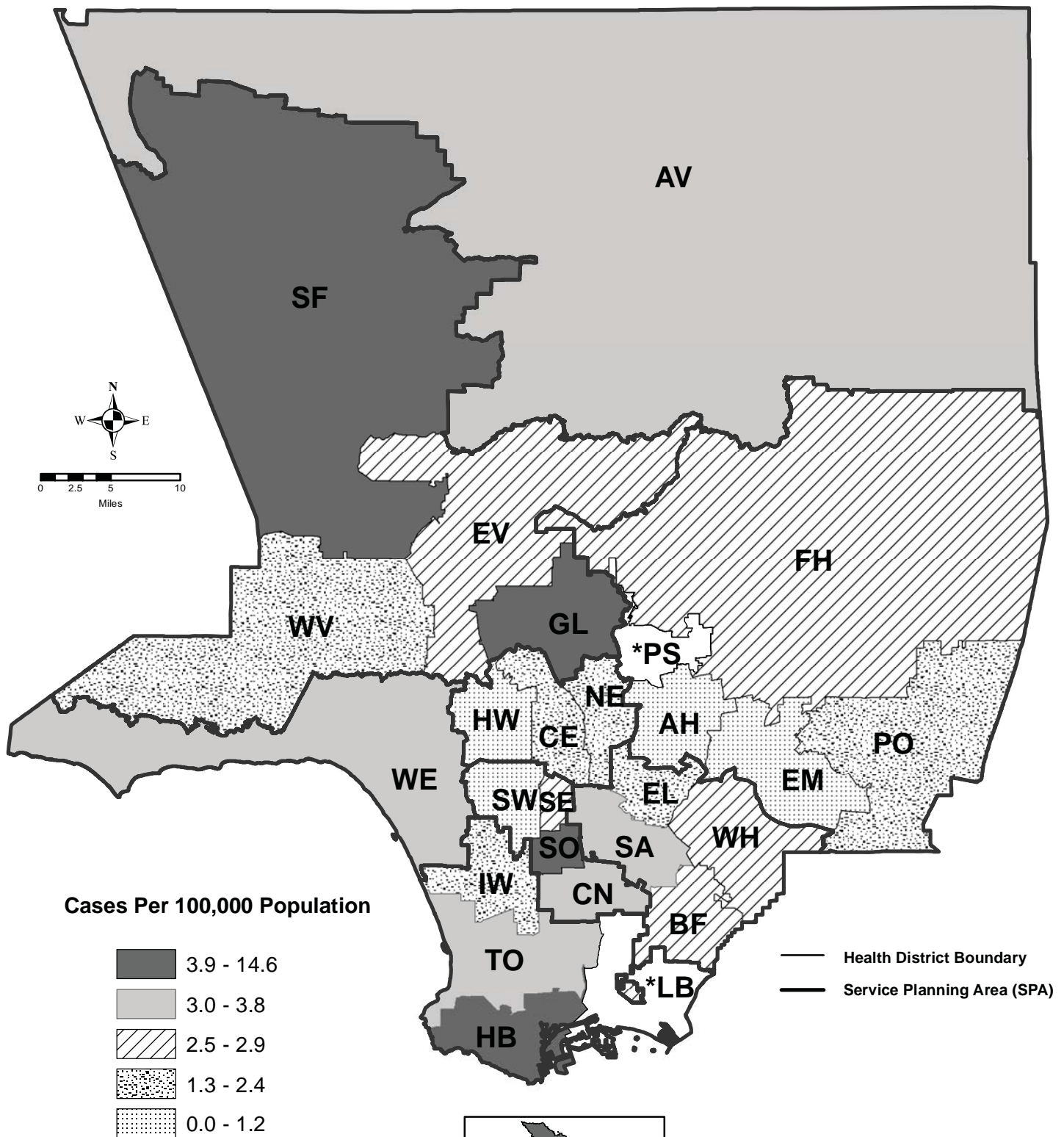
Reported Cases	Cases Too Young to Be Vaccinated <sup>1</sup>	Cases Eligible for Vaccination and Up-to-Date <sup>2</sup>	Cases Eligible for Vaccination and Not Up-to-Date <sup>3</sup>	Personal Beliefs Exemption School Vaccine Waivers Among Cases Age <18 years (n=231)
No.	16	142	138	21
%	5.4%	47.9%	46.6%	9.1%

<sup>1</sup>Cases less than 2 months of age.

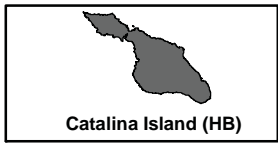
<sup>2</sup>Cases 2 months of age and older and who are up-to-date with the pertussis immunization recommendations for their age.

<sup>3</sup>Cases 2 months of age and older and who are not up-to-date with the pertussis immunization recommendations for their age. Includes cases that have unknown immunization status, have personal belief exemption school vaccine waivers, or have no valid documentation of receiving pertussis vaccines prior to disease onset.

# Map 11. Pertussis Rates by Health District, Los Angeles County, 2013\*



\*Excludes Long Beach and Pasadena Data.





## PERTUSSIS (WHOOPIING COUGH)

CRUDE DATA	
Number of Cases	154
Annual Incidence <sup>a</sup>	
LA County	1.66
California <sup>b</sup>	2.11
United States <sup>b</sup>	15.49
Age at Diagnosis	
Mean	16.2 years
Median	10.0 years
Range	Birth – 79 years

<sup>a</sup>Cases per 100,000 population.

<sup>b</sup>Calculated from Final 2012 Reports of Nationally Notifiable Infectious Disease. MMWR 62(33);669-682.

### DESCRIPTION

Pertussis, commonly known as whooping cough, is a vaccine-preventable disease spread by close contact with the respiratory secretions of infected individuals. The clinical case definition for pertussis is a cough lasting at least two weeks with paroxysms of coughing, a inspiratory “whoop,” or post-tussive vomiting, without other apparent causes. Complications include pneumonia, seizures, and encephalopathy. Infants under one year of age are at highest risk for developing severe complications. Pertussis is confirmed by either positive *Bordetella pertussis* culture or PCR.

### Immunization Recommendations:

- A pertussis-containing vaccine (DTP/DTaP) should be administered at 2, 4, 6, 15-18 months, and 4-6 years of age to provide protection against the disease.
- Immunity conferred by the pertussis component of the DTP/DTaP vaccine decreases over time, with some vaccinated individuals becoming susceptible to pertussis 5 to 10 years following their last dose. Two Tdap vaccines are licensed and are recommended for use in adolescents and adults.
- Since July 2011, the California school immunization law requires that all students entering the 7<sup>th</sup> grade be vaccinated with Tdap.

### 2012 TRENDS AND HIGHLIGHTS

- In 2012, a total of 154 pertussis cases (97 confirmed, 57 probable) (1.66 cases per 100,000) were reported to Los Angeles County (LAC), a decrease of more than 60% from 2011 (Figures 1 and 2). This continued decrease in cases brings LAC to a level comparable to 2009, the year prior to the 2010 resurgence. Unlike previous years, the incidence trend peaking in the summer was not observed (Figure 7). No deaths were reported.
- Similar to previous years, infants less than one year of age had the highest incidence rate (25.2 cases per 100,000) (Figure 3). However, infants continued to account for a smaller proportion of reported cases (19.5%) compared to a previous five year average of 41.4%. The highest proportion of cases was reported in the 5-14 and 15-34 year age groups, accounting in total for nearly half (49.3%) of all cases reported in 2012 and underscoring the importance of Tdap immunizations among adolescents and adults.
- Similar to previous years, Hispanics and whites accounted for the highest proportion of cases and age-adjusted incidence rates (Figure 4, Figure 5).
- In 2012 and for the third year in a row, SPA 2 had the highest proportion of cases observed (27.9%). However, the highest incidence rate was observed in SPA 5 (3.4 cases per 100,000) (Figure 6). This high incidence rate was attributable to school outbreaks that occurred towards the end of the year and accounted for 73% of all cases.
- Among the 27 cases that had epidemiological linkages to other cases, nearly half resided in SPA 2 (n=7, 25.9%) and SPA 5 (n=6, 22.2%). A similar proportion was observed for SPA 2 in 2011 (25.3%), but the proportion for SPA 5 is the highest percentage observed in the last 5 years, in part due to the school outbreaks. In SPA 2, the vast majority of epidemiologically linked cases were household contacts.
- Of the total 154 cases, 51.9% (n=79) were either too young to be vaccinated (5.8%) or were not up-to-date with the immunization recommendations for their age (46.1%) indicating that more work needs to be done to increase pertussis vaccination rates. Additionally, 8.8% (n=10) of the cases less than 18 years of age had personal belief



exemption school vaccine waivers which is similar to the percentage reported in 2011 (8.0%), but is more than twice the percentage reported in 2010 (4.2%) (Figure 8). The increasing proportion in the last two years is due in part to the rise of personal belief exemption (PBE) rates throughout LAC.





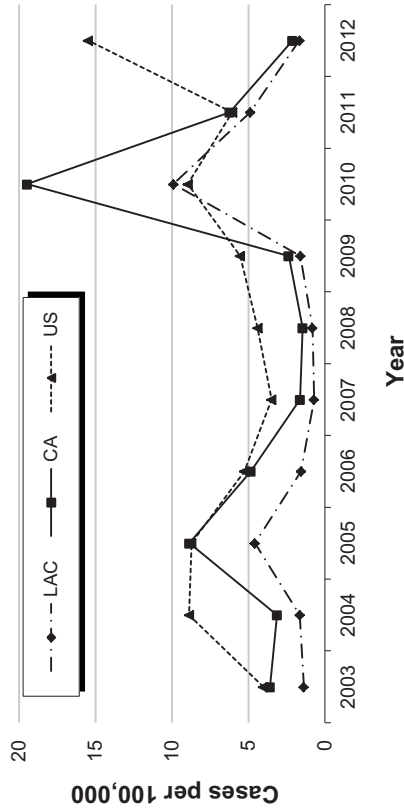
**Reported Pertussis Cases and Rates\* per 100,000 by Age Group, Race/Ethnicity, and SPA  
Los Angeles County, 2008-2012**

Age Group	2008 (N=80)			2009 (N=156)			2010 (N=972)			2011 (N=453)			2012 (N=154)		
	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000
<1	42	52.5	30.1	79	50.7	57.6	273	28.1	195.	139	30.7	117.	30	19.5	25.2
1-4	7	8.8	1.2	10	6.4	1.8	158	16.2	27.2	73	16.1	15.1	22	14.3	4.6
5-14	13	16.3	0.9	18	11.5	1.3	304	31.3	22.9	133	29.4	11.0	53	34.4	4.4
15-34	12	15.0	0.4	20	12.8	0.7	122	12.5	4.1	48	10.6	1.7	23	14.9	0.8
35-44	1	1.3	0.1	9	5.8	0.6	40	4.1	2.8	26	5.7	2.0	8	5.2	0.6
45-54	2	2.5	0.1	12	7.7	0.9	28	2.9	2.1	14	3.1	1.1	6	3.9	0.5
55-64	2	2.5	0.2	5	3.2	0.5	24	2.5	2.5	9	2.0	0.9	6	3.9	0.6
65+	1	1.3	0.1	3	1.9	0.3	23	2.4	2.2	11	2.4	1.0	6	3.9	0.5
Unknown	0	0.0		0	0.0		0	0.0		0	0.0		0	0.0	
<b>Race/Ethnicity</b>															
Asian	4	5.0	0.3	10	6.4	0.8	32	3.3	2.4	17	3.8	1.3	8	5.2	0.6
Black	4	5.0	0.5	6	3.9	0.7	50	5.1	5.9	24	5.3	3.1	10	6.5	1.3
Hispanic	52	65.0	1.1	100	64.1	2.1	655	67.4	13.8	286	63.1	6.4	71	46.1	1.6
White	18	22.5	0.6	39	25.0	1.3	216	22.2	7.5	110	24.3	4.1	54	35.1	2.0
Other	0	0.0	-	1	0.6	3.9	2	0.2	7.7	0	0.0	-	1	0.6	5.6
Unknown	2	2.5		0	0.0		17	1.8		16	3.5		10	6.5	
<b>SPA</b>															
1	2	2.5	0.5	9	5.8	2.4	19	1.9	5.1	19	4.2	4.9	7	4.5	1.8
2	12	15.0	0.5	21	13.5	0.9	209	21.5	9.4	99	21.8	4.6	43	27.9	2.0
3	4	5.0	0.2	24	15.4	1.4	147	15.1	8.5	86	19.0	5.3	25	16.2	1.5
4	17	21.3	1.3	18	11.5	1.4	162	16.7	12.9	51	11.3	4.6	18	11.7	1.6
5	10	12.5	1.5	17	10.9	2.6	57	5.8	8.6	27	6.0	4.2	22	14.3	3.4
6	9	11.3	0.9	24	15.4	2.3	158	16.3	14.8	63	13.9	6.2	10	6.5	1.0
7	13	16.3	0.9	22	14.1	1.6	129	13.3	9.4	60	13.2	4.6	16	10.4	1.2
8	13	16.3	1.2	21	13.5	1.9	90	9.3	8.0	48	10.6	4.5	13	8.4	1.2
Unknown	0	0.0		0	0.0		1	0.1		0	0.0		0	0.0	

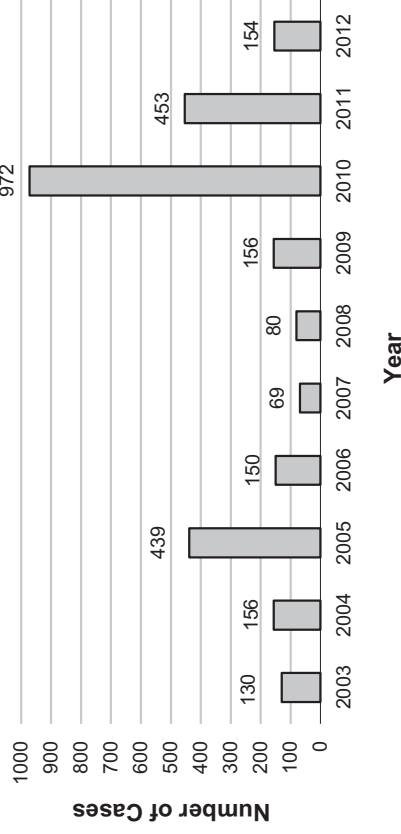
\* Rates calculated based on less than 19 cases or events are considered unreliable. A zero rate is reported with a dash ("-").



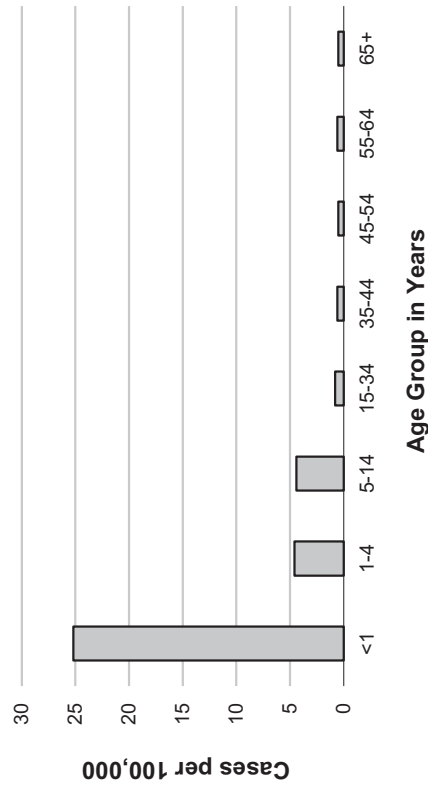
**Figure 1. Incidence Rates of Pertussis  
LAC, CA and US, 2003-2012**



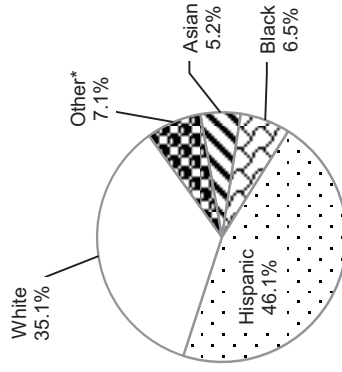
**Figure 2. Reported Cases of Pertussis  
LAC, 2003-2012**



**Figure 3. Incidence Rates of Pertussis by Age Group  
LAC, 2012 (N=154)**



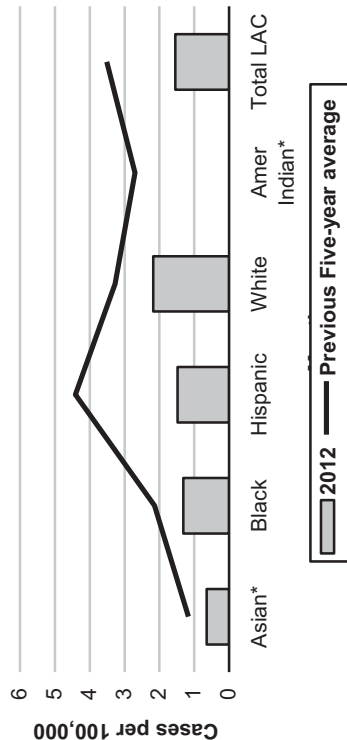
**Figure 4. Percent Cases of Pertussis by Race/Ethnicity  
LAC, 2012 (N=154)**



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

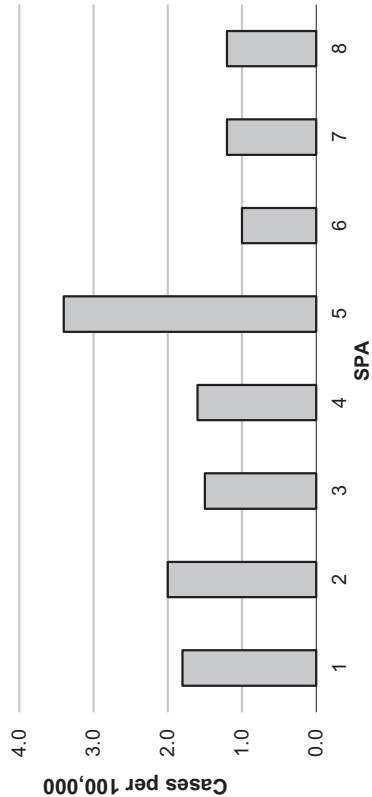


**Figure 5. Age-Adjusted Incidence Rates of Pertussis by Race/Ethnicity, LAC, 2012 (N=154) vs. Previous Five-Year Average**



\* Incidence rates based on <19 cases are considered unreliable.

**Figure 6. Incidence Rates of Pertussis by SPA LAC, 2012 (N=154)**



**Figure 8. Vaccination Status of Reported Pertussis Cases, LAC, 2012**

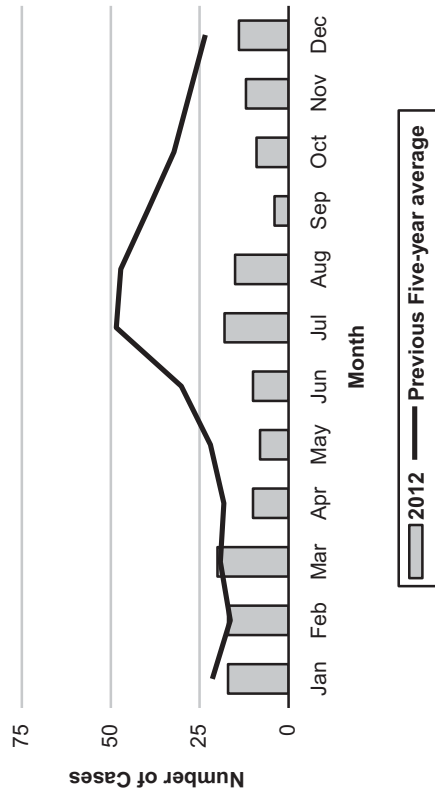
Reported Cases	Cases Too Young to Be Vaccinated <sup>1</sup>	Cases Eligible for Vaccination and Up-to-Date <sup>2</sup>	Cases Eligible for Vaccination and Not Up-to-Date <sup>3</sup>	Personal Beliefs Exemption School Vaccine Waivers Among Cases Age <18 years (n=114)
No. 154	9	74	71	10
% 100%	5.8%	48.1%	46.1%	8.8%

<sup>1</sup>Cases less than 2 months of age.

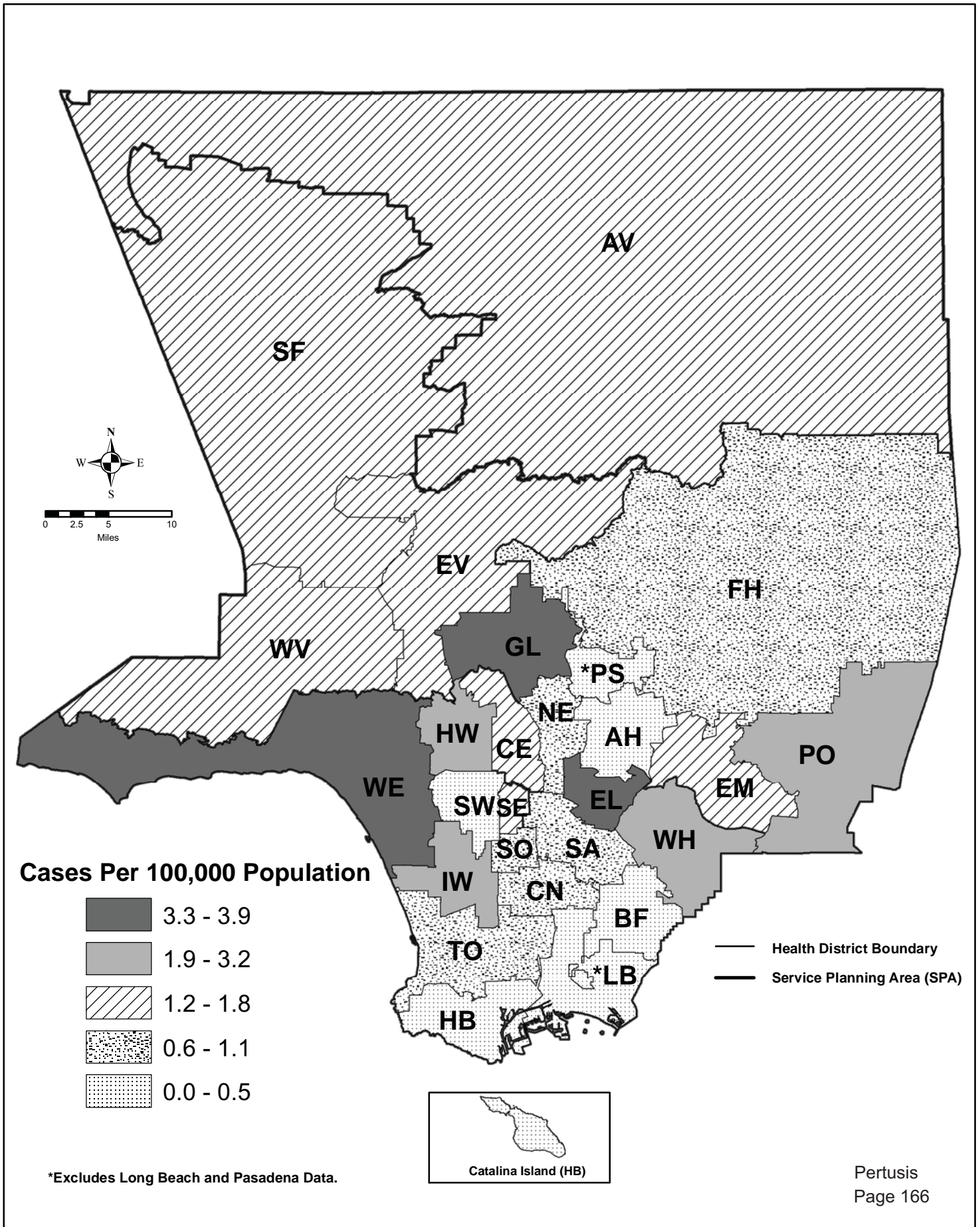
<sup>2</sup>Cases 2 months of age and older and who are up-to-date with the pertussis immunization recommendations for their age.

