

Recent Trends in Incidence of Infant Pertussis Hospitalization in the United States

Keith L Davis, Samantha Kurosky

RTI Health Solutions, Research Triangle Park, NC, United States

BACKGROUND

- Infants are at greatest risk for severe pertussis, with ~50% of infant cases requiring hospitalization¹
- Recent surveillance indicates a resurgence of overall pertussis incidence in the United States (US),² but limited data exist on whether severe infantile cases are also resurging and the extent to which severe pertussis incidence in infants varies by sex and race

OBJECTIVE

- We assessed recent US trends in overall and sex- and race-stratified incidence of infant pertussis-related hospitalizations

METHODS

Study Design

- Retrospective database analysis

Data Source

- Discharge data from the 2000-2011 Healthcare Cost and Utilization Project (HCUP) Nationwide Inpatient Sample (NIS)
- The NIS is the largest all-payer inpatient care database in the US
- The NIS includes many variables for each inpatient stay, including demographics, diagnosis codes, length of stay, total charges, admission, and discharge status
- Sampling weights allow for generating nationally representative estimates

Inclusion Criteria

- Inpatient discharges containing a diagnosis code (primary or nonprimary) for pertussis (International Classification of Diseases, 9th Revision, Clinical Modification codes 033.0, 033.8, 033.9, 484.3)

- Age < 1 year

Study Measures and Analytical Methods

- The annual number of pertussis-related hospitalizations per 10,000 infants aged < 1 year was estimated using NIS sampling weights and year-specific population denominators from US census data
- Incidence was analyzed descriptively and stratified by sex and race/ethnicity
- Demographic characteristics of infants hospitalized for pertussis during 2000-2011 also were reported
- Analyses were descriptive and carried out using SAS[®] (Version 9.3) statistical software

RESULTS

Demographics (Tables 1a, 1b)

- Infants hospitalized for pertussis were generally evenly distributed by sex each year of the study period
- The racial composition of infant pertussis-related hospitalizations was relatively stable during this period, with whites representing the highest proportion of cases in each year except for 2006 and 2010, when Hispanics represented 33% and 39% of cases, respectively

Incidence (Figures 1, 2)

- Overall incidence of pertussis-related hospitalization was ~6/10,000 infants between 2000 and 2003 before increasing sharply in 2004 (9.0/10,000) and 2005 (13.8/10,000) (Figures 1 and 2).
- Thereafter, overall incidence of infant pertussis-related hospitalization fell substantially in 2006, 2007, and 2008 (6.2, 4.1, and 4.2/10,000, respectively) before increasing again in 2009 and 2010 (5.9 and 7.8/10,000, respectively).
- Overall incidence declined again in 2011 (3.2/10,000).
- Incidence was similar between males and females (Figure 1), but substantial differences were observed by race (Figure 2).
- Incidence was highest in Hispanic infants, starting at 8.6/10,000 in 2000, peaking at 24.9/10,000 in 2005, and then falling to 4.3/10,000 in 2008 before another sharp increase to 14.7/10,000 by 2010.
- Incidence was lowest for white and Asian infants, reaching a 2005 peak of only 5.4 and 5.3/10,000, respectively.

LIMITATIONS

- Patient discharges were identified based upon diagnosis codes that, if recorded inaccurately, may cause misidentification of pertussis
- Because unique patient identifiers were not provided, we were unable to follow patients who moved from facility to facility; results may be biased somewhat if the experiences of patients who transferred from facility to facility differed from those who remained in the analytic sample

CONCLUSIONS

- Infant pertussis hospitalization peaked in 2005 before a sharp decline thereafter, possibly due to increased herd immunity conferred by the 2006 launch of universal adolescent tetanus, diphtheria toxoids, and acellular pertussis (Tdap) vaccination
- Incidence resurged again through 2010 before another decline in 2011, demonstrating for severe cases the documented cyclic pattern of peaks and nadirs for overall pertussis incidence
- This analysis also highlights the need for increased focus on minorities, particularly Hispanics, in pertussis vaccination programs