<sup>3</sup>Cases 2 months of age and older and who are not up-to-date with the pertussis immunization recommendations for their age. Includes cases that have unknown immunization status, have personal belief exemption school vaccine waivers, or have no valid documentation of receiving pertussis vaccines prior to disease onset.

**Figure 7. Reported Pertussis Cases by Month of Onset LAC, 2012 (N=154) vs. Previous Five-year Average**



# Map 9. Pertussis Rates by Health District, Los Angeles County, 2012\*





## PERTUSSIS (WHOOING COUGH)

CRUDE DATA	
Number of Cases	972
Annual Incidence <sup>a</sup>	
LA County	9.91
California <sup>b</sup>	--
United States <sup>b</sup>	--
Age at Diagnosis	
Mean	12.2 years
Median	7.0 years
Range	Birth – 88 years

<sup>a</sup>Cases per 100,000 population.

<sup>b</sup>See Final Summary of Nationally Notifiable Infectious Diseases, United States on MMWR website [http://www.cdc.gov/mmwr/mmwr\\_nd/index.html](http://www.cdc.gov/mmwr/mmwr_nd/index.html).

### DESCRIPTION

Pertussis, commonly known as whooping cough, is a vaccine-preventable disease spread by close contact with the respiratory secretions of infected individuals. The clinical case definition for pertussis is a cough lasting at least two weeks with paroxysms of coughing, inspiratory “whoop,” or post-tussive vomiting, without other apparent causes. Complications include pneumonia, seizures, and encephalopathy. Infants under one year of age are at highest risk for developing severe complications. Pertussis is confirmed by either positive *Bordetella pertussis* culture or PCR.

### Immunization Recommendations:

- A pertussis-containing vaccine (DTP/DTaP) should be administered at 2, 4, 6, 15-18 months, and 4-6 years of age to provide protection against the disease.
- Immunity conferred by the pertussis component of the DTP/DTaP vaccine decreases over time, with some vaccinated individuals becoming susceptible to pertussis 5-10 years following their last dose. In Spring 2005, two Tdap vaccines were licensed for use in adolescents and adults. A single dose of Tdap is recommended for persons aged 10-64 years.
- In 2010, Tdap recommendations were expanded to include children age 7-9 years who did not receive all five doses of DTaP and

adults age 65 years and older who were not previously vaccinated with Tdap.

### 2010 TRENDS AND HIGHLIGHTS

- Pertussis incidence has peaked every three to five years, with the last peak occurring in 2005. In 2010, a resurgence occurred, as Los Angeles County’s (LAC) highest peak in incidence in over 50 years occurred with 972 cases (696 confirmed, 276 probable) reported (9.91 cases per 100,000) (Figure 1, Figure 2). The resurgence started in April and peaked during the summer months of July-September (Figure 7). Four deaths were also reported in LAC; all were infants less than three months of age. A total of 9,120 cases were reported in California for a state rate of 23.3 cases per 100,000.
- Similar to previous years, infants less than one year of age had the highest incidence rate (195.6 cases per 100,000) (Figure 3). However, infants accounted for a smaller proportion of cases (28.1%) compared to an average of 46.7% from 2006-2009. Cases continue to increase among adolescents and adults. For the first time, the 5-14 year age group accounted for the highest proportion of cases (31.3%). Furthermore, the median age of cases increased by six years in 2010 (7.0 years) compared to 2009 (10.5 months).
- Similar to previous years, Hispanics and whites accounted for the highest proportion of cases and age-adjusted incidence rates (Figure 4, Figure 5).
- Unlike previous years, SPA 6, SPA 4, and SPA 2 had the highest incidence rates (Figure 6). Household clusters were identified in SPA 2 (n=20), SPA 3 (n=26), SPA 4 (n=16), SPA 5 (n=4), SPA 6 (n=15), SPA 7 (n=7), and SPA 8 (n=22). Except for SPA 1, all of the SPAs increased their incidence rates by three-fold compared to 2009.
- Of the total 972 cases, 57.2% (n=556) cases were either too young to be vaccinated (8.6%) or were not up-to-date with the immunization recommendations for their age (48.6%) indicating that more work needs to be done to increase pertussis vaccination rates. Additionally, 4.2% (n=33) of the cases age less <18 years of age had personal beliefs exemption school vaccine waivers (Figure 8).



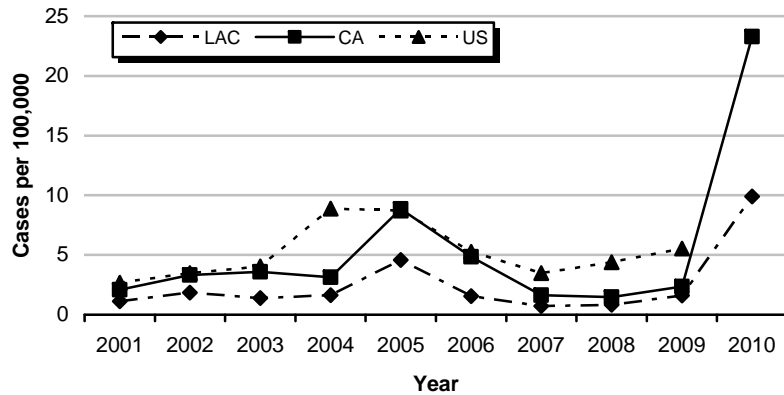
**Reported Pertussis Cases and Rates\* per 100,000 by Age Group, Race/Ethnicity, and SPA  
 Los Angeles County, 2006-2010**

	2006 (N=150)			2007 (N=69)			2008 (N=80)			2009 (N=156)			2010 (N=972)		
	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000
<b>Age Group</b>															
<1	58	38.7	40.0	31	44.9	21.0	42	52.5	30.1	79	50.7	57.6	273	28.1	195.6
1-4	14	9.3	2.4	4	5.8	0.7	7	8.8	1.2	10	6.4	1.8	158	16.2	27.2
5-14	33	22.0	2.2	13	18.8	0.9	13	16.3	0.9	18	11.5	1.3	304	31.3	22.9
15-34	21	14.0	0.8	14	20.3	0.5	12	15.0	0.4	20	12.8	0.7	122	12.5	4.1
35-44	8	5.3	0.5	4	5.8	0.3	1	1.3	0.1	9	5.8	0.6	40	4.1	2.8
45-54	7	4.7	0.5	1	1.4	0.1	2	2.5	0.1	12	7.7	0.9	28	2.9	2.1
55-64	6	4.0	0.7	2	2.9	0.2	2	2.5	0.2	5	3.2	0.5	24	2.5	2.5
65+	3	2.0	0.3	0	0.0	0.0	1	1.3	0.1	3	1.9	0.3	23	2.4	2.2
Unknown	0	0.0		0	0.0		0	0.0		0	0.0		0	0.0	
<b>Race/Ethnicity</b>															
Asian	8	5.3	0.6	8	11.6	0.6	4	5.0	0.3	10	6.4	0.8	32	3.3	2.4
Black	4	2.7	0.5	1	1.4	0.1	4	5.0	0.5	6	3.9	0.7	50	5.1	5.9
Hispanic	79	52.7	1.7	42	60.9	0.9	52	65.0	1.1	100	64.1	2.1	655	67.4	13.8
White	59	39.3	2.1	18	26.1	0.6	18	22.5	0.6	39	25.0	1.3	216	22.2	7.5
Other	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	1	0.6	3.9	2	0.2	7.7
Unknown	0	0.0		0	0.0		2	2.5		0	0.0		17	1.8	
<b>SPA</b>															
1	12	8.0	3.5	1	1.4	0.3	2	2.5	0.5	9	5.8	2.4	19	1.9	5.1
2	32	21.3	1.5	16	23.2	0.7	12	15.0	0.5	21	13.5	0.9	209	21.5	9.4
3	21	14.0	1.2	8	11.6	0.5	4	5.0	0.2	24	15.4	1.4	147	15.1	8.5
4	14	9.3	1.1	9	13.0	0.7	17	21.3	1.3	18	11.5	1.4	162	16.7	12.9
5	11	7.3	1.7	8	11.6	1.2	10	12.5	1.5	17	10.9	2.6	57	5.8	8.6
6	17	11.3	1.6	9	13.0	0.9	9	11.3	0.9	24	15.4	2.3	158	16.3	14.8
7	27	18.0	2.0	8	11.6	0.6	13	16.3	0.9	22	14.1	1.6	129	13.3	9.4
8	16	10.7	1.4	10	14.5	0.9	13	16.3	1.2	21	13.5	1.9	90	9.3	8.0
Unknown	0	0.0		0	0.0		0	0.0		0	0.0		1	0.1	

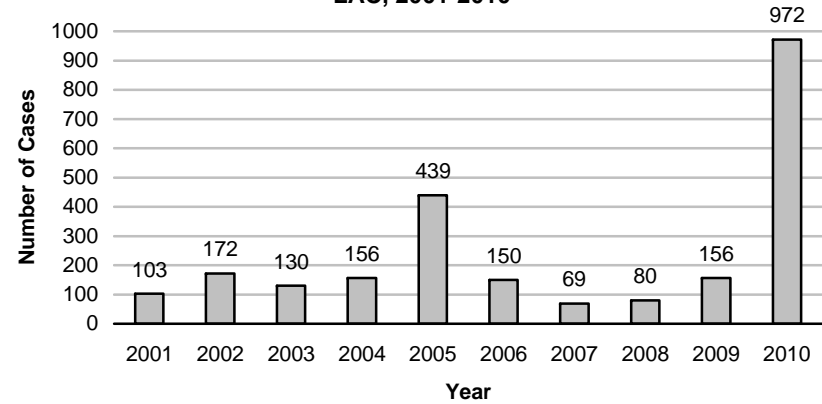
\*Rates calculated based on less than 19 cases or events are considered unreliable.



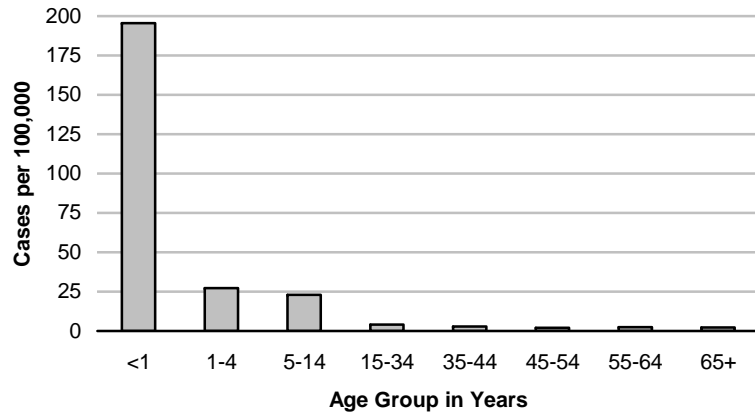
**Figure 1. Incidence Rates of Pertussis  
 LAC, CA and US, 2001-2010**



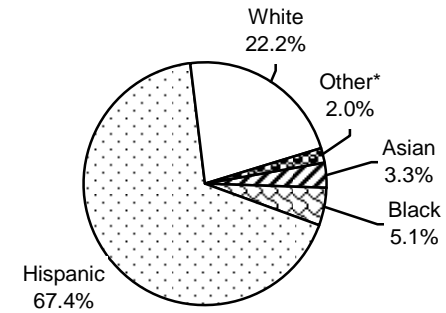
**Figure 2. Reported Cases of Pertussis  
 LAC, 2001-2010**



**Figure 3. Incidence Rates of Pertussis by Age Group  
 LAC, 2010 (N=972)**



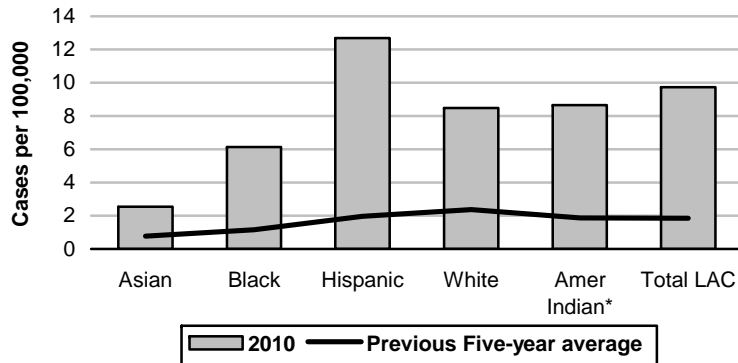
**Figure 4. Percent Cases of Pertussis by Race/Ethnicity  
 LAC, 2010 (N=972)**



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

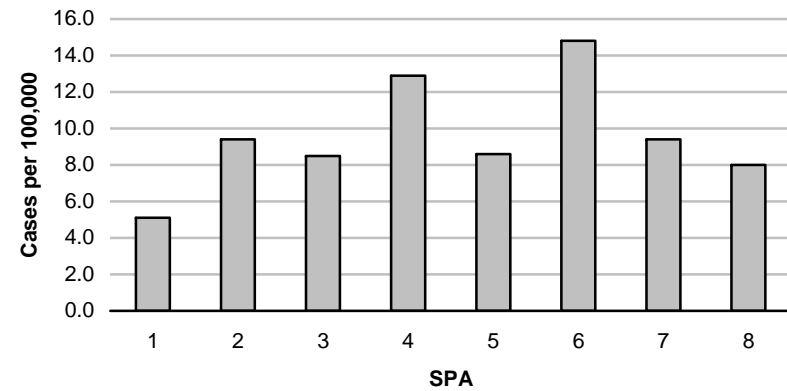


**Figure 5. Age-Adjusted Incidence Rates of Pertussis by Race/Ethnicity, LAC, 2010 (N=972) vs. Previous Five-Year Average**

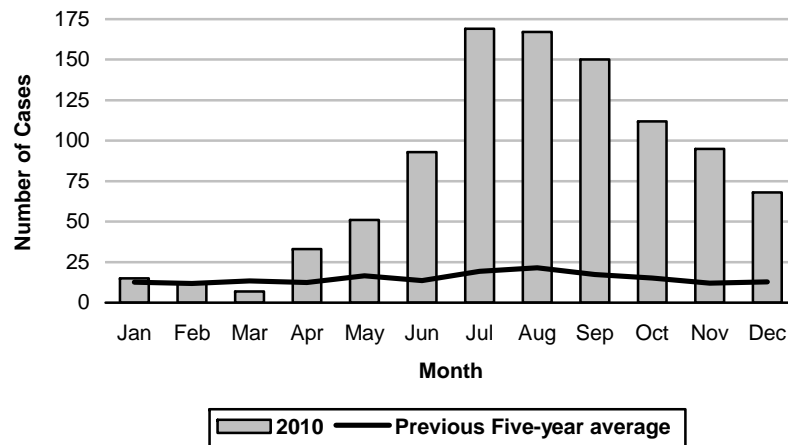


\* Incidence rates based on <19 cases are considered unreliable.

**Figure 6. Incidence Rates of Pertussis by SPA LAC, 2010 (N=972)**



**Figure 7. Reported Pertussis Cases by Month of Onset LAC, 2010 (N=972) vs. Previous Five-year Average**



**Figure 8. Vaccination Status of Reported Pertussis Cases, LAC, 2010**

	Reported Cases	Cases Too Young to Be Vaccinated <sup>1</sup>	Cases Eligible for Vaccination and Up-to-Date <sup>2</sup>	Cases Eligible for Vaccination and Not Up-To-Date <sup>3</sup>	Personal Beliefs Exemption School Vaccine Waivers Among Cases Age <18 years (n=784)
No.	972	84	416	472	33
%	100%	8.6%	42.8%	48.6%	4.2%

<sup>1</sup>Cases less than 2 months of age.

<sup>2</sup>Cases 2 months of age and older and who are up-to-date with the pertussis immunization recommendations for their age.

<sup>3</sup>Cases 2 months of age and older and who are not up-to-date with the pertussis immunization recommendations for their age. Includes cases that have unknown immunization status, have personal belief exemption school vaccine waivers, or have no valid documentation of receiving pertussis vaccines prior to disease onset.





## PERTUSSIS (WHOOPIING COUGH)

CRUDE DATA	
Number of Cases	156
Annual Incidence <sup>a</sup>	
LA County	1.60
California <sup>b</sup>	1.46
United States <sup>b</sup>	4.40
Age at Diagnosis	
Mean	13.7 years
Median	10.5 months
Range	Birth – 73 years

<sup>a</sup>Cases per 100,000 population.

<sup>b</sup>Calculated from Final 2008 Reports of Nationally Notifiable Infectious Disease. MMWR 58(31); 856-857; 859-869.

### DESCRIPTION

Pertussis, commonly known as whooping cough, is a vaccine-preventable disease spread by close contact with the respiratory secretions of infected individuals. The clinical case definition for pertussis is a cough lasting at least two weeks with paroxysms of coughing, inspiratory “whoop,” or post-tussive vomiting, without other apparent causes. Complications include pneumonia, seizures, and encephalopathy. Infants under one year of age are at highest risk for developing severe complications. Pertussis is confirmed by either positive *Bordetella pertussis* culture or PCR.

#### Immunization Recommendations:

- A pertussis-containing vaccine should be administered at 2, 4, 6, 15-18 months, and 4-6 years of age to provide protection against the disease.
- Immunity conferred by the pertussis component of the DTP/DTaP vaccine decreases over time, with some vaccinated individuals becoming susceptible to pertussis 5-10 years following their last dose.
- In Spring 2005, two Tdap vaccines were licensed for use in adolescents and adults, one for persons aged 10 to 18 years (BOOSTRIX®, GlaxoSmithKline) and the other for persons aged 11 to 64 years (ADACEL®, Sanofi Pasteur).

### 2009 TRENDS AND HIGHLIGHTS

- Pertussis incidence has peaked every three to five years, with the last peak occurring in 2005. As expected, a peak in incidence occurred in 2009 with 156 cases (96 confirmed, 60 probable) reported (1.60 cases per 100,000) (Figure 1, Figure 2). Similar to previous years, infants less than one year of age accounted for the highest proportion of cases (50.7%) and incidence rate (57.6 cases per 100,000) (Figure 3). Cases appear to be increasing among adolescents and adults as evidenced by the fact that 31.4% (n=49) of the cases were over 14 years of age in 2009 compared to 22.6% (n=18) in 2008. Furthermore, the mean and median ages have increased by 4-5 years in 2009 (mean: 13.7 years, median: 10.5 months) compared to 2008 (mean: 9.4 years, median: 5.5 months).
- Similar to previous years, Hispanics and whites accounted for the highest proportion of cases and age-adjusted incidence rates (Figure 4, Figure 5).
- For the third year in a row, SPA 5 reported the highest incidence rate. The higher number of children with personal beliefs exemptions (PBE) in SPA 5 compared to other SPAs may be a contributing factor. Of the 17 cases reported from SPA 5, two of the cases had PBEs. SPA 1 and SPA 6 also had high incidence rates (Figure 6). Household clusters were identified in SPA 2 (n=7), SPA 3 (n=5), SPA 4 (n=2), SPA 5 (n=3), SPA 6 (n=5), and SPA 8 (n=9).
- The fact that the only pertussis-related death in 2009 was in an infant that was less than two months of age underscores the need to vaccinate individuals of all ages in order to protect young children.
- 71.8% (n=112) of the cases were either too young to be vaccinated or were not up-to-date with the immunization recommendations for their age indicating that more work needs to be done to increase pertussis vaccination rates. Additionally, 5.5% (n=6) of the cases age less <18 years of age had a (PBE) school vaccine waivers (Figure 8).



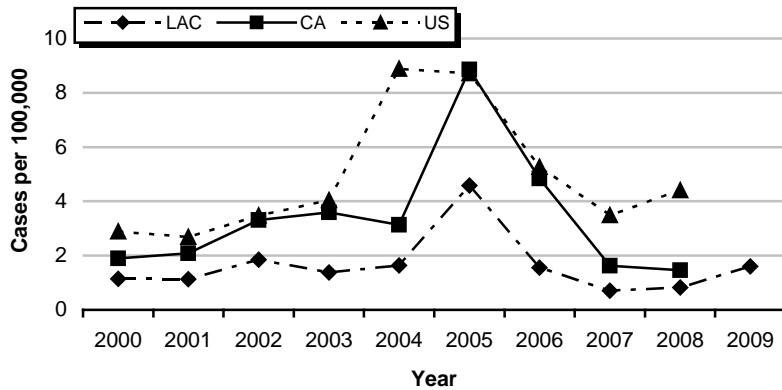
**Reported Pertussis Cases and Rates\* per 100,000 by Age Group, Race/Ethnicity, and SPA  
 Los Angeles County, 2005-2009**

	2005 (N=439)			2006 (N=150)			2007 (N=69)			2008 (N=80)			2009 (N=156)		
	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000
<b>Age Group</b>															
<1	180	41.0	127.	58	38.7	40.0	31	44.9	21.0	42	52.5	30.1	79	50.7	57.6
1-4	27	6.2	4.7	14	9.3	2.4	4	5.8	0.7	7	8.8	1.2	10	6.4	1.8
5-14	88	20.0	5.9	33	22.0	2.2	13	18.8	0.9	13	16.3	0.9	18	11.5	1.3
15-34	83	18.9	3.0	21	14.0	0.8	14	20.3	0.5	12	15.0	0.4	20	12.8	0.7
35-44	32	7.3	2.1	8	5.3	0.5	4	5.8	0.3	1	1.3	0.1	9	5.8	0.6
45-54	16	3.6	1.3	7	4.7	0.5	1	1.4	0.1	2	2.5	0.1	12	7.7	0.9
55-64	8	1.8	1.0	6	4.0	0.7	2	2.9	0.2	2	2.5	0.2	5	3.2	0.5
65+	5	1.1	0.5	3	2.0	0.3	0	0.0	0.0	1	1.3	0.1	3	1.9	0.3
Unknown	0	0.0		0	0.0		0	0.0		0	0.0		0	0.0	
<b>Race/Ethnicity</b>															
Asian	14	3.2	1.1	8	5.3	0.6	8	11.6	0.6	4	5.0	0.3	10	6.4	0.8
Black	31	7.1	3.7	4	2.7	0.5	1	1.4	0.1	4	5.0	0.5	6	3.9	0.7
Hispanic	245	55.8	5.4	79	52.7	1.7	42	60.9	0.9	52	65.0	1.1	100	64.1	2.1
White	148	33.7	5.1	59	39.3	2.1	18	26.1	0.6	18	22.5	0.6	39	25.0	1.3
Other	1	0.2	3.5	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	1	0.6	3.9
Unknown	0	0.0		0	0.0		0	0.0		2	2.5		0	0.0	
<b>SPA</b>															
1	46	10.5	13.5	12	8.0	3.5	1	1.4	0.3	2	2.5	0.5	9	5.8	2.4
2	113	25.7	5.3	32	21.3	1.5	16	23.2	0.7	12	15.0	0.5	21	13.5	0.9
3	50	11.4	2.9	21	14.0	1.2	8	11.6	0.5	4	5.0	0.2	24	15.4	1.4
4	37	8.4	3.0	14	9.3	1.1	9	13.0	0.7	17	21.3	1.3	18	11.5	1.4
5	31	7.1	4.9	11	7.3	1.7	8	11.6	1.2	10	12.5	1.5	17	10.9	2.6
6	61	13.9	5.9	17	11.3	1.6	9	13.0	0.9	9	11.3	0.9	24	15.4	2.3
7	39	8.9	2.8	27	18.0	2.0	8	11.6	0.6	13	16.3	0.9	22	14.1	1.6
8	62	14.1	5.6	16	10.7	1.4	10	14.5	0.9	13	16.3	1.2	21	13.5	1.9
Unknown	0	0.0		0	0.0		0	0.0		0	0.0		0	0.0	

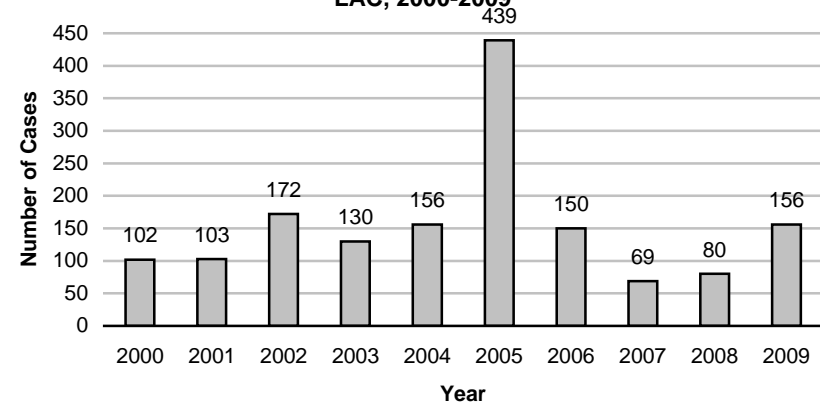
\*Rates calculated based on less than 19 cases or events are considered unreliable.



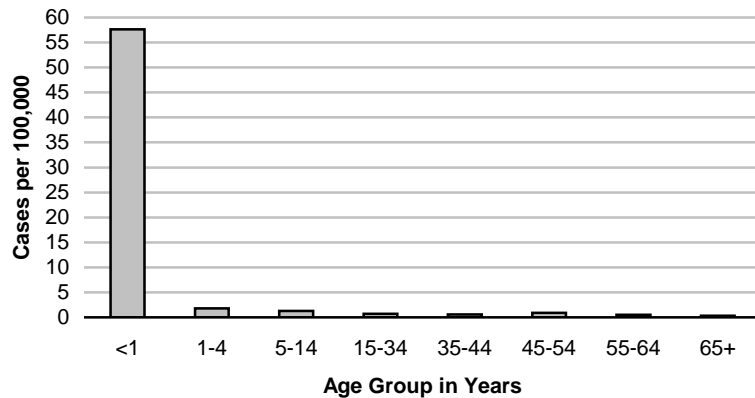
**Figure 1. Incidence Rates of Pertussis  
LAC, CA and US, 2000-2009**



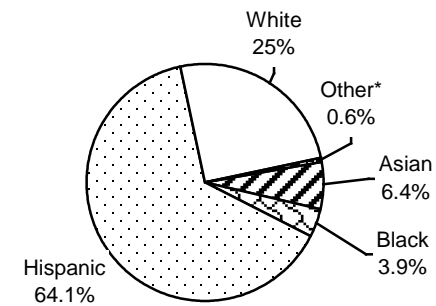
**Figure 2. Reported Cases of Pertussis  
LAC, 2000-2009**



**Figure 3. Incidence Rates of Pertussis by Age Group  
LAC, 2009 (N=156)**



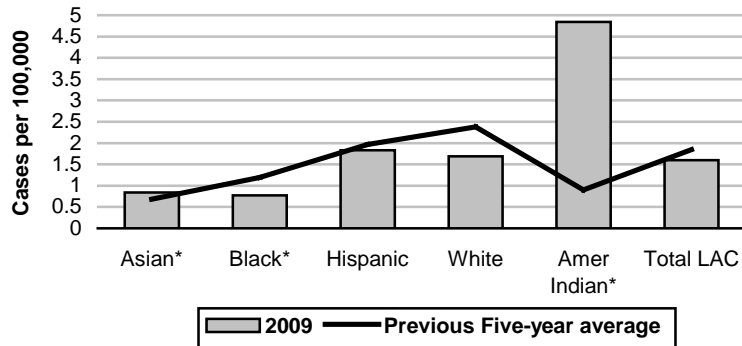
**Figure 4. Percent Cases of Pertussis by Race/Ethnicity  
LAC, 2009 (N=156)**



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

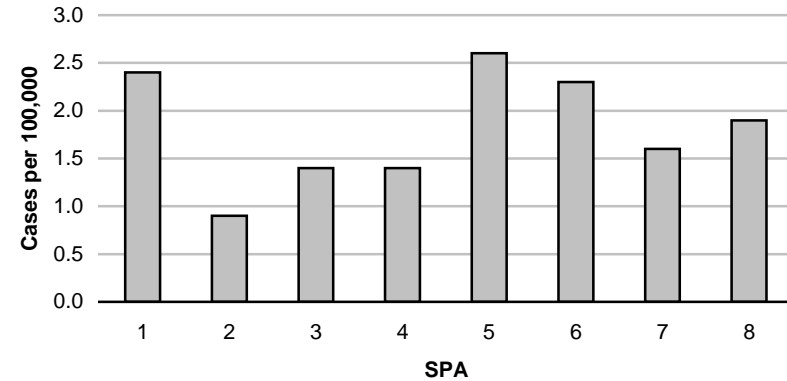


**Figure 5. Age-Adjusted Incidence Rates of Pertussis by Race/Ethnicity, LAC, 2009 (N=156) vs. Previous Five-Year Average**

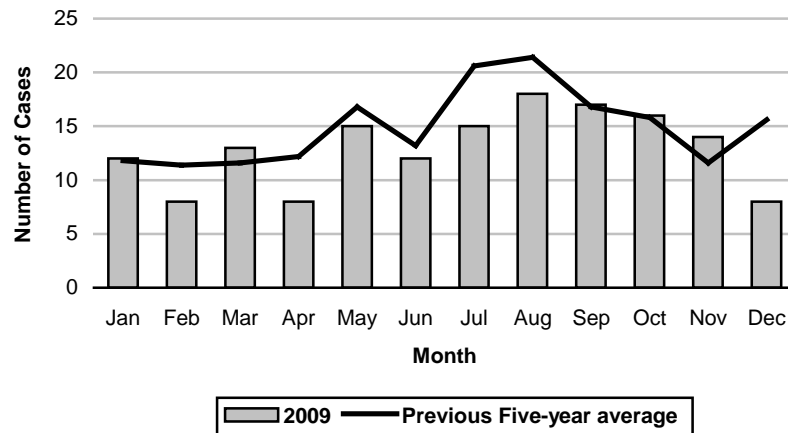


\* Incidence rates based on <19 cases are considered unreliable.

**Figure 6. Incidence Rates of Pertussis by SPA LAC, 2009 (N=156)**



**Figure 7. Reported Pertussis Cases by Month of Onset LAC, 2009 (N=156) vs. Previous Five-year Average**



**Figure 8. Vaccination Status of Reported Pertussis Cases, LAC, 2009**

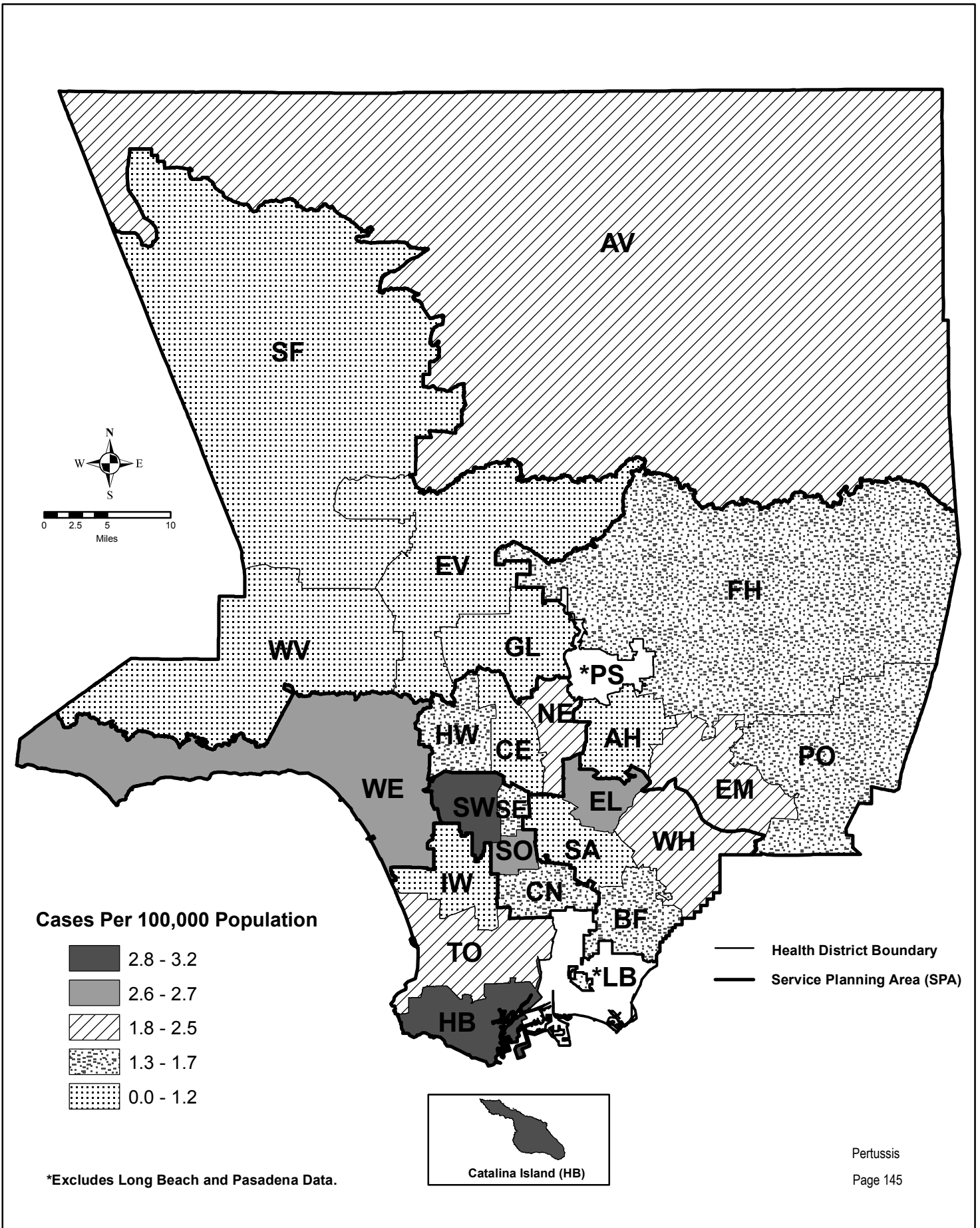
	Reported Cases	Cases Too Young to Be Vaccinated <sup>1</sup>	Cases Eligible for Vaccination and Up-to-Date <sup>2</sup>	Cases Eligible for Vaccination and Not Up-To-Date <sup>3</sup>	Personal Beliefs Exemption School Vaccine Waivers Among Cases Age <18 years (n=110)
No.	156	42	44	70	6
%	100%	26.9%	28.2%	44.9%	5.5%

<sup>1</sup>Cases less than 2 months of age.

<sup>2</sup>Cases 2 months of age and older and who are up-to-date with the pertussis immunization recommendations for their age.

<sup>3</sup>Cases 2 months of age and older and who are not up-to-date with the pertussis immunization recommendations for their age. Includes cases that have unknown immunization status, have personal belief exemption school vaccine waivers, or have no valid documentation of receiving pertussis vaccines prior to disease onset.

# Map 10. Pertussis Rates by Health District, Los Angeles County, 2009\*





## PERTUSSIS (WHOOING COUGH)

CRUDE DATA	
Number of Cases	80
Annual Incidence <sup>a</sup>	
LA County	0.82
California <sup>b</sup>	1.46
United States <sup>b</sup>	4.40
Age at Diagnosis	
Mean	9.4 years
Median	5.5 months
Range	12 days – 72 years

<sup>a</sup>Cases per 100,000 population.

<sup>b</sup>Calculated from Final 2008 Reports of Nationally Notifiable Infectious Disease. MMWR 58(31);856-857;859-869.

### DESCRIPTION

Pertussis, commonly known as whooping cough, is a vaccine-preventable disease spread by close contact with the respiratory secretions of infected individuals. The clinical case definition for pertussis is a cough lasting at least two weeks with paroxysms of coughing, inspiratory “whoop,” or post-tussive vomiting, without other apparent causes. Complications include pneumonia, seizures, and encephalopathy. Infants under 1 year of age are at highest risk for developing severe complications. Pertussis is confirmed by either positive *Bordetella pertussis* culture or PCR.

#### Immunization Recommendations:

- A pertussis-containing vaccine should be administered at 2, 4, 6, 15-18 months, and 4-6 years of age to provide protection against the disease.
- Immunity conferred by the pertussis component of the DTP/DTaP vaccine decreases over time, with some vaccinated individuals becoming susceptible to pertussis 5-10 years following their last dose.
- In Spring 2005, two Tdap vaccines were licensed for use in adolescents and adults, one for persons aged 10 to 18 years (Boostrix, GlaxoSmithKline) and the other for persons aged 11 to 64 years (ADACEL, Sanofi Pasteur).

### 2008 TRENDS AND HIGHLIGHTS

- Pertussis incidence has peaked every 3 to 5 years, with the last peak occurring in 2005. Although a higher incidence was expected in 2008, only 80 cases (55 confirmed, 25 probable) were reported (0.82 cases per 100,000), which is the second lowest annual number of reported cases and incidence rate since 1999 (Figure 1, Figure 2). Tdap usage may be a contributing factor.
- Similar to previous years, infants less than one year of age accounted for the highest proportion of cases (52.5%) and incidence rate (30.1 cases per 100,000) (Figure 3). Cases appear to be decreasing among adolescents and adults, as evidenced by the fact that 22.5% (n=18) of the cases were over 14 years of age in 2008 compared to an average of 30.8% (n=63) from 2004-2007.
- Similar to previous years, Hispanics and whites accounted for the highest proportion of cases and age-adjusted incidence rates (Figure 4, Figure 5).
- For the second year in a row, SPA 5, SPA 4, and SPA 8 reported the highest incidence rates (Figure 6). Household clusters were identified in SPA 2 (n=4), SPA 4 (n=4), SPA 8 (n=4), and SPA 7 (n=2).
- The fact that the only pertussis-related death in 2008 was in an infant that was less than one month of age underscores the need to vaccinate individuals of all ages in order to protect young children.
- 65% (n=52) of the cases were either too young to be vaccinated or were not up-to-date with the immunization recommendations for their age indicating that more work needs to be done to increase pertussis vaccination rates (Figure 8).



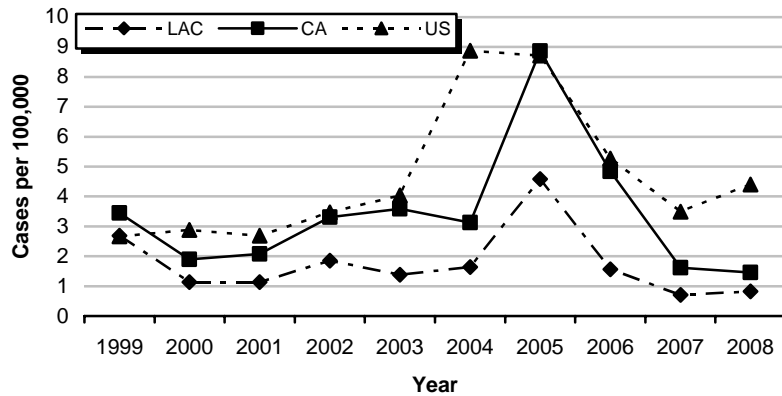
**Reported Pertussis Cases and Rates\* per 100,000 by Age Group, Race/Ethnicity, and SPA  
Los Angeles County, 2004-2008**

	2004 (N=156)			2005 (N=439)			2006 (N=150)			2007 (N=69)			2008 (N=80)		
	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000	No.	(%)	Rate/ 100,000
<b>Age Group</b>															
<1	87	55.8	61.1	180	41.0	127.8	58	38.7	40.0	31	44.9	21.0	42	52.5	30.1
1-4	10	6.4	1.7	27	6.2	4.7	14	9.3	2.4	4	5.8	0.7	7	8.8	1.2
5-14	17	10.9	1.1	88	20.0	5.9	33	22.0	2.2	13	18.8	0.9	13	16.3	0.9
15-34	29	18.6	1.0	83	18.9	3.0	21	14.0	0.8	14	20.3	0.5	12	15.0	0.4
35-44	4	2.6	0.3	32	7.3	2.1	8	5.3	0.5	4	5.8	0.3	1	1.3	0.1
45-54	5	3.2	0.4	16	3.6	1.3	7	4.7	0.5	1	1.4	0.1	2	2.5	0.1
55-64	2	1.3	0.3	8	1.8	1.0	6	4.0	0.7	2	2.9	0.2	2	2.5	0.2
65+	1	0.6	0.1	5	1.1	0.5	3	2.0	0.3	0	0.0	0.0	1	1.3	0.1
Unknown	1	0.6		0	0.0		0	0.0		0	0.0		0	0.0	
<b>Race/Ethnicity</b>															
Asian	5	3.2	0.4	14	3.2	1.1	8	5.3	0.6	8	11.6	0.6	4	5.0	0.3
Black	7	4.5	0.8	31	7.1	3.7	4	2.7	0.5	1	1.4	0.1	4	5.0	0.5
Hispanic	101	64.7	2.3	245	55.8	5.4	79	52.7	1.7	42	60.9	0.9	52	65.0	1.1
White	41	26.3	1.4	148	33.7	5.1	59	39.3	2.1	18	26.1	0.6	18	22.5	0.6
Other	0	0.0	0.0	1	0.2	3.5	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
Unknown	2	1.3		0	0.0		0	0.0		0	0.0		2	2.5	
<b>SPA</b>															
1	5	3.2	1.5	46	10.5	13.5	12	8.0	3.5	1	1.4	0.3	2	2.5	0.5
2	21	13.5	1.0	113	25.7	5.3	32	21.3	1.5	16	23.2	0.7	12	15.0	0.5
3	24	15.4	1.4	50	11.4	2.9	21	14.0	1.2	8	11.6	0.5	4	5.0	0.2
4	25	16.0	2.0	37	8.4	3.0	14	9.3	1.1	9	13.0	0.7	17	21.3	1.3
5	10	6.4	1.6	31	7.1	4.9	11	7.3	1.7	8	11.6	1.2	10	12.5	1.5
6	24	15.4	2.3	61	13.9	5.9	17	11.3	1.6	9	13.0	0.9	9	11.3	0.9
7	18	11.5	1.3	39	8.9	2.8	27	18.0	2.0	8	11.6	0.6	13	16.3	0.9
8	29	18.6	2.6	62	14.1	5.6	16	10.7	1.4	10	14.5	0.9	13	16.3	1.2
Unknown	0	0.0		0	0.0		0	0.0		0	0.0		0	0.0	

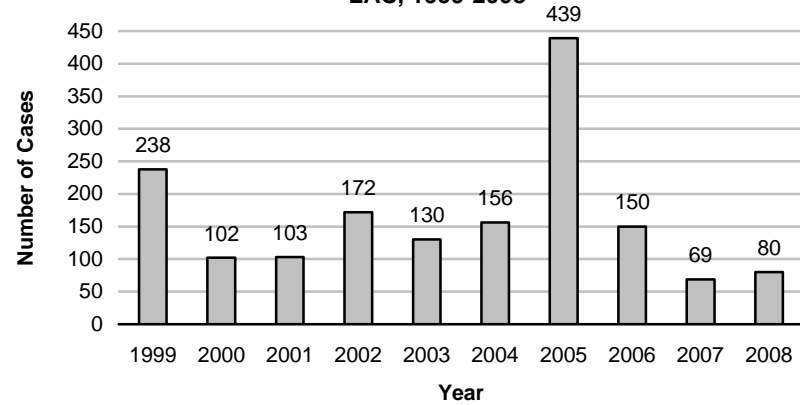
\*Rates calculated based on less than 19 cases or events are considered unreliable.



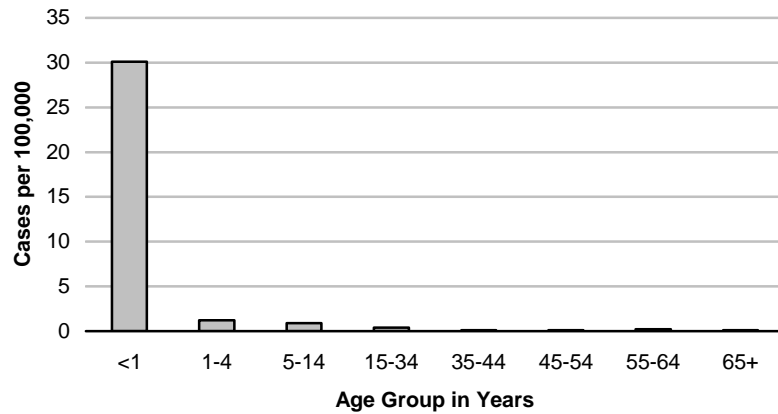
**Figure 1. Incidence Rates of Pertussis  
US, CA and LAC, 1999-2008**



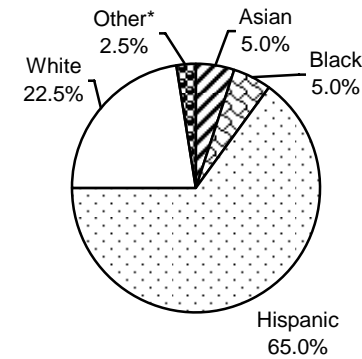
**Figure 2. Reported Cases of Pertussis  
LAC, 1999-2008**



**Figure 3. Incidence Rates of Pertussis by Age Group  
LAC, 2008**



**Figure 4. Percent Cases of Pertussis by Race/Ethnicity  
LAC, 2008**

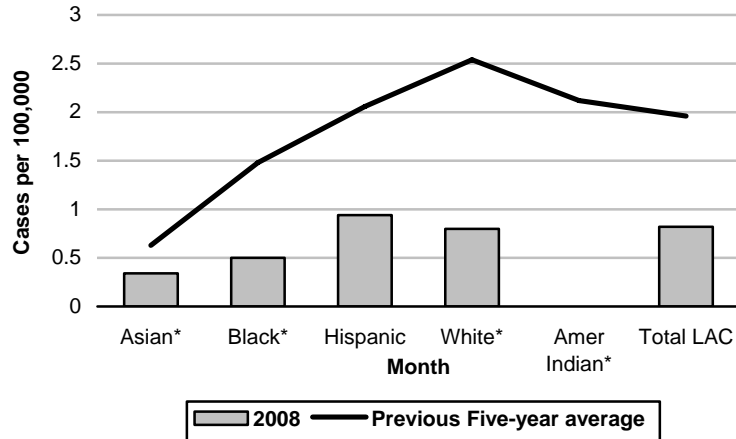


\* Other includes Native American and any additional racial/ethnic group that cannot be categorized as Asian, black, Hispanic, or white.