Table 1a. Characteristics of Inpatient Admissions for Infant Pertussis in the United States, 2000-2005

	2000		2001		2002		2003		2004		2005	
	Weighted n	Weighted %	Weighted n	Weighted %	Weighted n	Weighted %	Weighted n	Weighted %	Weighted n	Weighted %	Weighted n	Weighted %
Total	2,282	100.00	2,026	100.00	2,549	100.00	2,410	100.00	3,480	100.00	5,343	100.00
Sex												
Male	1,128	49.43	1,081	53.36	1,251	49.08	1,309	54.32	1,776	51.03	2,664	49.86
Female	1,154	50.57	945	46.64	1,298	50.92	1,101	45.68	1,689	48.54	2,674	50.04
Unknown/missing	—	—	—	—	—	—	—	—	15	0.43	5	0.10
Race/ethnicity												
White	831	36.40	643	31.72	745	29.22	806	33.47	1,245	35.76	1,231	23.04
Black	302	13.25	224	11.04	282	11.08	280	11.63	288	8.28	343	6.42
Hispanic	567	24.86	645	31.82	785	30.82	683	28.34	957	27.50	1,857	34.76
Asian/Pacific Islander	42	1.84	49	2.40	44	1.74	22	0.92	55	1.58	106	1.98
Native American	—	—	6	0.27	—	—	10	0.41	31	0.88	19	0.35
Other	130	5.69	88	4.34	178	7.00	108	4.48	85	2.43	249	4.65
Unknown/missing	410	17.95	373	18.40	513	20.14	500	20.75	820	23.57	1,539	28.80

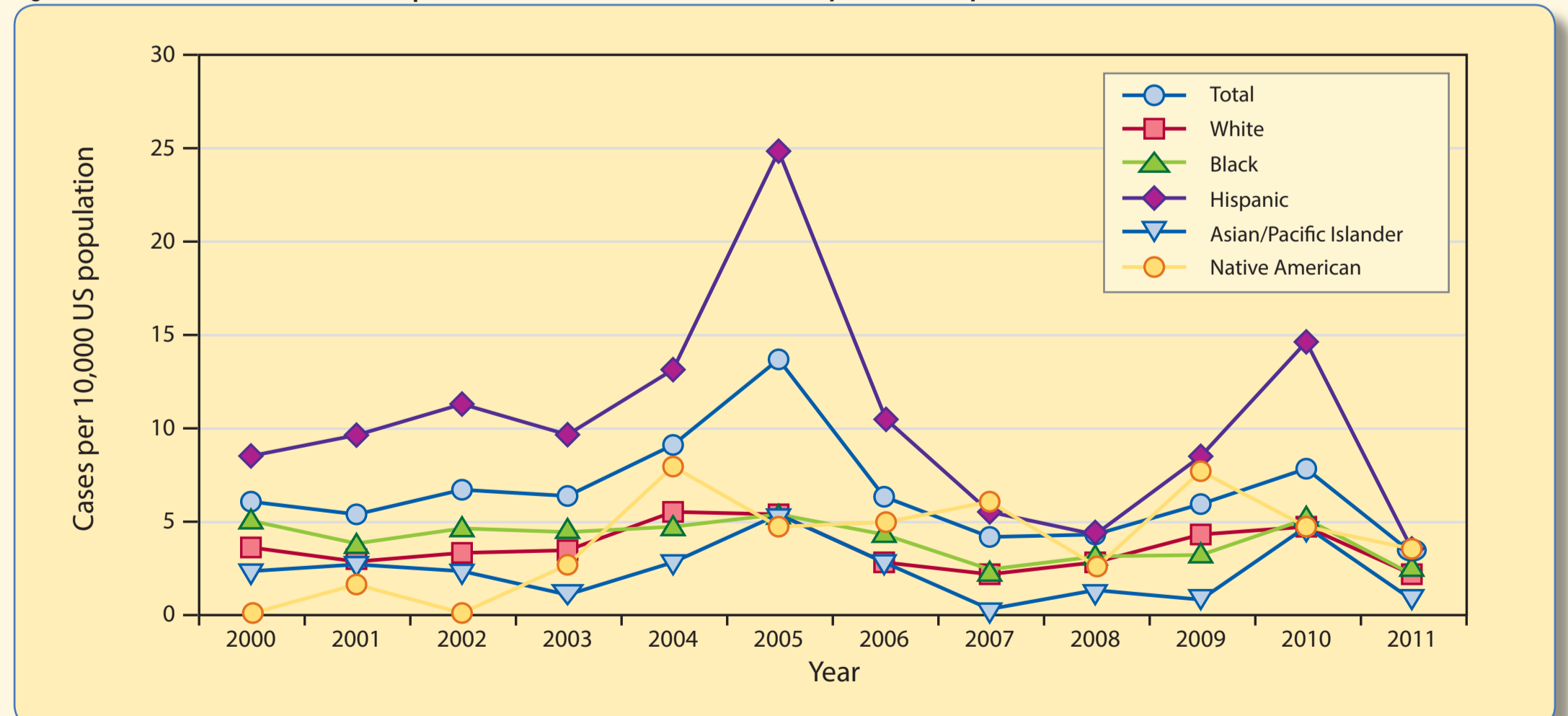
Table 1b. Characteristics of Inpatient Admissions for Infant Pertussis in the United States, 2006-2011