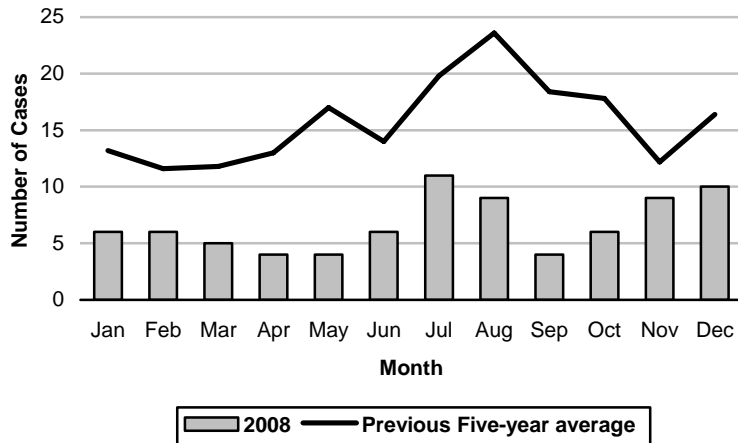


**Figure 5. Age-Adjusted Incidence Rates of Pertussis by Race/Ethnicity, LAC, 2008 vs. Previous Five-Year Average**

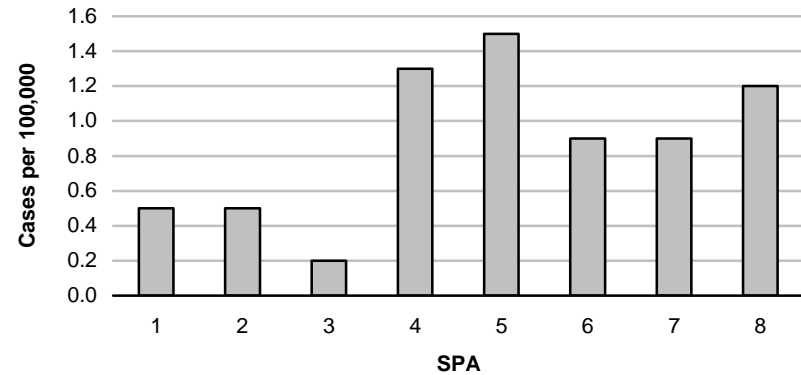


\* Incidence rates based on <19 cases are considered unreliable.

**Figure 7. Reported Pertussis Cases by Month of Onset LAC, 2008 vs. Previous Five-year Average**



**Figure 6. Incidence Rates of Pertussis by SPA LAC, 2008**



**Figure 8. Vaccination Status of Reported Pertussis Cases, LAC, 2008**

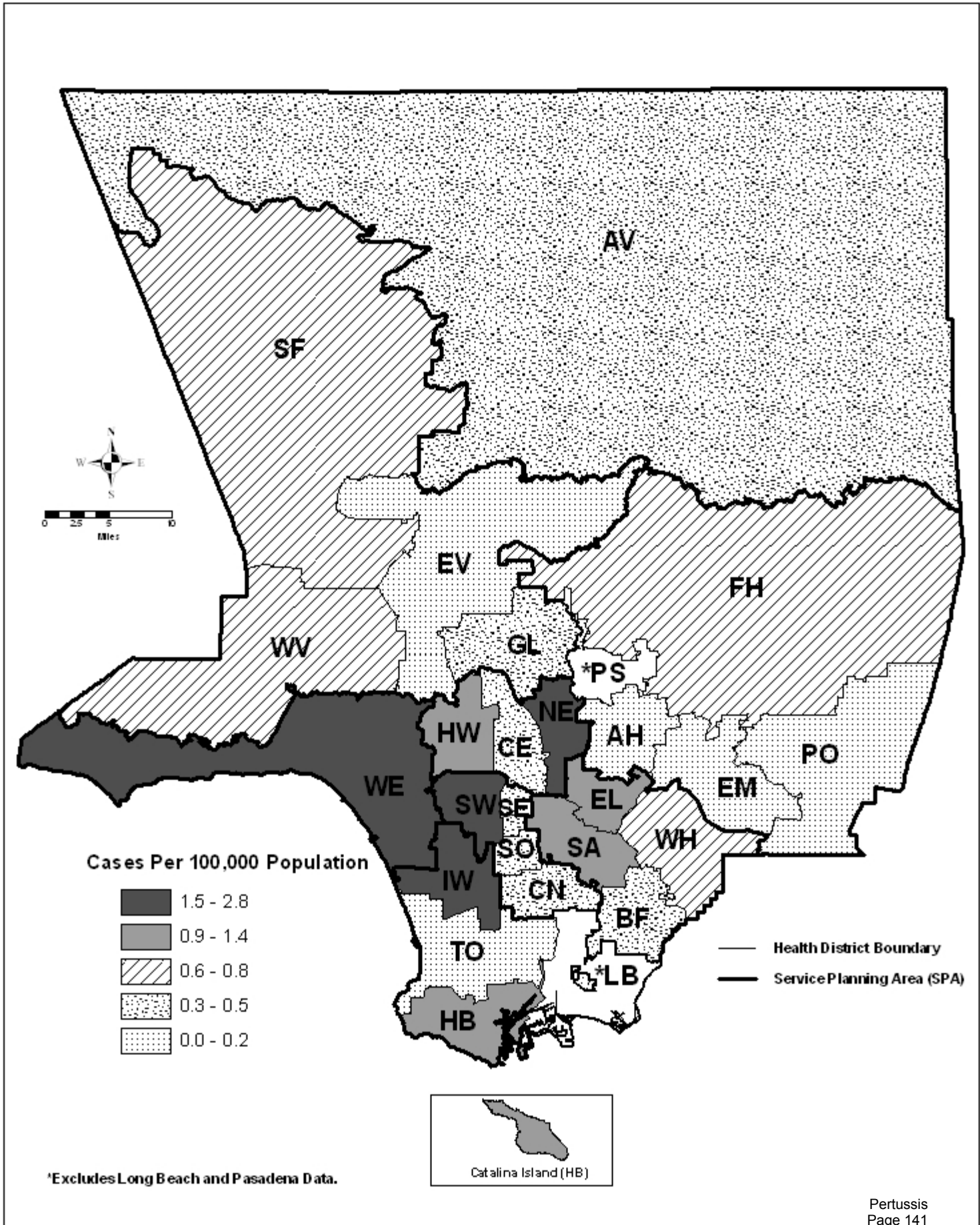
	Reported Cases	Cases Too Young to Be Vaccinated <sup>1</sup>	Cases Eligible for Vaccination and Up-to-Date <sup>2</sup>	Cases Eligible for Vaccination and Not Up-To-Date <sup>3</sup>	Personal Beliefs Exemption School Vaccine Waivers Among Cases Age <18 years (n=65)
No.	80	23	28	29	3
%	100%	28.8%	35.0%	36.2%	4.6%

<sup>1</sup>Cases less than 2 months of age.

<sup>2</sup>Cases 2 months of age and older and who are up-to-date with the pertussis immunization recommendations for their age.

<sup>3</sup>Cases 2 months of age and older and who are not up-to-date with the pertussis immunization recommendations for their age. Includes cases that have unknown immunization status, have personal belief exemption school vaccine waivers, or have no valid documentation of receiving pertussis vaccines prior to disease onset.

# Map 11. Pertussis Rates by Health District, Los Angeles County, 2008\*



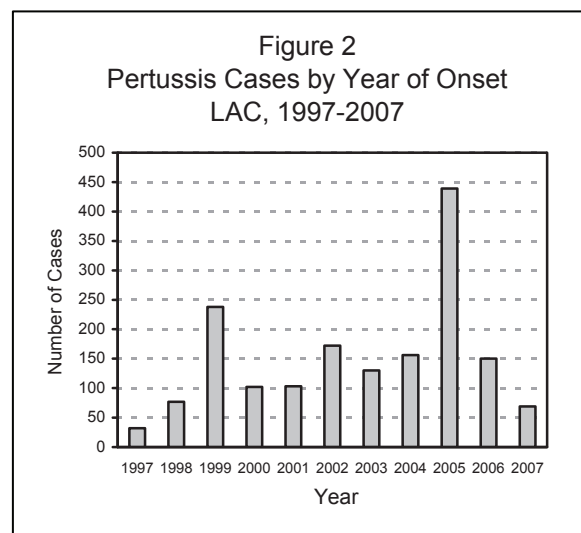
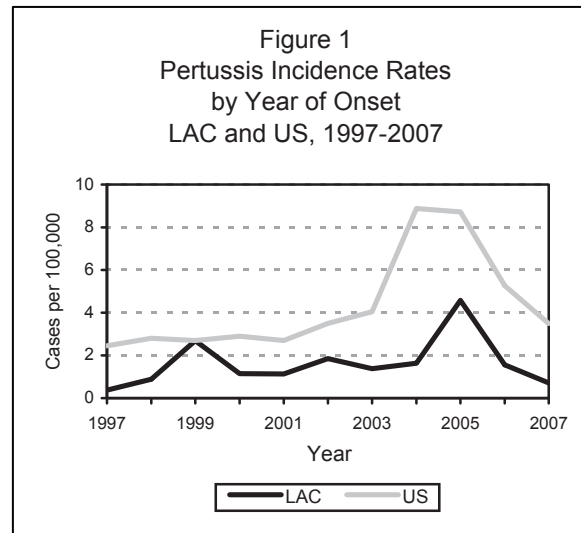


## PERTUSSIS (WHOOPIING COUGH)

CRUDE DATA	
Number of Cases	69
Annual Incidence <sup>a</sup>	
LA County	0.71
California	1.62 <sup>b</sup>
United States	3.49 <sup>b</sup>
Age at Diagnosis	
Mean	10.9 years
Median	4.0 years
Range	10 days – 59 years

<sup>a</sup> Cases per 100,000 population.

<sup>b</sup> Calculated from Final 2007 Reports of Nationally Notifiable Infectious Diseases issues of MMWR (57: 901, 903-913).



### DESCRIPTION

Pertussis, commonly known as whooping cough, is a vaccine-preventable disease spread by close contact with the respiratory secretions of infected individuals. Typical symptoms include paroxysmal coughing, inspiratory whooping, and post-tussive vomiting. Complications include pneumonia, seizures, and encephalopathy. Infants under 1 year of age are at highest risk for developing severe complications.

The minimum clinical criteria for pertussis is a cough lasting at least two weeks with paroxysms of coughing, inspiratory “whoop,” or post-tussive vomiting, without other apparent causes. Pertussis is confirmed by either positive *Bordetella pertussis* culture or PCR.

### DISEASE ABSTRACT

- Only 69 cases were reported in 2007 (0.71 cases per 100,000), which is the lowest number of reported cases and incidence rate since 1997.
- One pertussis-related death occurred in 2007, marking the twelfth death within the last 10 years.
- Of the 2007 cases, 82% were not adequately immunized that could have been fully protected against pertussis (7 months to 64 years old).

### IMMUNIZATION RECOMMENDATIONS

- A pertussis-containing vaccine should be administered at 2, 4, 6, 15-18 months, and 4-6 years of age to provide protection against the disease.
- Immunity conferred by the pertussis component of the DTP/DTaP vaccine decreases over time, with some vaccinated individuals becoming susceptible to pertussis 5-10 years following their last dose.
- In Spring 2005, 2 Tdap vaccines were licensed for use in adolescents and adults, one for persons aged 10-18 years (Boostrix, GlaxoSmithKline) and the other for persons aged 11-64 years (ADACEL, Sanofi Pasteur).



## STRATIFIED DATA

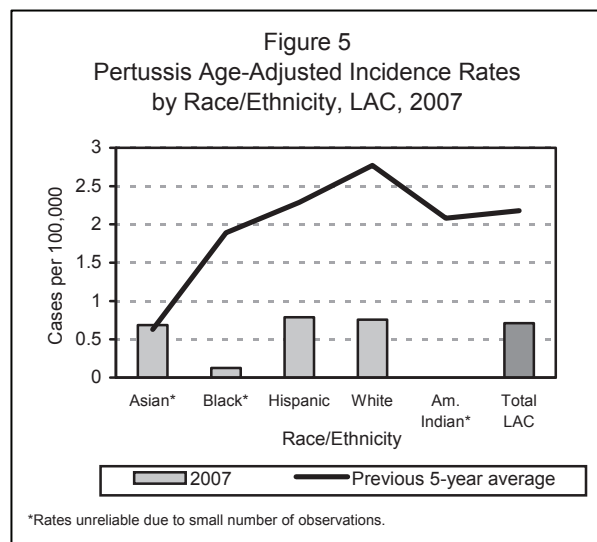
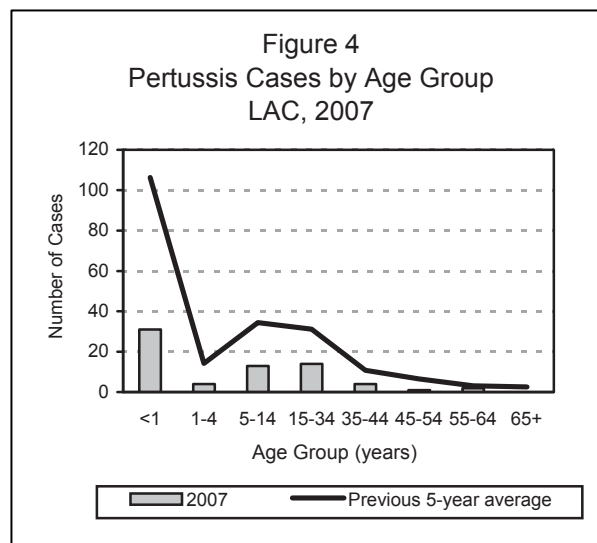
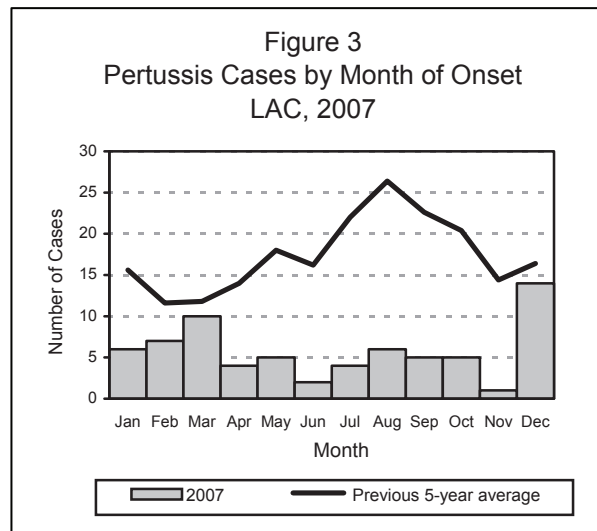
**Seasonality:** Typically, the summer months have the highest pertussis incidence in LAC (Figure 3). However, in 2007, there were peaks in the winter months of March and December. March accounted for 15% (n=10) of cases; six of the cases were a part of two separate household clusters. December accounted for 20% (n=14) of cases; three of the cases had epidemiological linkages to other cases with December onset dates. The onset of cases was distributed fairly uniformly throughout the rest of the year.

**Age:** Although the majority of reported cases are still in children <1 year of age, the proportion of cases in the <1 age group is slightly smaller in 2007 (45%) compared to the previous five year average (51%). As seen nationally, cases are slightly increasing among adolescents and adults, as evidenced by the fact that 30% (n=21) of the cases were over 14 years of age in 2007 compared to an average of 26% (n=54) in the previous five years (Figure 4). Increased recognition and diagnosis of pertussis in older age groups has contributed to the increase in reported cases among adolescents and adults.

**Sex:** The male-to-female case ratio was approximately 1:1.4.

**Race/Ethnicity:** After adjusting for the age differential in the cases, incidence rates in 2007 for blacks, Hispanics, whites, and American Indians were lower than the previous 5-year averages (Figure 5). However, it should be noted that the previous 5-year average is influenced by the high incidence rates reported in 2005, for which whites had the highest incidence rate at 6.1 cases per 100,000. The incidence rates for Hispanics and whites were approximately equivalent to the total LAC rate. However, the LAC population proportion of whites (30%) is much lower than that for Hispanics (48%).

**Location:** For the first time in over five years, West SPA 5 had the highest incidence rate of 1.2 cases per 100,000 (n=8); two of the cases in SPA 5 were epidemiologically linked. The second highest incidence rate occurred in South Bay SPA 8 with 0.9 cases per 100,000 (n=10); 60% (n=6) of the 10 cases were epidemiologically linked to cases living within two unrelated households.





## COMMENTS

During 2007, pertussis received some media attention due to school outbreaks in the Virgin Islands and South Carolina. No LAC were identified in association with either of these outbreaks nor were there any outbreaks in LAC.

Historically, pertussis incidence peaks every 3 to 5 years. The last peak in incidence occurred in 2005, which was the same year the two Tdap vaccines for adolescents and adults were licensed. Following the cyclical nature of pertussis incidence, a high incidence would not be expected in 2007. However, compared to the last 10 years, an incidence of 0.71 cases per 100,000 in 2007 is unusually low. The decrease in pertussis activity is not likely to be due to increased use of pertussis vaccine. According to the most recent National Immunization Survey (NIS) data, vaccine coverage levels for 4+ doses of DTaP among children 19-35 months of age in LAC has consistently been above 80%; 85% in 2006 compared with an average of 83.9% during the previous 5 years (2001-2005). An NIS telephone survey conducted from May to August 2007 found that Tdap vaccine coverage levels among adults aged 18 to 64 years of age is only 2.1%. Additional surveillance and epidemiological studies will be needed to monitor the impact of Tdap vaccination on pertussis incidence following its 2005 licensure. However, it is clear that more work needs to be done to increase Tdap vaccination rates.

Trends: The epidemiology of pertussis in LAC is shifting to different age groups, racial/ethnic groups, and geographic areas (LAC IP, 2007). During the winter quarters preceding the most recent peak incidence years (1999, 2002, and 2005), more LAC cases were reported among adolescents 10 to 19 years of age. Whites are contributing more of the LAC adolescent/adult cases. The geographic face of pertussis is also shifting outside of the historical high morbidity areas for vaccine-preventable diseases in central Los Angeles to surrounding areas with higher proportions of whites (West Los Angeles, South Bay, and Antelope Valley).

Laboratory Confirmation: More than half of the reported cases (59%, n=41) were laboratory confirmed by either *B. pertussis* culture or PCR. Culture is considered the gold standard laboratory test because it is the most specific of all the laboratory tests for pertussis. While the PCR test's rapidity and sensitivity can greatly aid in the diagnosis of pertussis, specificity can be poor with high rates of false-positive results.

Vaccination Status: Of the 38 cases who could have had full immunity from vaccination (7 months to 64 years old), only 18% (n=7) were fully up to date. Of these 38 cases, 68% (n=26) were 10 years of age or older. Although the 26 cases would have been eligible for Tdap vaccine, none had received Tdap.

Less than one fifth of all cases (19%, n=13) were younger than two months of age and were too young to receive pertussis vaccine. Approximately 26% (n=18) of cases were between 2–6 months of age. Of these, 56% (n=10) were up to date with pertussis vaccination for their age, but would not have developed full immunity against pertussis. Of the 12 children who could have had full immunity from childhood DTaP vaccination (7 months to 9 years old), 58% (n=7) were fully up to date. The previous 5-year trend has indicated that, on average, 65% of cases 7 months to 9 years of age were adequately immunized.

Complications/Hospitalizations: Approximately 39% (n=27) were hospitalized, with an average hospital stay of 7 days (range 1-16 days). Among the hospitalized cases, 93% (n=25) were less than one year of age. Of the 6 cases who developed pneumonia, 83% (n=5) were infants less than one year of age.

Case Fatalities: There was one pertussis-related death in 2007. The fatality occurred in a Hispanic female infant who was less than 1 month of age. The principal diagnosis in the discharge/death summary was cardiorespiratory arrest. The female infant died 18 days after cough onset. The infant was in contact with 3 family members who were also coughing around the same time. During the first 13 days of her illness, the patient sought hospital care and was discharged both times without a pertussis diagnosis. During the third hospital visit 4 days later, she was admitted into the pediatric intensive care unit with a diagnosis of hypoxemia, respiratory failure, lymphocytosis, and suspect pertussis. A PCR test detected *Bordetella pertussis* DNA and azithromycin treatment was initiated. The patient expired the next day. Earlier consideration of pertussis may have prevented death.



## REFERENCES

Los Angeles County Immunization Program (2007). The endemic and cyclical nature of pertussis disease morbidity: The evolving epidemiology of a unique vaccine-preventable disease in Los Angeles County. Los Angeles County Department of Public Health.

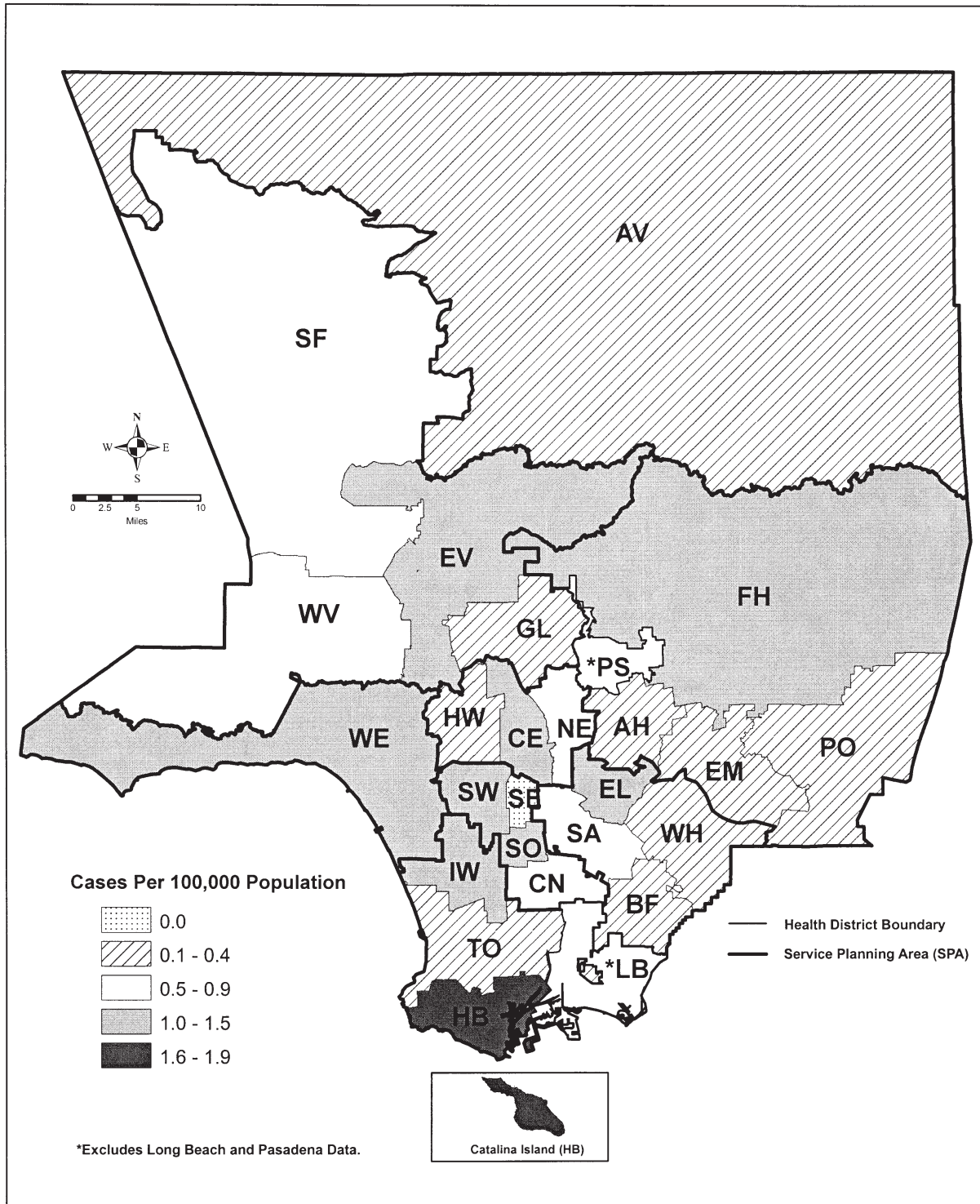
## ADDITIONAL RESOURCES

Additional information is available at:

- National Center for Immunization and Respiratory Diseases – <http://www.cdc.gov/vaccines>
- Immunization Action Coalition – <http://www.immunize.org>
- LAC Immunization Program – <http://www.lapublichealth.org/ip>



**Map 11. Pertussis  
 Rates by Health District, Los Angeles County, 2007\***



## PERTUSSIS (WHOOING COUGH)

CRUDE DATA	
Number of Cases	150
Annual Incidence <sup>a</sup>	
LA County	1.56
California	4.43
United States	5.27 <sup>b</sup>
Age at Diagnosis	
Mean	13.6 years
Median	6.0 years
Range	8 days–89 years

<sup>a</sup> Cases per 100,000 population.

<sup>b</sup> Calculated from 2007 Summary of notifiable diseases issue of MMWR (56:853-863).

### DESCRIPTION

Pertussis, commonly known as whooping cough, is a vaccine-preventable disease spread by close contact with the respiratory secretions of infected individuals. Typical symptoms include paroxysmal coughing, inspiratory whooping, and post-tussive vomiting. Complications include pneumonia, seizures, and encephalopathy. Infants under 1 year of age are at highest risk for developing severe complications.

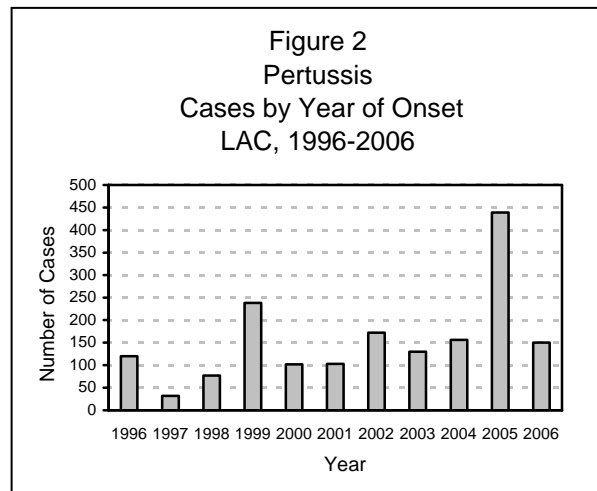
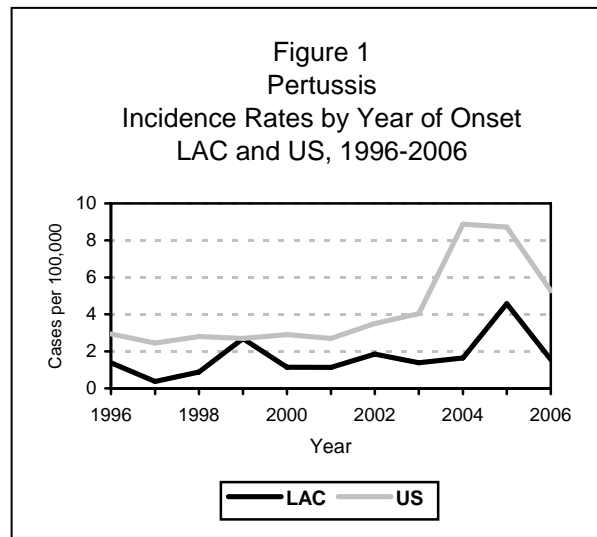
The minimum clinical criteria for pertussis is a cough lasting at least two weeks with paroxysms of coughing, inspiratory “whoop,” or post-tussive vomiting, without other apparent causes. Pertussis is confirmed by either positive *B. pertussis* culture or PCR.

### DISEASE ABSTRACT

- Following a record-high of 438 cases in 2005, 150 cases were reported in 2006, which is similar to pre-2005 baseline levels.
- Preceding their illness, less than half of the cases in 2006 indicated contact to a person who had a prolonged cough.
- Of the 2006 cases that could have been fully immunized and protected against pertussis, approximately one fourth were not adequately immunized.

### IMMUNIZATION RECOMMENDATIONS

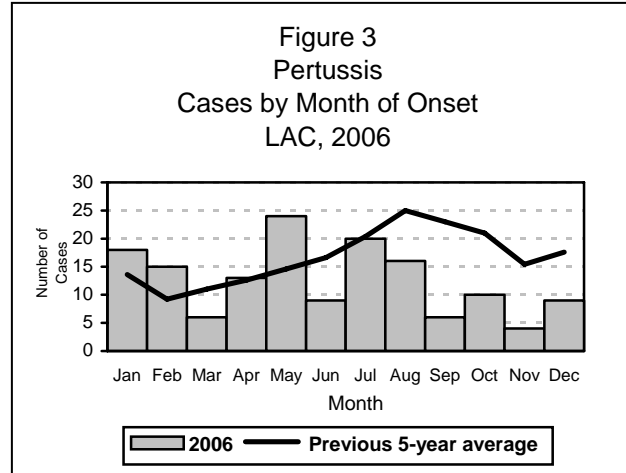
- A pertussis-containing vaccine should be administered at 2 months, 4 months, 6 months, 15–18 months, and 4–6 years of age to provide protection against the disease.
- Immunity conferred by the pertussis component of the DTP/DTaP vaccine decreases over time, with some vaccinated individuals becoming susceptible to pertussis 5–10 years following their last dose.
- In Spring 2005, 2 Tdap vaccines were licensed for use in adolescents and adults, one for persons aged 10-18 years (Boostrix, GlaxoSmithKline) and the other for persons aged 11-64 years (ADACEL, Sanofi Pasteur).



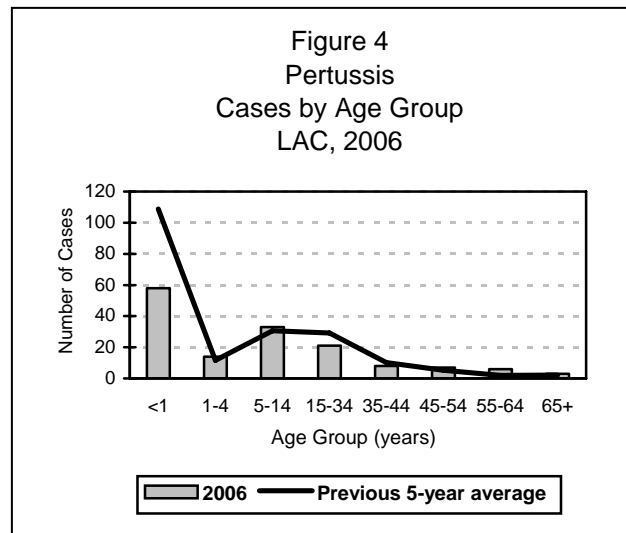


**STRATIFIED DATA**

**Seasonality:** Following the record-high number of cases reported in 2005, a higher number of cases were reported during the first 5 months of 2006 compared to the previous five-year average. The number of cases peaked in May, which accounted for 16% (n=24) of cases. (Note: The only LAC pertussis outbreak in 2006 occurred in May and involved 4 cases.) From June to December, the number of 2006 cases was lower than the previous five-year average during this same time period. Typically, the summer months have the highest pertussis incidence in LAC. In 2006, 46% (n=69) of reported cases had disease onset during the months of May, June, July, and August. (Figure 3)

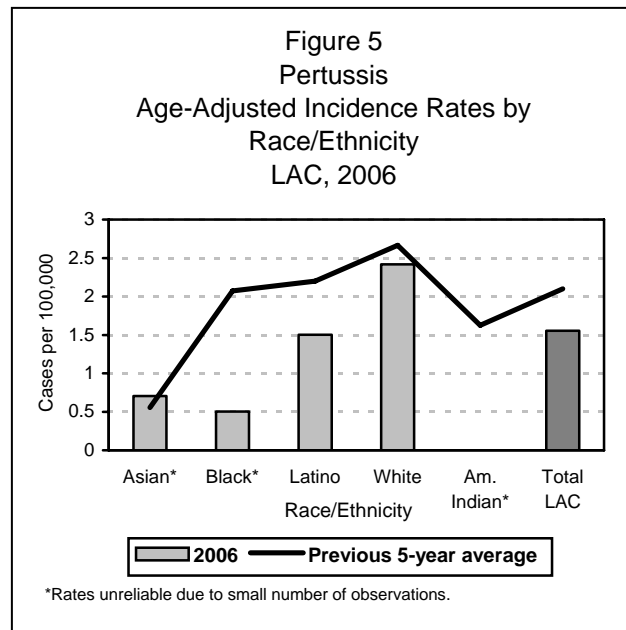


**Age:** Although the majority of reported cases are still in children less than one year of age, the proportion of cases in the <1 age group is smaller in 2006 (39%) compared to the previous five year average (54%). As expected, cases are increasing among adolescents and adults, as evidenced by the fact that 30% (n=45) of the cases were over 14 years of age (Figure 4) in 2006 compared to an average of 24% (n=49) in the previous five years. Increased recognition and diagnosis of pertussis in older age groups has contributed to the increase in reported cases among adolescents and adults.



**Sex:** The male-to-female case ratio was approximately 1:1.6.

**Race/Ethnicity:** After adjusting for the age differential in the cases, incidence rates in 2006 for blacks, Latinos, whites, and American Indians were lower than the previous 5-year averages (Figure 5). However, it should be noted that the previous 5-year average is influenced by the high incidence rates reported in 2005. Only whites had a higher incidence rate than the total LAC rate. The incidence rate for Latinos was approximately equivalent to the total LAC rate. However, the LAC population proportion of whites (30%) is much lower than that for Latinos (48%).



**Location:** For the second year in a row, Antelope Valley (SPA 1) had the highest incidence rate of 3.5 cases per 100,000 (n=12). Of the 12 cases reported in SPA 1, 42% (n=5) were epidemiologically linked to cases living within two households. The second highest incidence rate occurred in East (SPA 7) with 2.0 cases per 100,000 (n=27), followed by West (SPA 5) with 1.7 cases per 100,000 (n=11), South (SPA 6) with 1.6 cases per 100,000 (n=17),

San Fernando Valley (SPA 2) with 1.5 cases per 100,000 (n=32), South Bay (SPA 8) with 1.4 cases per 100,000 (n=16), San Gabriel Valley (SPA 3) with 1.2 cases per 100,000 (n=21), and Metro (SPA 4) with 1.1 cases per 100,000 (n=14).

At the health district level, Bellflower (n=13) and Antelope Valley (n=12) had the highest incidence rates, each reporting 3.5 cases per 100,000. Compton had 2.7 cases per 100,000 (n=8), followed by Harbor with 2.4 cases per 100,000 (n=5). The lowest incidences rates were in El Monte and Inglewood health districts, each reporting only 1 case and an incidence rate of 0.2 cases per 100,000.

## COMMENTS

In 2005, two Tdap vaccines were newly licensed for use in adolescents and adults. The Immunization Program conducted multiple intervention activities (*i.e.*, health alerts, fact sheets, a symposium) to increase the community's awareness of pertussis cases in individuals of all ages. In addition, LAC experienced a significantly high incidence rate of 4.5 cases per 100,000, which was consistent with similar increases throughout California and the United States. It was also observed that more cases were being reported among adolescents and adults. Whether the increase in pertussis incidence represented a true increase in disease or improved recognition and reporting remains unclear.

During 2006, the Immunization Program continued to promote the Tdap vaccines. Because they have yet to be provided to the population at large, data on the impact of the vaccines is not yet available. No county-wide pertussis-specific intervention activities were conducted. The only outbreak of pertussis occurred at a local university where four epidemiologically-linked cases were identified, prompting the health district to conduct a Tdap vaccination clinic in which 201 faculty and students were vaccinated. Although the 2006 incidence rate in LAC decreased to pre-2005 baseline levels (1.56 cases per 100,000), adolescents and adults now comprise a larger proportion of cases. As discussed previously in this report, infants less than one year of age no longer make up the overwhelming majority of cases. However, infants still account for the majority of complications/hospitalizations. The only fatal case in 2006 occurred in an infant less than 2 months of age. Thus, in order to protect the population at large, it is critical that high DTaP and Tdap coverage rates are achieved in LAC.

Trends: Pertussis incidence normally peaks every 3 to 5 years. Between 1990 and 1999, there was an annual average of 101 cases reported, with the highest incidence occurring in 1999 (n=238). During 2000-2004, an annual average of 133 cases was reported, with the highest incidence occurring in 2002 (n=172). In 2005, 439 cases were reported, which was the highest number of cases reported in more than 35 years. In 2006, 150 cases were reported, which is comparable to pre-2005 baseline levels.

Laboratory Confirmation: More than half of the reported cases (55%, n=83) were not laboratory confirmed by either *B. pertussis* culture or PCR.

Vaccination Status: Less than one fifth of cases (14%, n=21) were younger than two months of age and were too young to receive pertussis vaccine. About 43% (n=65) of cases were 10 years of age or older; so even if they were fully immunized in early childhood, they would not have had complete immunity against pertussis in 2006 and would thus be eligible for Tdap vaccine.

Approximately 23% (n=35) of cases were between 2–6 months of age. Of these, 80% (n=28) were up-to-date with pertussis vaccination for their age, but would not have developed full immunity against pertussis. Of the 29 children who could have had full immunity from vaccination (7 months to 9 years old), 21 (72%) were fully up to date. The previous 5-year trend has indicated that, on average, 65% of cases 7 months to 9 years of age were adequately immunized.

Complications/Hospitalizations: Approximately 37% (n=55) were hospitalized, with an average hospital stay of 7 days (range 1-24 days). Among the hospitalized cases, 85% (n=47) were less than one year of age. Of the 15 cases who developed pneumonia, 8 (53%) were infants less than 1 year of age. One of the 15 cases with pneumonia, a child in the 1-4 year age group, also developed seizures. One additional case in the 1-4 year age group developed seizures.

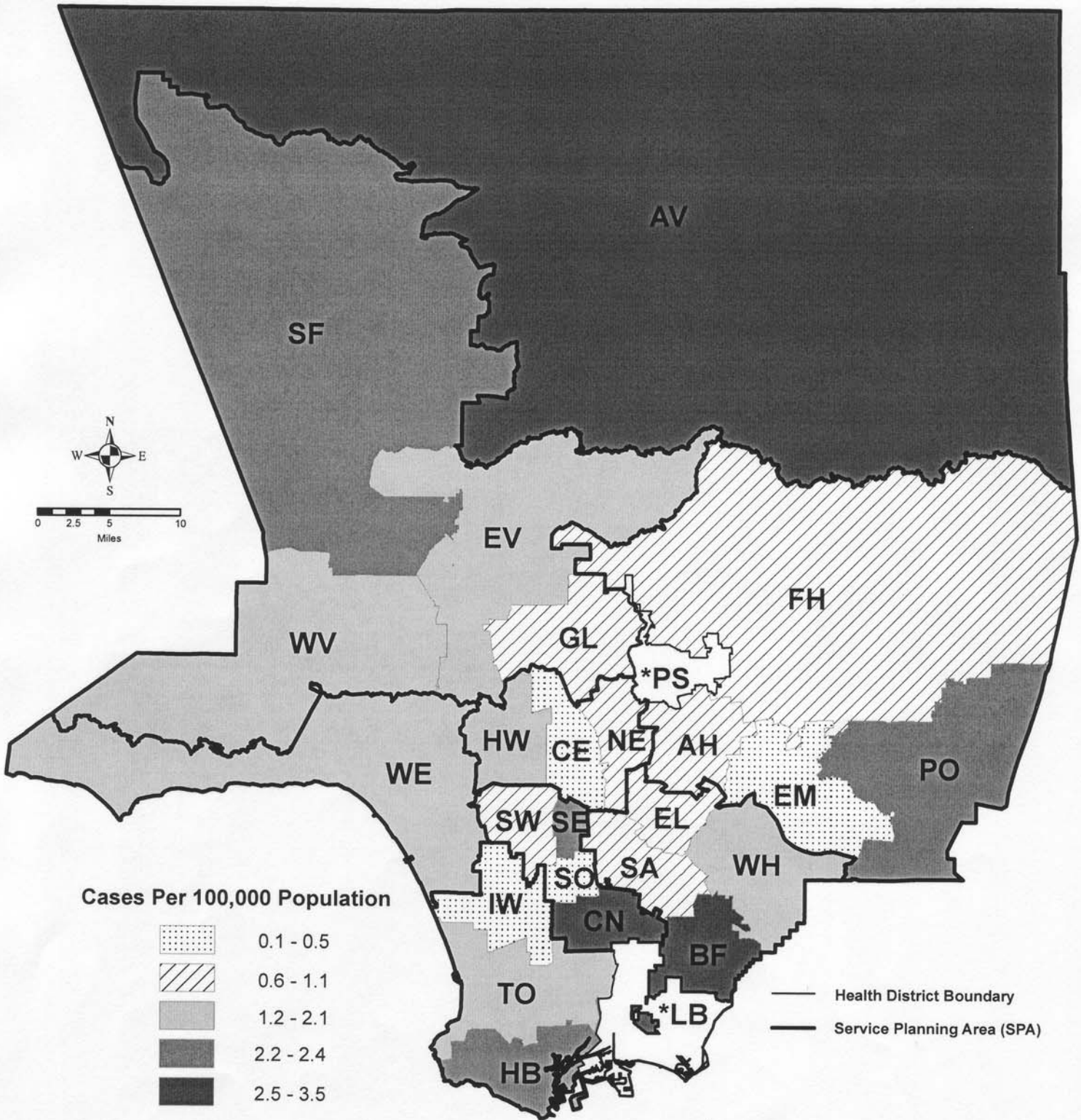
Case Fatalities: There was one pertussis-related death in 2006. The fatality occurred in a Hispanic female infant who was less than 2 months of age and was too young to receive pertussis vaccine. The principal diagnosis in the discharge/death summary was cardiorespiratory failure. The female infant died 6 days after cough onset and a PCR test detected *Bordetella pertussis* DNA. The infant was exposed to her twin brother whose cough onset was 3 weeks prior. Earlier consideration of pertussis for the brother would have initiated the administration of appropriate chemoprophylaxis to close contacts. Disease and death may have been prevented in this female infant.

### **ADDITIONAL RESOURCES**

Additional information is available at:

- National Immunization Program – [www.cdc.gov/vaccines](http://www.cdc.gov/vaccines)
- Immunization Action Coalition – [www.immunize.org](http://www.immunize.org)
- LAC Immunization Program – [www.lapublichealth.org/ip](http://www.lapublichealth.org/ip)

# Map 9. Pertussis Rates by Health District, Los Angeles County, 2006\*



\*Excludes Long Beach and Pasadena Data.





## PERTUSSIS (WHOOPING COUGH)

CRUDE DATA	
Number of Cases	438
Annual Incidence <sup>a</sup>	
LA County	4.57
California	8.57
United States	
Age at Diagnosis	
Mean	12.7 years
Median	7.5 years
Range	2 days–86 years
Case Fatality	
LA County	0.46%
United States	N/A

<sup>a</sup> Cases per 100,000 population.

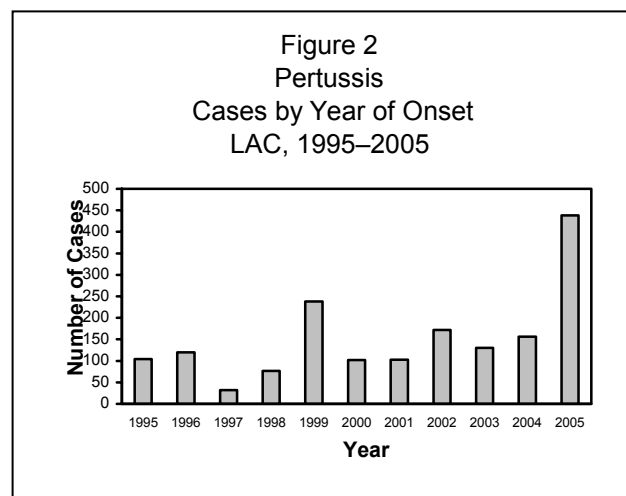
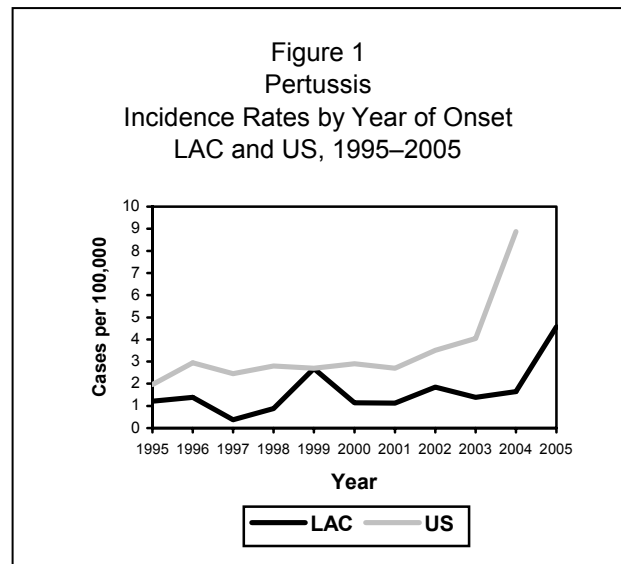
### DESCRIPTION

Pertussis, commonly known as whooping cough, is a vaccine-preventable disease spread by close contact with the respiratory secretions of infected individuals. Typical symptoms include paroxysmal coughing, inspiratory whooping, and post-tussive vomiting. Complications include pneumonia, seizures, and encephalopathy. Infants under 1 year of age are at highest risk for developing severe complications.

The minimum clinical criteria for pertussis is a cough lasting at least two weeks with paroxysms of coughing, inspiratory “whoop,” or post-tussive vomiting, without other apparent causes. Pertussis is confirmed by either positive *B. pertussis* culture or PCR.

### DISEASE ABSTRACT

- A record-high 438 cases were reported in 2005, which is a three-fold increase over the previous five-year average.
- Preceding their illness, only approximately half of the cases in 2005 indicated contact to a person who had a prolonged cough.
- Of the 2005 cases that could have been fully immunized and protected against pertussis, one fifth were not adequately immunized.