	2006		2007		2008		2009		2010		2011	
	Weighted n	Weighted %	Weighted n	Weighted %	Weighted n	Weighted %	Weighted n	Weighted %	Weighted n	Weighted %	Weighted n	Weighted %
Total	2,445	100.00	1,614	100.00	1,676	100.00	2,407	100.00	3,221	100.00	1,349	100.00
Sex												
Male	1,188	48.58	819	50.73	898	53.58	1,295	53.82	1,654	51.35	651	48.25
Female	1,248	51.04	790	48.99	778	46.42	1,112	46.18	1,549	48.10	692	51.33
Unknown/missing	9	0.38	5	0.28	—	—	—	—	18	0.55	6	0.42
Race/ethnicity												
White	664	27.14	499	30.93	632	37.68	998	41.45	1,059	32.87	518	38.38
Black	281	11.51	148	9.20	199	11.86	215	8.92	353	10.95	172	12.79
Hispanic	804	32.90	422	26.17	348	20.77	708	29.43	1,265	39.29	276	20.44
Asian/Pacific Islander	56	2.30	6	0.34	27	1.62	20	0.84	106	3.28	19	1.44
Native American	20	0.81	25	1.58	10	0.59	33	1.37	20	0.63	15	1.11
Other	116	4.76	43	2.67	155	9.24	143	5.93	83	2.57	68	5.07
Unknown/missing	503	20.58	470	29.10	306	18.25	290	12.05	336	10.42	280	20.77

Figure 1. Incidence of Infant Pertussis Hospitalization in the United States, 2000-2011, by Sex



Figure 2. Incidence of Infant Pertussis Hospitalization in the United States, 2000-2009, by Race/Ethnicity



REFERENCES

1. Centers for Disease Control and Prevention. Pertussis: fast facts. Available at: <http://www.cdc.gov/pertussis/fast-facts.html>. Accessed April 28, 2014.
2. Cherry JD. Epidemic pertussis in 2012 — the resurgence of a vaccine-preventable disease. *N Engl J Med*. 2012;367(9):785-7.

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CONTACT INFORMATION

Keith L Davis, MA
Senior Director, Health Economics
RTI Health Solutions
300 Park Offices Drive
Research Triangle Park, NC, 27709
Phone: +1.919.541.1273
Email: kldavis@rti.org

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