## IMMUNIZATION RECOMMENDATIONS

- A pertussis-containing vaccine should be administered at 2 months, 4 months, 6 months, 15–18 months, and 4–6 years of age to provide protection against the disease.
- Immunity conferred by the pertussis component of the DTP/DTaP vaccine decreases over time, with some vaccinated individuals becoming susceptible to pertussis 5–10 years following their last dose.
- In Spring 2005, 2 Tdap vaccines were licensed for use in adolescents and adults, one for persons aged 10-18 years (Boostrix, GlaxoSmithKline) and the other for persons aged 11-64 years (ADACEL, Sanofi Pasteur).

## STRATIFIED DATA

**Seasonality:** Compared to the previous five-year average, record high numbers of cases were reported throughout 2005. Typically, the summer months have the highest pertussis incidence in LAC (Figure 3). In 2005, 46% (n=200) of reported cases had disease onset during the summer months of June, July, August, and September. The <1 year age group accounted for 45% (n=90) of the cases with disease onset during these summer months.

**Age:** Although the majority of reported cases are still in children less than one year of age, the proportion of cases in the <1 age group is smaller in 2005 (41%) compared to the previous five year average (64%). Cases are increasing among adolescents and adults, as evidenced by the fact that 33% (n=143) of the cases were over 14 years of age (Figure 4) in 2005 compared to an average of 24% (n=24) in the previous five years. Increased recognition and diagnosis of pertussis in older age groups has probably contributed to the increase in reported cases among adolescents and adults.

**Sex:** The male-to-female case ratio was approximately 1:1.2.

**Race/Ethnicity:** After adjusting for the age differential in the cases, incidence rates in 2005 for all races were at least 2.5 times higher than the previous 5-year averages (Figure 5). Only rates among Latinos and Whites were higher than the total LAC rate. However, the LAC population proportion of Whites (30%) is much lower than that for Latinos (47%).

Figure 3  
Pertussis  
Cases by Month of Onset  
LAC, 2005

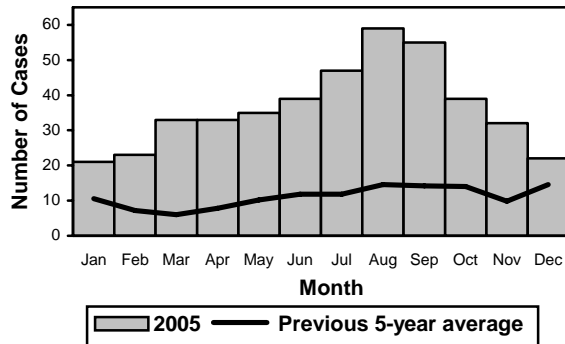


Figure 4  
Pertussis  
Cases by Age Group  
LAC, 2005

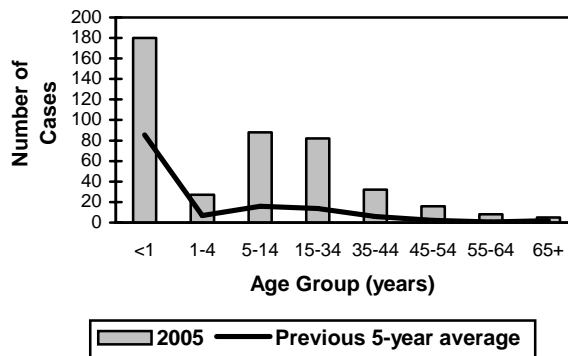
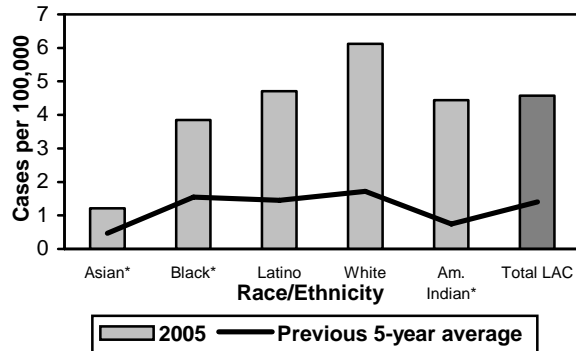


Figure 5  
Pertussis  
Age-Adjusted Incidence Rates by  
Race/Ethnicity  
LAC, 2005



\*Rates unreliable due to small number of observations.



**Location:** Antelope Valley SPA 1 had the highest incidence rate of 13.4 cases per 100,000 (n=46). Of the 46 cases reported, 44% (n=20) were epi-linked to at least two other pertussis cases living within the same household. The second highest incidence rate occurred in South SPA 6 with 5.9 cases per 100,000 (n=61), followed by South Bay SPA 8 with 5.6 cases per 100,000 (n=62), San Fernando Valley SPA 2 with 5.3 cases per 100,000 (n=112), West SPA 5 with 4.8 cases per 100,000 (n=31), Metro SPA 4 with 3 cases per 100,000 (n=37), San Gabriel Valley SPA 3 with 2.9 cases per 100,000 (n=50), and East SPA 7 with 2.8 cases per 100,000 (n=39). The clustering of cases in specific geographic areas is influenced in part by the active reporting efforts of local hospitals.

## COMMENTS

Despite high rates of pertussis vaccination among children, the number of pertussis cases reported annually has risen. In 2005, Los Angeles County (LAC) experienced a significant increase in the number of reported cases of pertussis, with a similar trend evidenced throughout California and the United States. There was a three-fold increase in the number of cases reported in 2005 compared to the previous five-year average. Not since the 1970s has LAC experienced this magnitude of pertussis morbidity. In addition, cases are being reported more among adolescents and adults. Whether this increase in pertussis incidence represents a true increase in disease or improved recognition and reporting remains unclear.

Because immunity induced by the childhood pertussis vaccine decreases over time, adolescents and adults can develop infection and serve as a source of transmission to infants who are not adequately immunized. The need to protect infants from pertussis infection is underscored by the fact that there were 2 pertussis-related deaths among infants less than 2 months of age. The licensure of 2 Tdap vaccines for use as pertussis boosters in adolescents and adults is cause for great optimism. Widespread use of the Tdap vaccine should protect adolescents and adults as well as protect infants from exposure to pertussis.

Greater media and general public awareness of vaccine-preventable diseases has increased the detection and reporting of pertussis cases. During 2005, much effort was invested in urging providers to be more diligent in observing, confirming, and reporting suspect pertussis cases in individuals of all ages. Outreach to providers included:

- 1) a pertussis health alert to LAC providers via the Health Alert Network on March 9, 2005;
- 2) creation of a Pertussis Fact Sheet in April 2005 and ongoing distribution throughout the year;
- 3) publication of an article in the May edition of The Public's Health newsletter;
- 4) a pertussis symposium held on May 18, 2005;
- 5) release of a statewide health alert by the California Department of Health Services on September 19, 2005;
- 6) release of a second health alert to LAC providers via the Health Alert Network on September 20, 2005;
- 7) distribution of the September health alert and fact sheet to all LAC hospital infection control practitioners via fax.

**Trends:** Pertussis incidence normally peaks every 3 to 5 years. Between 1990 and 1999, there was an annual average of 101 cases reported, with the highest incidence occurring in 1999 (n=238). During the previous five years (2000 – 2004), an annual average of 133 cases was reported, with the highest incidence occurring in 2002 (n=172). In 2005, 438 cases were reported, which was the highest number of cases reported in more than 35 years.

**Laboratory Confirmation:** More than half of the reported cases (52%, n=226) were not laboratory confirmed by either *B. pertussis* culture or PCR.

**Vaccination Status:** Less than one fifth of cases (18%, n=77) were younger than two months of age and were too young to receive pertussis vaccine. About 33% (n=143) of cases were 15 years of age or older; so even if they were fully immunized in early childhood, they would not have had complete immunity against pertussis in 2005 and would thus be eligible for Tdap vaccine.



Approximately 21% (n=92) of cases were between 2–6 months of age. Of these, 55% (n=51) were up to date with pertussis vaccination for their age, but would not have developed full immunity against pertussis. Of the 126 children who could have had full immunity from vaccination (7 months to 15 years old), 102 (81%) were fully up to date. The previous 5-year trend has indicated that, on average, 62% of cases 7 months to 15 years of age were adequately immunized.

Complications/Hospitalization: Approximately 35% (n=155) were hospitalized, with an average hospital stay of 9 days (range 1-54 days). Among the hospitalized cases, 92% (n=142) were less than one year of age. Of the 34 cases who developed pneumonia, 28 (82%) were infants less than 1 year of age. Three cases developed seizures and 1 case had encephalopathy.

Case Fatalities: There were two pertussis-related deaths in 2005. The first case fatality was in a 23-day-old Hispanic male. The case died 13 days after cough onset in February. The case was a previously healthy baby who was hospitalized for severe respiratory distress, cardiac failure, and septic shock. Causes of death as listed on the death certificate were renal failure, shock, pneumonia, and pertussis. The second case fatality was in a one-month old Hispanic male. The case died 6 days after cough onset in September. The case had a pre-existing medical condition and was previously hospitalized for coarctation of aorta repair. Causes of death as listed on the death certificate were cardiorespiratory failure, pulmonary hypertensive crisis, leukocytosis, and pertussis. Both cases had exposure to family members who were coughing but were too young to receive pertussis vaccine.

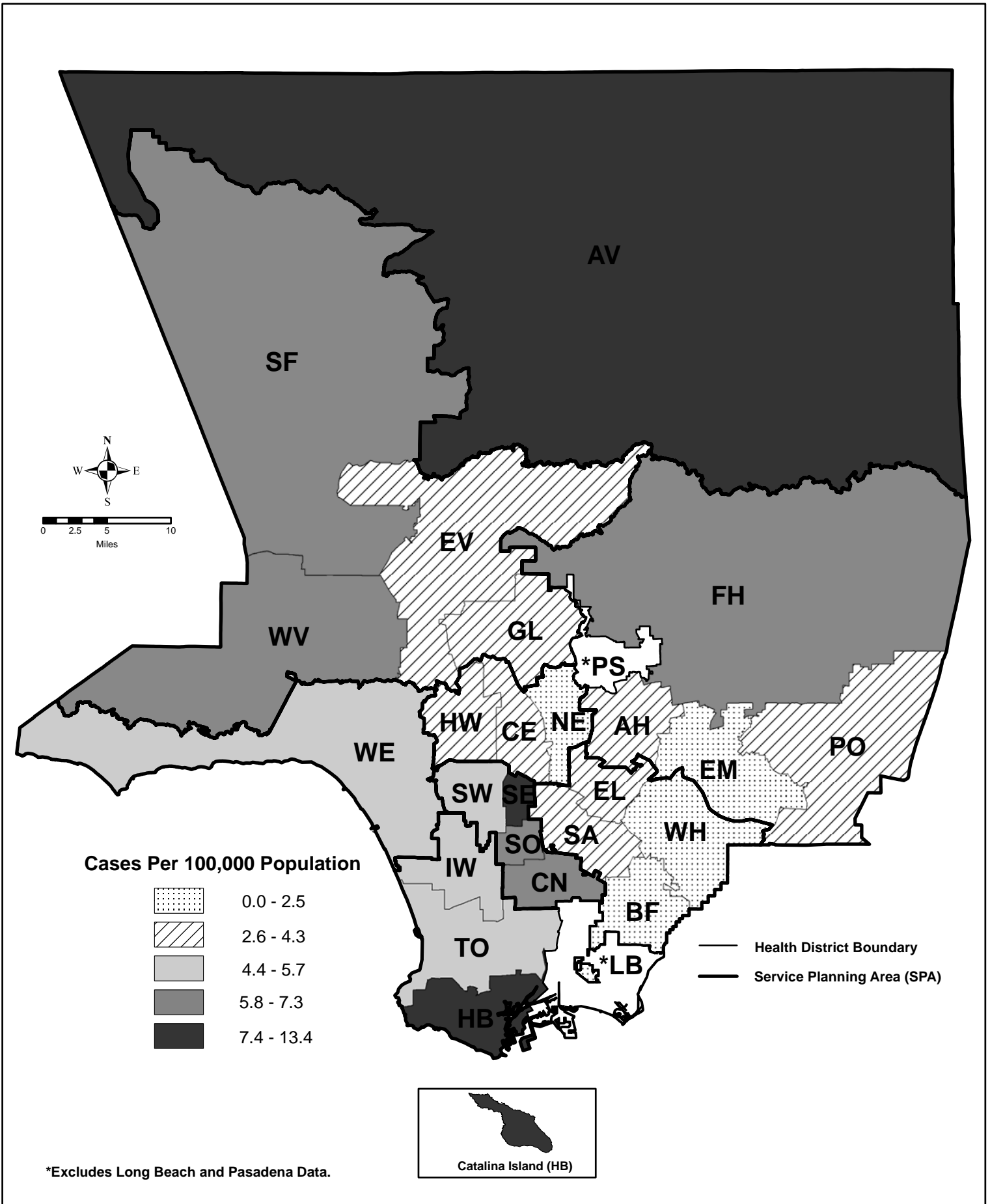
## **ADDITIONAL RESOURCES**

Additional information is available at:

- National Immunization Program – [www.cdc.gov/nip](http://www.cdc.gov/nip)
- Immunization Action Coalition – [www.immunize.org](http://www.immunize.org)
- LAC DHS, Immunization Program – [www.lapublichealth.org/ip](http://www.lapublichealth.org/ip)



# Map 10. Pertussis Rates by Health District, Los Angeles County, 2005\*

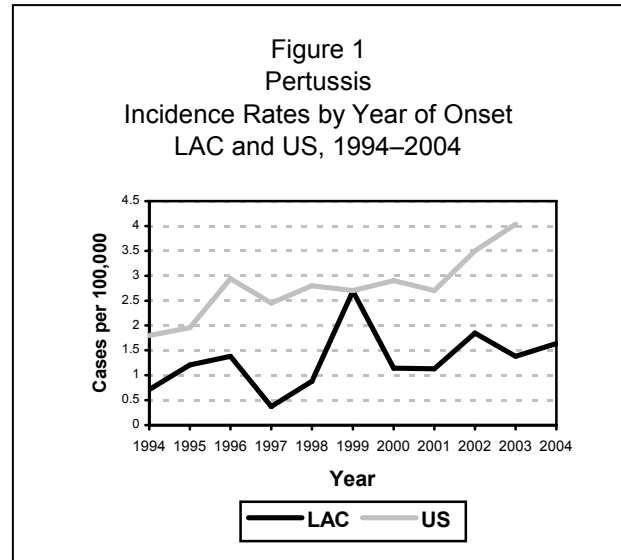




## PERTUSSIS (WHOOPIING COUGH)

CRUDE DATA	
Number of Cases	156
Annual Incidence <sup>a</sup>	
LA County	1.64
California	3.13
United States	8.88
Age at Diagnosis	
Mean	8.9 years
Median	4 months
Range	11 days – 70 years
Case Fatality	
LA County	0%
United States	N/A

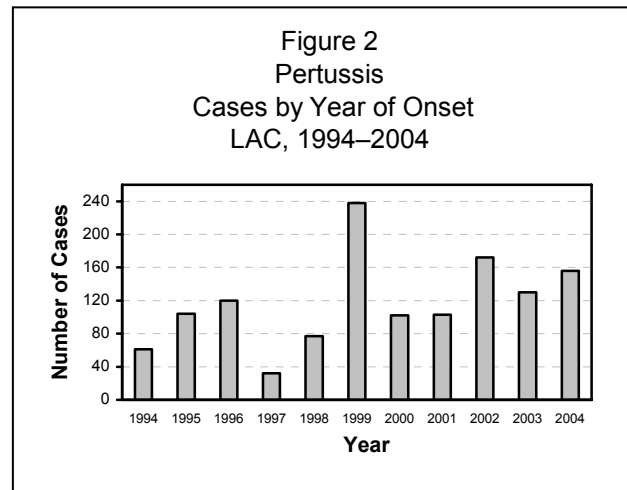
<sup>a</sup> Cases per 100,000 population.



### DESCRIPTION

Pertussis, commonly known as whooping cough, is a vaccine-preventable disease spread by close contact with the respiratory secretions of infected individuals. Typical symptoms include paroxysmal coughing, inspiratory whooping, and post-tussive vomiting. Complications include pneumonia, seizures, and encephalopathy. Infants under 1 year of age are at highest risk for developing severe complications.

The minimum clinical criteria for pertussis is a cough lasting at least two weeks with paroxysms of coughing, inspiratory “whoop,” or post-tussive vomiting, without other apparent causes. Pertussis is confirmed by either positive *B. pertussis* culture or PCR.



### DISEASE ABSTRACT

- Cases are increasing among adolescents and adults, as evidenced by the three-fold increase in the number of 2004 cases in the 15-34 age group over the previous five-year average.
- Preceding their illness, only approximately half of the cases in 2004 indicated contact to a person who had a prolonged cough.
- Of the 2004 cases that could have been fully immunized and protected against pertussis, less than half were not adequately immunized.



## IMMUNIZATION RECOMMENDATIONS

- A pertussis-containing vaccine should be administered at 2 months, 4 months, 6 months, 15–18 months, and 4–6 years of age to provide protection against the disease.
- Immunity conferred by the pertussis component of the DTP/DTaP vaccine decreases over time, with some vaccinated individuals becoming susceptible to pertussis 5–10 years following their last dose.
- In 2004, there were no licensed pertussis vaccines available for adolescents and adults.

## STRATIFIED DATA

**Seasonality:** Typically, the summer months have the highest pertussis incidence in LAC (Figure 3). However, in 2004, the onset of cases was distributed fairly uniformly throughout the summer and winter months. Approximately 33.3% (n=52) had disease onset during the summer months of July, August, and September and 34.0% (n=53) had disease onset during the winter months of October, November, and December. The 15-34 year age group accounted for 22.6% (n=12) of the cases with disease onset during the winter months, which can partially be attributed to a cluster of 11 cases that attended the same high school.

**Age:** Similar to previous years, approximately 55.8% (n=87) of reported cases in 2004 were among children less than one year of age. This is consistent with the national trend. However, cases are increasing among adolescents and adults, as evidenced by the 15-34 age group accounting for 18.6% (n=29) of the total reported cases (Figure 4).

**Sex:** The male-to-female case ratio was approximately 1:1.1.

**Race/Ethnicity:** After adjusting for the age differential in the cases, rates in 2004 among Asians, Blacks, and American Indians were lower than the previous 5-year averages (Figure 5). Rates among Latinos and Whites were approximately the same, although the LAC population proportion of Whites (30.2%) is much lower than that for Latinos (46.9%).

**Location:** The number of cases per SPA ranged from 5 to 29. South Bay SPA 8 accounted for the most cases (n=29) while Antelope Valley SPA 1 had the fewest cases (n=5). SPA 4 had 25 cases,

Figure 3  
Pertussis  
Cases by Month of Onset  
LAC, 2004

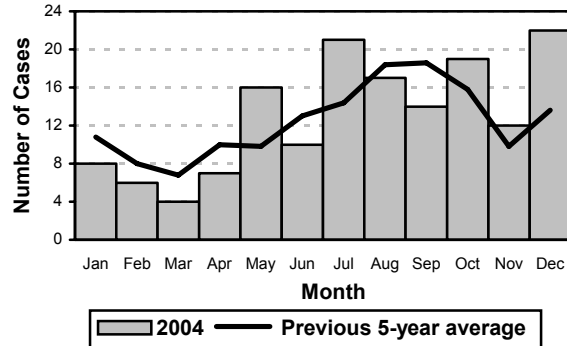


Figure 4  
Pertussis  
Cases by Age Group  
LAC, 2004

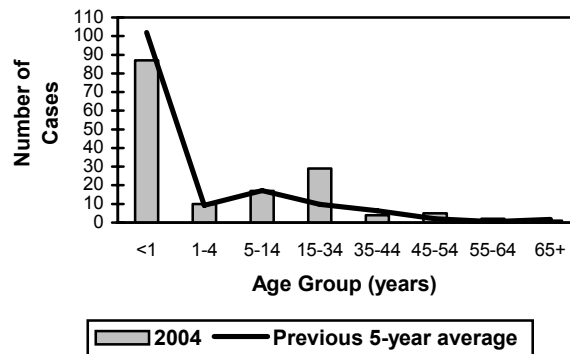
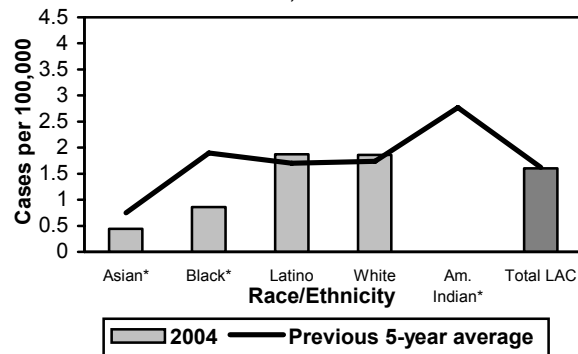


Figure 5  
Pertussis  
Age-Adjusted Incident Rates by  
Race/Ethnicity  
LAC, 2004



\*Rates unreliable due to small number of observations.



followed by SPA 3 with 24 cases, SPA 6 with 23 cases, SPA 2 with 21 cases, SPA 7 with 18 cases, and SPA 5 with 10 cases. SPA 8 had the highest rate (2.63 cases per 100,000) and West SPA 5 had the lowest rate of 0.15 cases per 100,000. The clustering of cases in specific geographic areas is influenced in part by the active reporting efforts of local hospitals.

## COMMENTS

Because immunity induced by pertussis vaccine decreases over time, adolescents and adults can develop infection and serve as a source of transmission to infants who are not adequately immunized. Adults and adolescents with pertussis are more likely to have mild or atypical disease, so they often go undiagnosed. Future licensure and widespread use of an acellular pertussis booster vaccine for adolescents and adults should significantly decrease the incidence of pertussis in children, as well as its complications. In 2004, two pharmaceutical companies submitted biologics license applications to the Food and Drug Administration for two tetanus toxoid and reduced diphtheria toxoid and acellular pertussis vaccine adsorbed (Tdap) products, one for persons aged 10-18 years (GlaxoSmithKline) and the other for persons aged 11-64 years (Sanofi Pasteur). Licensures of both vaccines were approved in 2005 and the anticipated introduction dates will be in late 2005.

More effort is underway to educate providers on the impact adults and adolescents have on the continued increase in transmission of pertussis, urging them to be more diligent in observing, confirming, and reporting suspect pertussis cases in this population. Clinicians need to consider the possibility of pertussis in all patients with a persistent cough illness and order the appropriate laboratory tests. A nasopharyngeal swab or aspirate should be obtained for either *B. pertussis* culture or PCR. Outreach to health care providers will include pertussis health alerts and a pertussis symposium.

Greater media and general public awareness of vaccine-preventable diseases has increased the detection and reporting of pertussis cases. However, timely reporting is critical in preventing secondary cases of pertussis. Identification of a single case of pertussis initiates a standard investigation that uncovers other undiagnosed cases. For example, in late 2004 the investigation of a reported pertussis case led to the discovery of 17 other pertussis cases that attended the same high school as the index case. Many of these cases were previously undiagnosed but met the minimum clinical criteria for pertussis. Ten of the 17 cases had disease onset in 2004.

**Trends:** Pertussis incidence normally peaks every 3 to 5 years. Between 1990 and 2000, there was an annual average of 101 cases reported. The highest incidence in 30 years occurred in 1999 (n=238). The County's last peak was in 2002 when 172 pertussis cases were reported. In 2004, 156 cases were reported, which is a 20% increase from the previous year.

**Laboratory Confirmation:** Half of reported cases (50.6%, n=79) were not laboratory confirmed by either *B. pertussis* culture or PCR.

**Vaccination Status:** One fifth of cases (20.5%, n=32) were younger than two months of age and were too young to receive pertussis vaccine. About 26.3% (n=41) of cases were 15 years of age or older; so even if they were fully immunized in early childhood, they would not have had complete immunity against pertussis in 2004. Thus, 46.8% percent of the cases reported in 2004 could not have had protected immunity with the currently available pediatric vaccine (DTaP).

Approximately 34.6% (n=54) of cases were between 2–6 months of age. Of these, 38.9% (n=21) were up to date with pertussis vaccination for their age, but would not have developed full immunity against pertussis. Of the children who could have had full immunity from vaccination (7 months to 15 years old), 19 (67.9%) were fully up to date. The previous 5-year trend has indicated that, on average, only 61.3% of cases 7 months to 15 years of age were adequately immunized.

**Complications/Hospitalization:** Half of the cases (50.6%, n=79) were hospitalized, with an average hospital stay of 11 days (range 1-37 days). Seventy-four (84.1%) of the hospitalized cases were less than one year of age. Of the 13 cases who developed pneumonia, 12 were infants less than 1 year of age. Of



the 5 cases with seizures and 2 cases with encephalopathy, all were infants less than 1 year of age. There were no pertussis-related deaths in 2004.

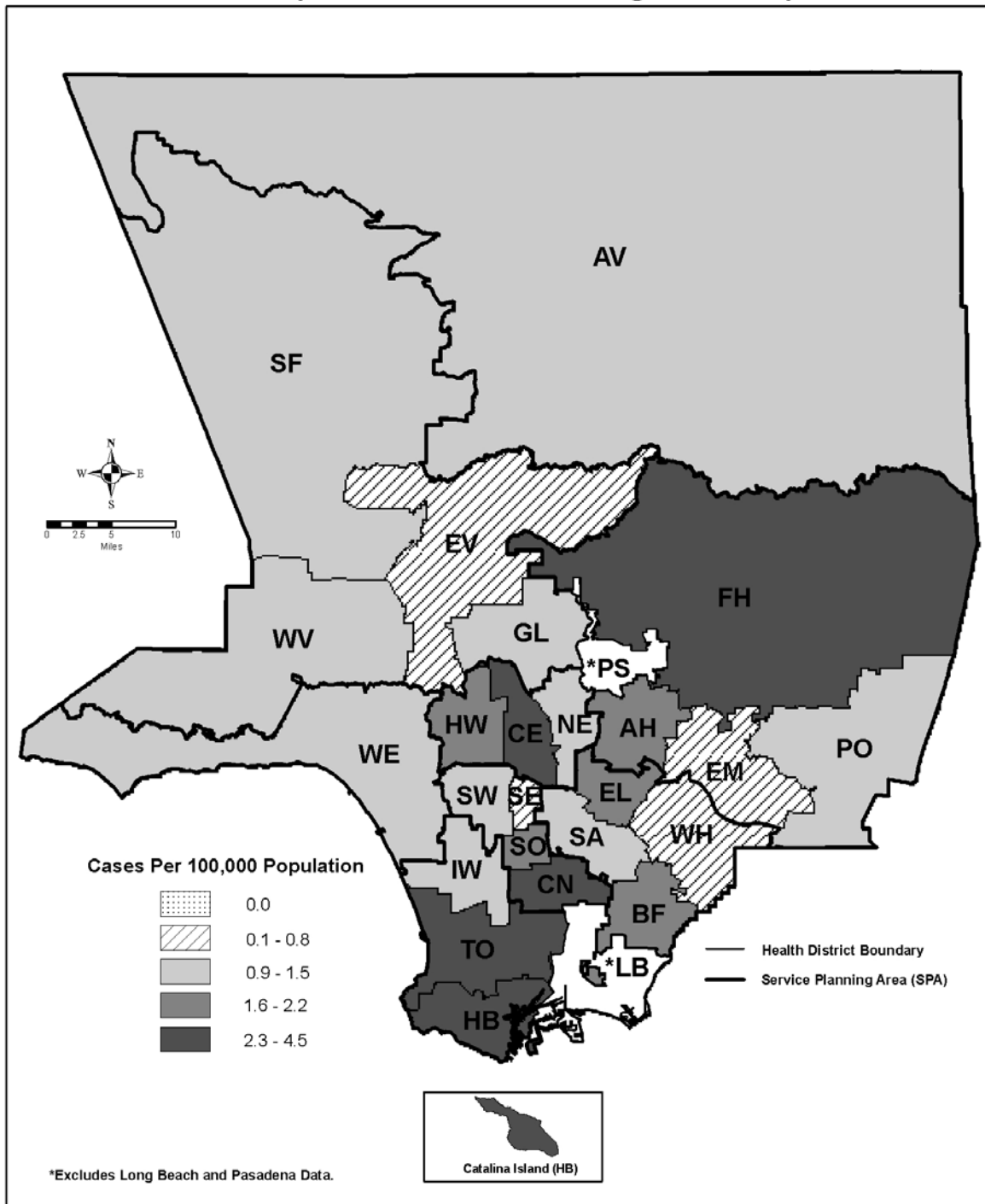
### **ADDITIONAL RESOURCES**

Additional information is available at:

- National Immunization Program – [www.cdc.gov/nip](http://www.cdc.gov/nip)
- Immunization Action Coalition – [www.immunize.org](http://www.immunize.org)
- LAC DHS, Immunization Program – [www.lapublichealth.org/ip](http://www.lapublichealth.org/ip)



**Map 10. Pertussis  
 Rates by Health District, Los Angeles County, 2004\***

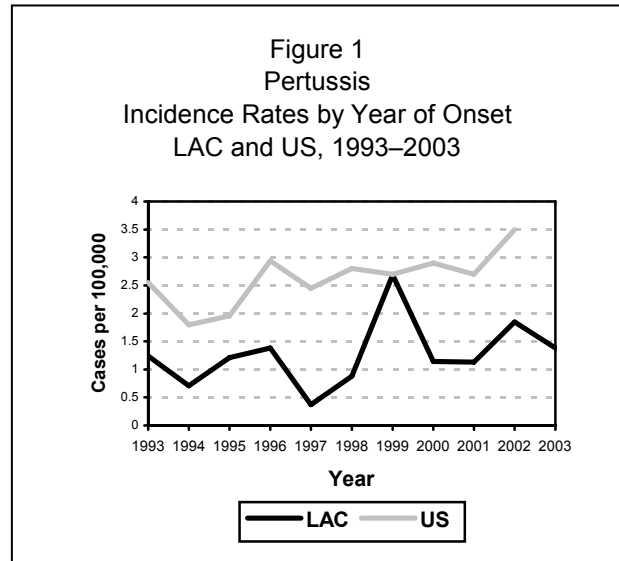




## PERTUSSIS (WHOOING COUGH)

CRUDE DATA	
Number of Cases	130
Annual Incidence <sup>a</sup>	
LA County	1.38
California	3.59
United States	4.04
Age at Diagnosis	
Mean	7.3 years
Median	4 months
Range	1 day–83 years
Case Fatality	
LA County	1.5%
United States	N/A

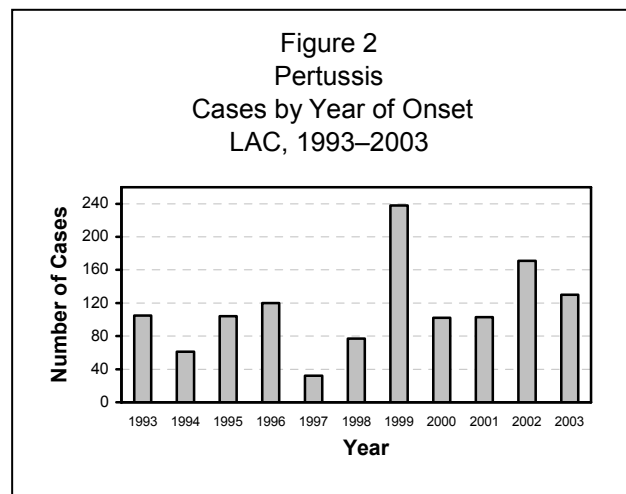
<sup>a</sup> Cases per 100,000 population.



### DESCRIPTION

Pertussis, commonly known as whooping cough, is a vaccine-preventable disease spread by close contact with the respiratory secretions of infected individuals. Typical symptoms include paroxysmal coughing, inspiratory whooping, and post-tussive vomiting. Complications include pneumonia, seizures, and encephalopathy. Infants under 1 year of age are at highest risk for developing severe complications, but are the least likely to transmit the disease to susceptible individuals if infected.

The minimum clinical criteria for pertussis is a cough lasting at least two weeks with paroxysms of coughing, inspiratory “whoop,” or post-tussive vomiting, without other apparent causes. Pertussis is confirmed by either positive *B. pertussis* culture or PCR.



### DISEASE ABSTRACT

- The majority of reported cases in 2003 were among children less than one year of age, followed by the 5-14 year age group.
- Preceding their illness, nearly half of the cases in 2003 had contact to a person who had a prolonged cough.
- Of the 2003 cases that could have been fully immunized and protected against pertussis, only half were adequately immunized.



## IMMUNIZATION RECOMMENDATIONS

- A pertussis-containing vaccine should be administered at 2 months, 4 months, 6 months, 15–18 months, and 4–6 years of age to provide protection against the disease.
- Immunity conferred by the pertussis component of the DTP/DTaP vaccine decreases over time, with some vaccinated individuals becoming susceptible to pertussis 5–10 years following their last dose.
- Currently, there is no pertussis vaccine booster available for adults.

## STRATIFIED DATA

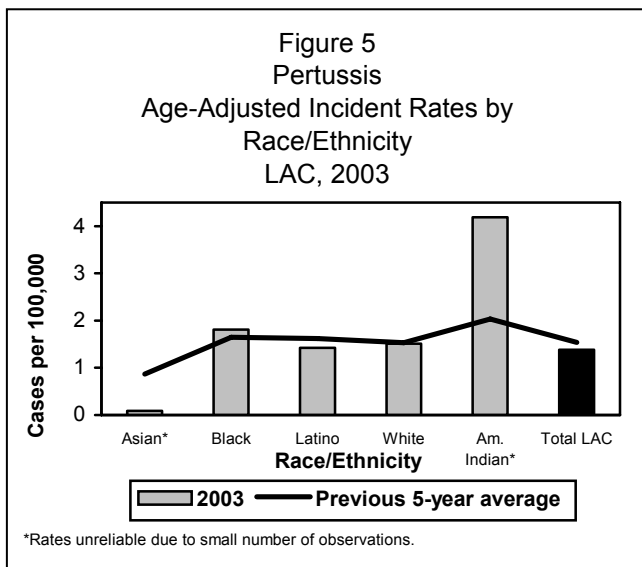
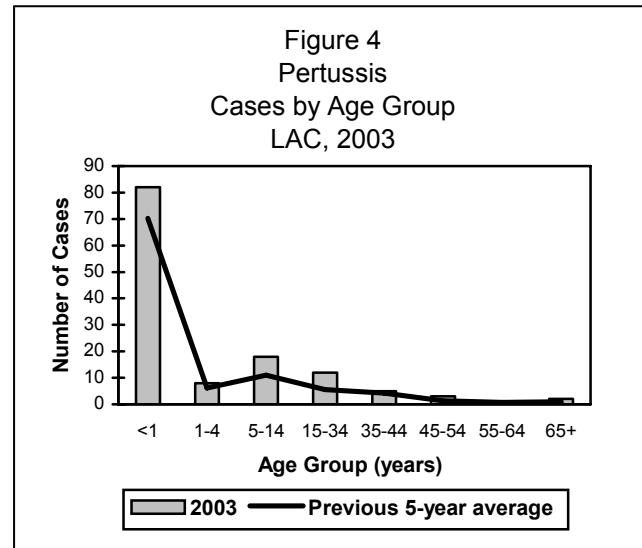
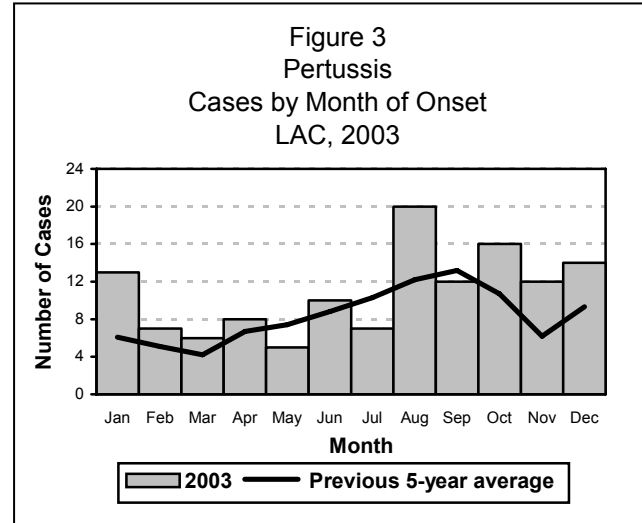
**Seasonality:** Typically, the summer months have the highest pertussis incidence in LAC (Figure 3). However, this was not exactly the case in 2003, as evidenced by the disease onset occurrence of 42.3% of the cases during the winter months of October, November, December, and January. The 5-14 year age group accounted for 21.4% of the cases with disease onset during the month of December alone.

**Age:** As evidenced in previous years, approximately 63.1% (n=82) of reported cases in 2003 were among children less than one year of age. This is consistent with the national trends. However, cases are increasing among older children and adolescents over the past few years, as evidenced by the 5-14 age group accounting for 13.9% of the total identified cases.

**Sex:** The male-to-female rate ratio was approximately 1:0.9

**Race/Ethnicity:** After adjusting for age, rates in 2003 among Blacks and American Indians were higher than the previous 5-year averages (Figure 5). Rates among Latinos and Whites are approximately the same, although the population proportion of Whites (30.3%) is much lower than that for Latinos (46.8%).

**Location:** The number of cases per SPA ranged from 0 to 34. Of those cases where address was indicated, San Fernando SPA 2, South SPA 6, and South Bay SPA 8 reported the most cases. However, SPA 6 had the highest rate (3.37 cases per 100,000 respectively) and Antelope Valley SPA 1 had the lowest rate of 0 cases per 100,000. The clustering of cases in specific geographic areas is influenced in part by the active reporting efforts of local hospitals.







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## COMMENTS

Because immunity induced by pertussis vaccine decreases over time, adolescents and adults can develop infection and serve as a source of transmission to infants who are not adequately immunized. Adults and adolescents with pertussis are more likely to have mild or atypical disease, so they often go undiagnosed. Future licensure and widespread use of an acellular pertussis booster vaccine for adolescents and adults should significantly decrease the incidence of pertussis in children, as well as its complications.

More effort is underway to educate providers on the impact adults and adolescents have on the continued increase in transmission of pertussis, urging them to be more diligent in observing, confirming, and reporting suspect pertussis cases in this population.

**Trends:** Pertussis incidence in LAC has peaked every 3–4 years since 1991 with the highest incidence in 30 years occurring in 1999 (N=238). After a 2002 rate was 48% higher than the previous 5-year average, the 2003 case rate was 25% lower.

**Laboratory Confirmation:** Over half of reported cases (57.7%, n=75) were not laboratory confirmed.

**Vaccination Status:** Nearly one third of cases (26.9%, n=35) were younger than two months of age and were too young to receive pertussis vaccine. About 16.9% (n=22) of cases were 15 years of age or older; so even if they were fully immunized in early childhood, they would not have had complete immunity against pertussis in 2002. Thus, 43.8% percent of the cases reported in 2003 were susceptible to pertussis.

Thirty-two percent (n=41) of cases were between 2–6 months of age. Of these, 29.3% were up to date with pertussis vaccination for their age, but would not have developed full immunity against pertussis. Of the children who could have had full immunity from vaccination (7 months to 15 years old), 18 (56.3%) were fully up to date. The previous 5-year trend has indicated that, on average, only 58.2% of cases 7 months to 15 years of age were adequately immunized.

**Complications/Hospitalization:** Half of the cases (50.8%, n=66) were hospitalized, with an average hospital stay of 9 days (range 2–31 days). Sixty-three of the hospitalized cases were less than one year of age. Of the 9 cases who developed pneumonia, all were infants less than 1 year of age. The one case with seizures was in an infant less than 1 year of age. Two infants aged less than one year died from complications.

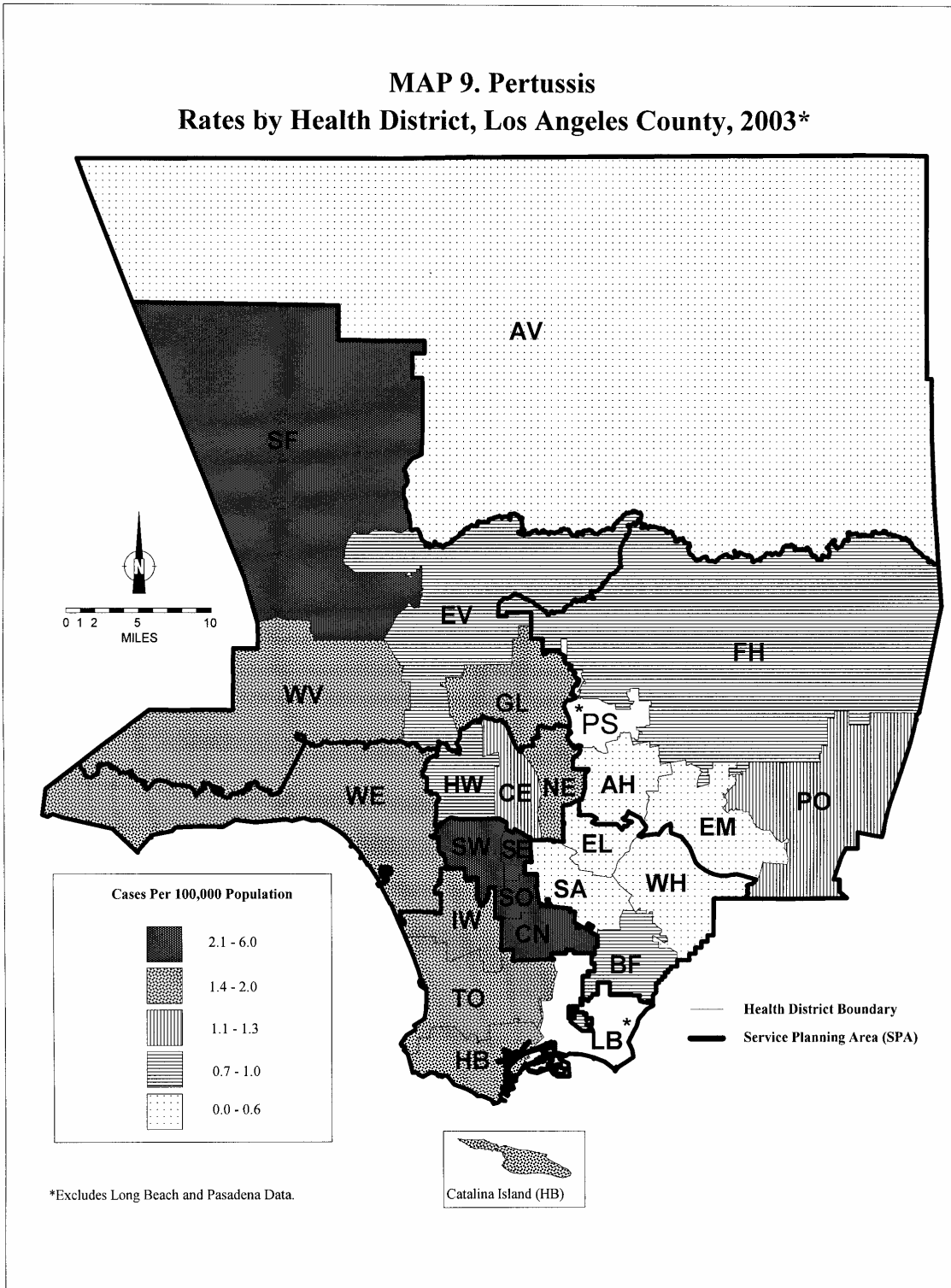
## ADDITIONAL RESOURCES

Additional information is available at:

- National Immunization Program – [www.cdc.gov/nip](http://www.cdc.gov/nip)
- Immunization Action Coalition – [www.immunize.org](http://www.immunize.org)
- LAC DHS, Immunization Program – [www.lapublichealth.org/ip](http://www.lapublichealth.org/ip)



### MAP 9. Pertussis Rates by Health District, Los Angeles County, 2003\*





## PERTUSSIS (WHOOPING COUGH)

CRUDE DATA	
Number of Cases	170
Annual Incidence <sup>a</sup>	
LA County	1.8
California	3.3
United States	3.5
Age at Diagnosis	
Mean	5 years
Median	6 months
Range	<1–83 years
Case Fatality	
LA County	1.2%
United States	N/A

<sup>a</sup> Cases per 100,000 population.

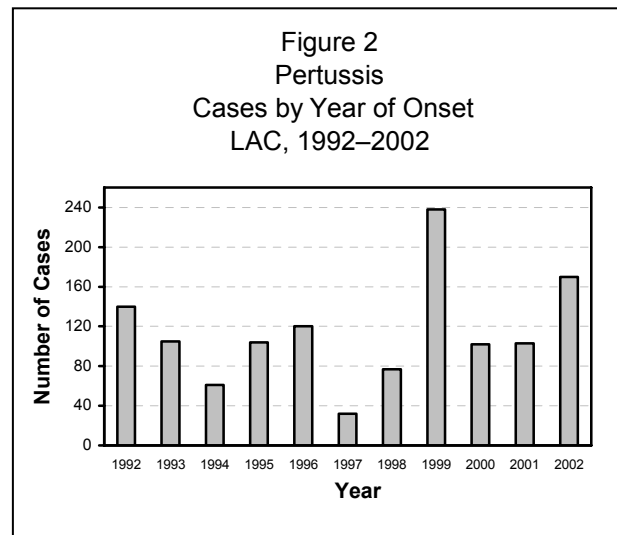
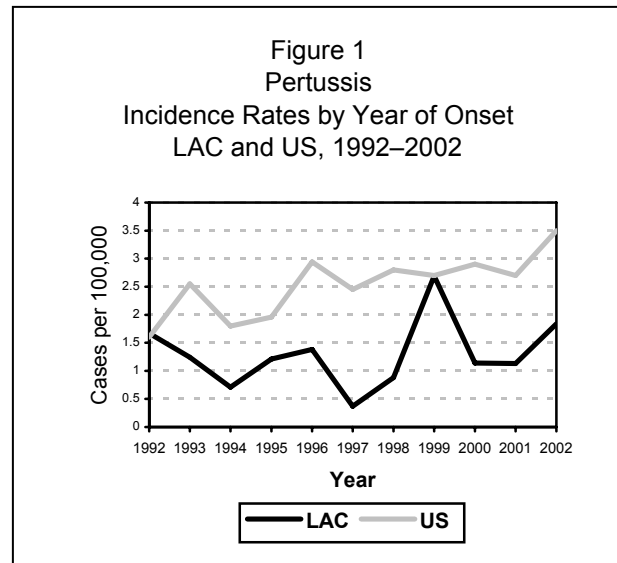
### DESCRIPTION

Pertussis, commonly known as whooping cough, is a vaccine-preventable disease spread by close contact with the respiratory secretions of infected individuals. Typical symptoms include paroxysmal coughing, inspiratory whooping, and post-tussive vomiting. Complications include pneumonia, seizures, and encephalopathy. Infants under 1 year of age are at highest risk for developing severe complications, but are the least likely to transmit the disease to susceptible individuals if infected.

The minimum clinical criteria for pertussis is a cough lasting at least two weeks with paroxysms of coughing, inspiratory “whoop,” or post-tussive vomiting, without other apparent causes. Pertussis is confirmed by either positive *B. pertussis* culture or PCR.

### DISEASE ABSTRACT

- The majority of reported cases in 2002 were among children less than one year of age. Infants younger than two months of age accounted for more than half of these cases.
- Preceding their illness, nearly half of the cases in 2002 had contact to a person who had a prolonged cough.
- Almost half of the cases reported in 2002 were susceptible to pertussis due to absent or waning immunization.





## IMMUNIZATION RECOMMENDATIONS

- A pertussis-containing vaccine should be administered at 2 months, 4 months, 6 months, 15–18 months, and 4–6 years of age to provide protection against the disease.
- Immunity conferred by the pertussis component of the DTP/DTaP vaccine decreases over time, with some vaccinated individuals becoming susceptible to pertussis 5–10 years following their last dose.
- Currently, there is no pertussis vaccine booster available for adults.

## STRATIFIED DATA

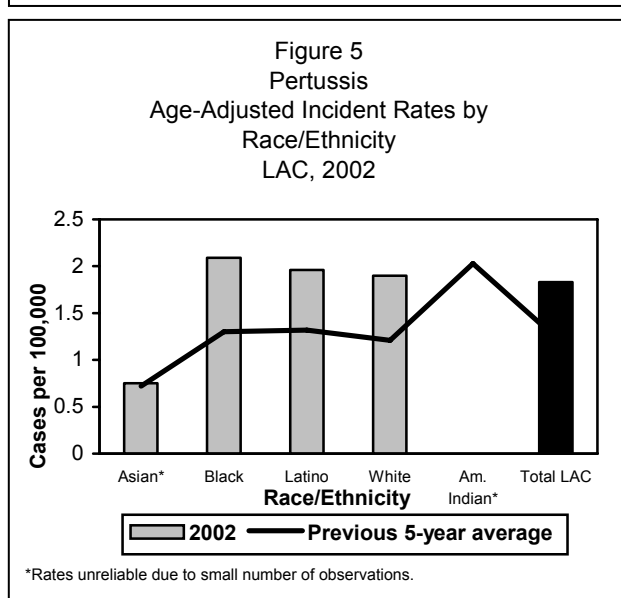
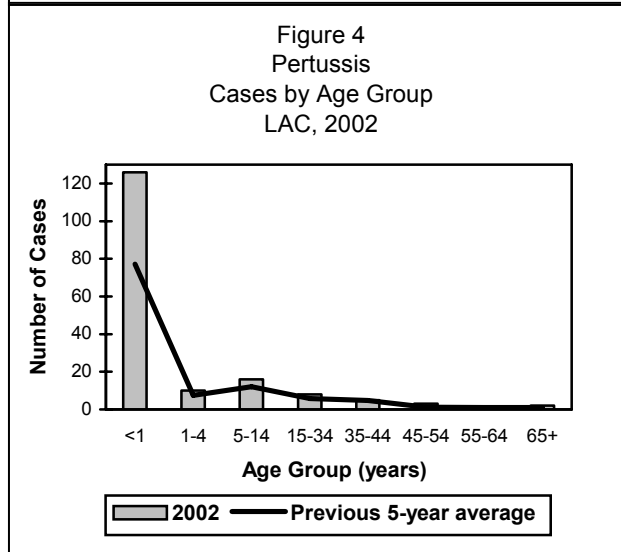
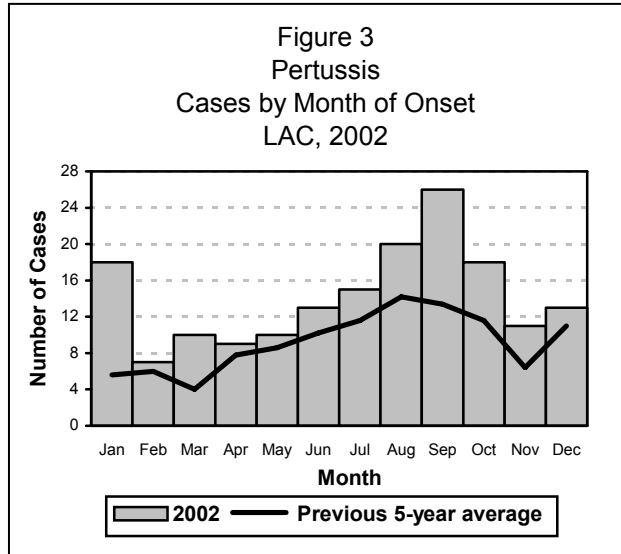
**Seasonality:** Typically, the summer months have the highest pertussis incidence in LAC (Figure 3). Although this was still the case in 2002, a steady increase in cases that began at the end of 2001 continued into the beginning of 2002. This yielded an unprecedented number of cases in January, and overall, a higher number of cases during every month than compared to previous years.

**Age:** As evidenced in previous years, approximately 71% (n=126) of reported cases in 2002 were among children less than one year of age. This is consistent with the national trends. However, cases are increasing among older children and adolescents over the past few years.

**Sex:** The male-to-female rate ratio was approximately 1:0.9

**Race/Ethnicity:** After adjusting for age, rates in 2002 among all racial/ethnic groups, except Asians, were higher than the previous 5-year averages (Figure 5). Rates among Blacks, Latinos, and Whites are approximately the same, although the population proportion of Blacks (9.4%) and Whites (31%) is much lower than that for Latinos (46%).

**Location:** The number of cases per SPA ranged from 1 to 32. Of those cases where address was indicated, San Fernando SPA 2, South SPA 6, and South Bay SPA 8 reported the most cases. However, SPA 5, 6, and 8 had the highest rates (2.20, 2.23, 2.05 cases per 100,000 respectively) and Antelope Valley SPA 1 had the lowest rate of 0.29 per 100,000. The clustering of cases in specific geographic areas is influenced in part by the active reporting efforts of local hospitals.





## COMMENTS

Because immunity induced by pertussis vaccine decreases over time, adolescents and adults can develop infection and serve as a source of transmission to infants who are not adequately immunized. Adults and adolescents with pertussis are more likely to have mild or atypical disease, so they often go undiagnosed. Future licensure and widespread use of an acellular pertussis booster vaccine for adolescents and adults should significantly decrease the incidence of pertussis in children, as well as its complications.

More effort is underway to educate providers on the impact adults and adolescents have on the continued increase in transmission of pertussis, urging them to be more diligent in observing, confirming, and reporting suspect pertussis cases in this population.

**Trends:** Pertussis incidence in LAC has peaked every 3–4 years since 1991 with the highest incidence in 30 years occurring in 1999 (n=238). The rate of pertussis has been steadily increasing since 1998, with a 2002 rate 48% higher than the previous 5-year average.

**Laboratory Confirmation:** Nearly half of reported cases (48%, n=82) were laboratory confirmed by a positive culture or PCR. The remaining cases (52%) were either epidemiologically linked to a confirmed case (2%, n=3), or met the clinical criteria for pertussis (98%, n=85).

**Vaccination Status:** One third of cases (33%, n=56) were younger than two months of age and were too young to receive pertussis vaccine. Only 11% (n=18) of cases were 15 years of age or older; so even if they were fully immunized in early childhood, they would not have had complete immunity against pertussis in 2001. Thus, 44% percent of the cases reported in 2001 were susceptible to pertussis.

Thirty-nine percent (n=67) of cases were between 2–6 months of age. Of these, 30% were up to date with pertussis vaccination for their age, but would not have developed full immunity against pertussis. Of the children who could have had full immunity from vaccination (7 months to 15 years old), 16 (55%) were fully up to date.

**Complications/Hospitalization:** The majority of cases (60%, n=102) were hospitalized, with an average hospital stay of eight days (range 1–30 days). All but four of the hospitalized cases were less than one year of age. Of the 14 cases who developed pneumonia, 13 were infants less than 1 year of age and 3 were between the ages of 1–4. The two cases with seizures were among infants less than 2 months of age. Two infants aged less than one year died from complications.

## ADDITIONAL RESOURCES

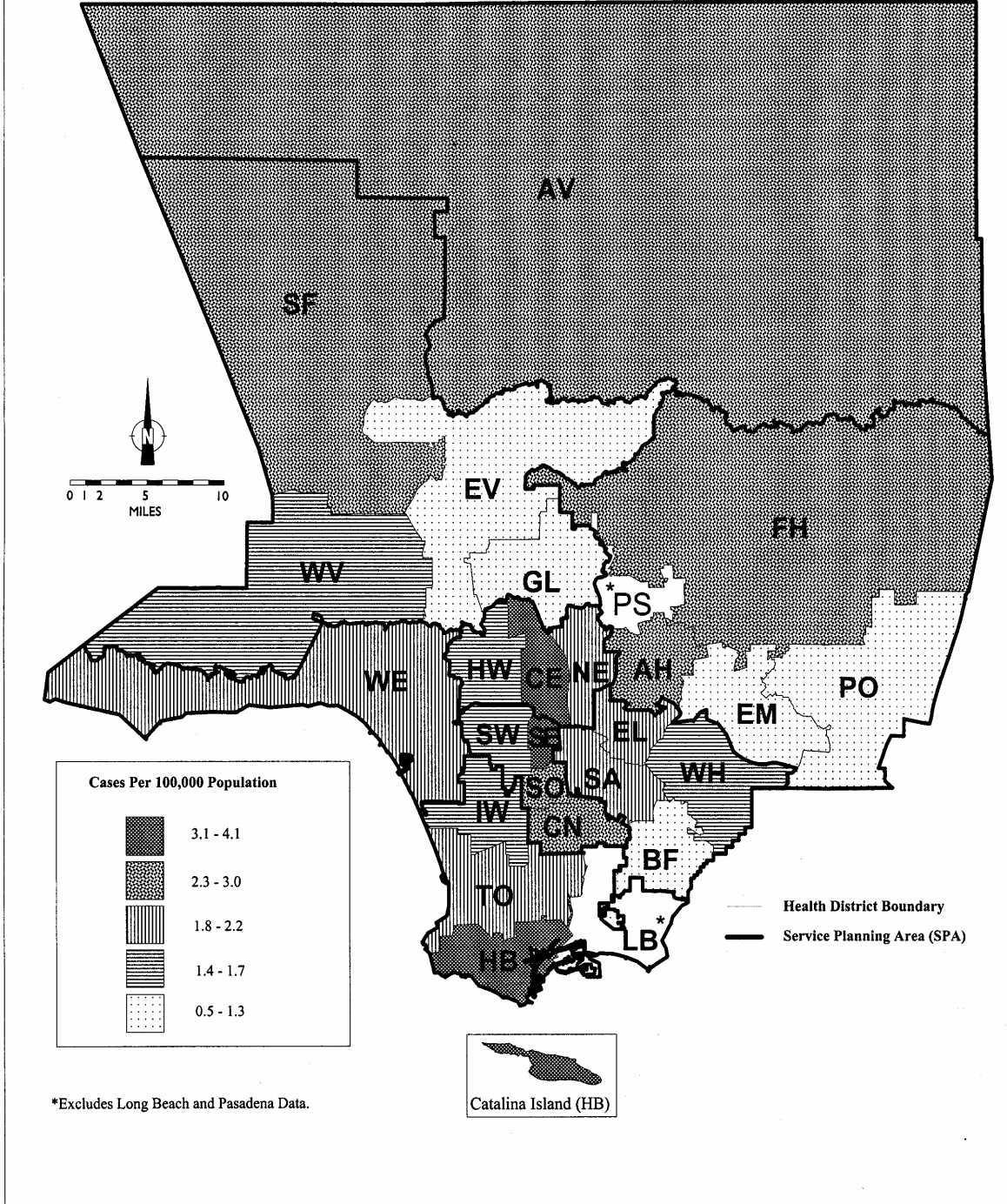
National Immunization Program at: [www.cdc.gov/nip](http://www.cdc.gov/nip)

Immunization Action Coalition at: [www.immunize.org](http://www.immunize.org)

LAC DHS, Immunization Program at: [www.lapublichealth.org/ip](http://www.lapublichealth.org/ip)



### MAP 10. Pertussis Rates by Health District, Los Angeles County, 2002\*



## PERTUSSIS (WHOOPIING COUGH)

CRUDE DATA	
Number of Cases	103
Annual Incidence <sup>a</sup>	
LA County	1.2
California	2.0
United States	1.2
Age at Diagnosis	
Mean	6 years
Median	2 months
Range	1 day – 69 years
Case Fatality	
LA County	2.0%
United States	N/A

<sup>a</sup> Cases per 100,000 population.

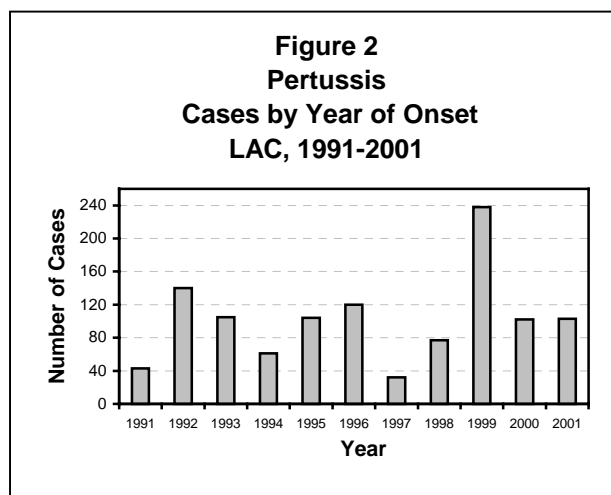
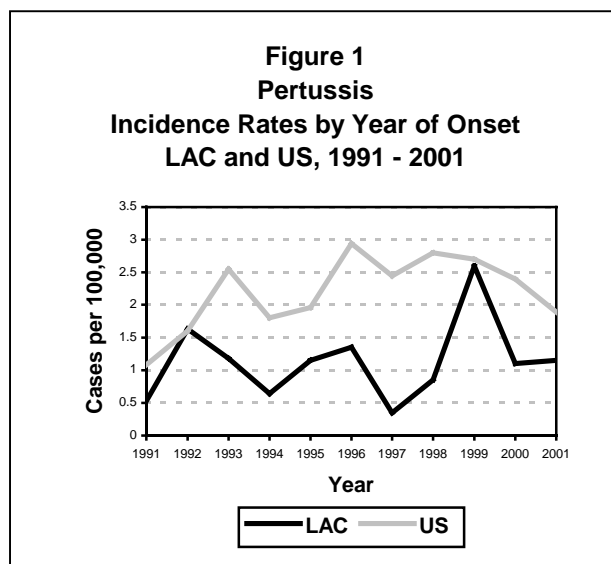
### DESCRIPTION

Pertussis, or whooping cough, is a vaccine-preventable disease spread by close contact with the respiratory secretions of infected individuals. Common symptoms include paroxysmal coughing, inspiratory whooping, and post-tussive vomiting. Complications from pertussis include pneumonia, seizures, and encephalopathy. Infants under 1 year of age are at highest risk for developing severe complications from pertussis.

The minimum clinical criteria for pertussis is a cough lasting at least two weeks with either paroxysms of coughing, inspiratory “whoop,” or post-tussive vomiting, without other apparent causes. Pertussis cases can be confirmed by either a positive *B. pertussis* culture or PCR.

### DISEASE ABSTRACT

- The majority of reported cases in 2001 were reported in children less than one year of age. Infants less than two months of age accounted for more than half of these cases.
- Eleven cases had complications from pertussis including pneumonia, seizures, and death in two cases.
- More than half of the cases reported in 2001 were susceptible to pertussis by reason of absent or waning immunization.



## IMMUNIZATION RECOMMENDATIONS

- A pertussis-containing vaccine should be given at 2 months, 4 months, 6 months, 15-18 months, and 4-6 years of age to provide protection against the disease.
- Immunity conferred by the pertussis component of the DTP/DTaP vaccine decreases over time, with little or no protection 5-10 years following the last dose.
- Currently, there is no pertussis vaccine booster available for adults.

## STRATIFIED DATA

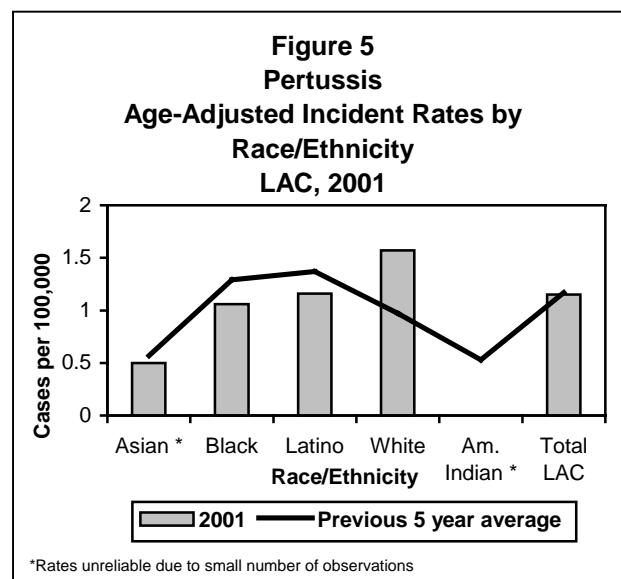
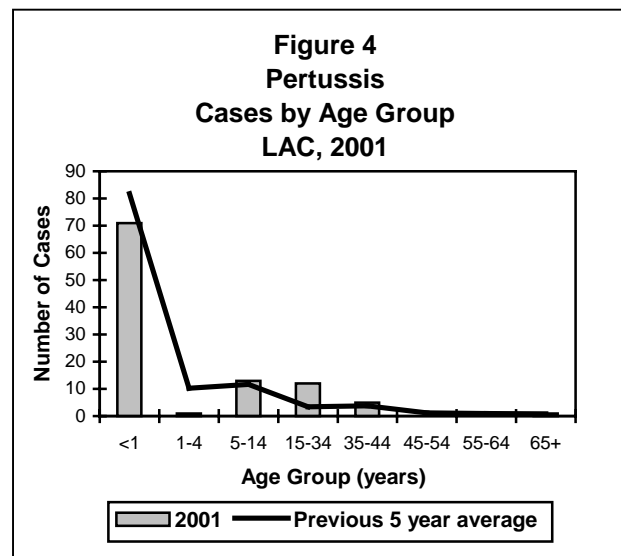
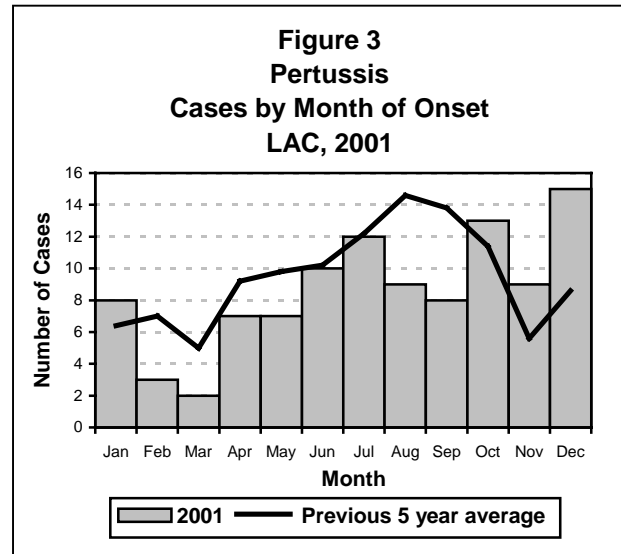
**Seasonality:** Typically, the summer months have the highest pertussis incidence in LAC (Figure 3). However, the number of 2001 cases steadily increased as the year progressed, peaking in mid summer and late fall/winter.

**Age:** As evidenced in previous years, approximately 69% (n=71) of reported cases in 2001 were reported in children less than one year of age. Infants less than two months of age and infants 2-6 months of age accounted for 58% and 38% of these cases, respectively. This is consistent with the national trend which has shown the highest annual pertussis incidence occurring among infants aged less than one year.

**Sex:** The male-to-female rate ratio was approximately 1.1:1.

**Race/Ethnicity:** After adjusting for age, racial group rates were similar to the previous 5 year average except for Whites which increased 62% from the previous 5 year average (Figure 5). Since 1998, the rate among Whites has been steadily increasing.

**Location:** Number of cases per SPA ranged from 3 to 25. San Fernando SPA 2 and Metro SPA 4 reported most cases. The clustering of cases in specific geographic areas is influenced in part by the active reporting efforts of local hospitals.





## COMMENTS

Because immunity induced by pertussis vaccine decreases over time, adolescents and adults can develop infection and serve as a source of transmission to infants who are not adequately immunized. Adults and adolescents with pertussis are more likely to have mild or atypical disease, so they often go undiagnosed. Future licensure and widespread use of an acellular pertussis booster vaccine for adolescents and adults should significantly decrease the incidence of pertussis in children, as well as its complications.

**Trends:** Pertussis incidence in LAC has peaked every 3-4 years since 1991 with the highest incidence in 30 years occurring in 1999 (n=238). The number of pertussis cases in 2001 was similar to that of 2000.

**Laboratory Confirmation:** Forty-five percent (n=46) of reported cases were laboratory confirmed by a positive culture or PCR. The other 55% were either epidemiologically linked to a confirmed case, or met the clinical criteria for pertussis.

**Vaccination Status:** Forty percent (n=41) of cases were less than two months of age and were too young to receive pertussis vaccine. Only 17% (n=18) of cases were 15 years of age or older; so even if they were fully immunized in early childhood, they would not have had complete immunity against pertussis in 2001. Thus, 57% percent of the cases reported in 2001 were susceptible to pertussis.

Twenty-six percent (n=27) of cases were between 2-6 months of age. Of these, 44% were up to date with pertussis vaccination for their age, but would not have developed full immunity against pertussis. Of the children who could have had full immunity from vaccination (7 months to 15 years old), 50 (75%) were fully up to date. Two of eight patient-cases were not immunized due to religious/philosophical exemptions, one child had medical exclusion, and the other five had undisclosed reasons.

**Complications/Hospitalization:** Sixty-one cases (59%) were hospitalized, with an average hospital stay of nine days (range 1-34 days). All but one of the hospitalized cases were less than one year of age. Of the eight cases who developed pneumonia, six were infants aged less than nine months and two were 15 years old. The one case with seizures was reported in a two-week-old infant. Two infants aged less than one year died from complications of pertussis.

## ADDITIONAL RESOURCES

National Immunization Program at: [www.cdc.gov/nip](http://www.cdc.gov/nip)

Immunization Action Coalition at: [www.immunize.org](http://www.immunize.org)

LAC DHS, Immunization Program at: [www.lapublichealth.org/ip](http://www.lapublichealth.org/ip)

## MAP 6. Pertussis Rates by Health District, Los Angeles County, 2001\*

