

# Length of Stay, and Mortality Associated With Pediatric Meningococcal Disease in the United States

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## BACKGROUND

- An estimated 1,400 to 3,000 people in the United States (US) develop meningococcal disease (MD) each year (O'Brien et al., 2006)
- While most cases are sporadic, outbreaks do occur, especially in young children and persons living in close quarters (e.g., first-year college students), making the disease a significant public health concern
- Even when treated with antibiotics, 10% to 15% of individuals who develop MD die, while 10% to 20% of survivors suffer serious, potentially debilitating complications such as hearing loss, brain damage, seizure, and stroke
- MD is always life threatening and requires immediate hospitalization
- Limited data are available on trends in MD burden (as measured by hospital costs, length of stay [LOS], and mortality) since the 2005 introduction of the meningococcal conjugate vaccine

## OBJECTIVE

- To describe trends in hospital costs, LOS, and mortality associated with pediatric MD cases in the US from 2000 to 2009

## METHODS

### Study Design

- Retrospective database analysis

### Data Source

- Discharge data from the 2000, 2003, 2006, and 2009 Healthcare Cost and Utilization Project (HCUP) Kids' Inpatient Database (KID)
  - Is the largest all-payer pediatric ( $\leq 20$  years of age) inpatient care database in the US
  - Includes many clinical and nonclinical variables for each inpatient stay, including patient demographics, diagnosis codes, LOS, total charges, admission and discharge status, payer, and hospital-specific characteristics
  - Uses sampling weights to generate nationally representative estimates

### Inclusion Criteria

- Inpatient discharges containing a diagnosis code (primary or nonprimary) for MD (ICD-9-CM codes in the range of 036.xx)
- Aged  $\leq 20$  years

### Study Measures and Analytical Methods

- Weighted, nationally representative estimates of the following:
  - Case fatality rates, stratified by age category ( $< 1$  year, 1-4 years, 5-10 years, 11-18 years, and 19-20 years)
  - LOS
  - Costs per admission in 2012 US dollars (charges were converted to costs using a 0.5 cost-to-charge ratio)
- Description of background patient characteristics for MD cases
- Descriptive analyses using SAS® (Version 9.3) statistical software

## RESULTS

### Patient Characteristics (Table 1)

- The age distribution of pediatric MD cases was relatively stable from 2000 to 2009, with infants representing approximately one-fifth to one-quarter of all MD cases
- Pediatric patients with MD were predominantly male, with male representation increasing from 55% to 61% of cases from 2000 to 2009
- Racial composition of pediatric MD shifted during this period, with representation declining among white patients (from 56% to 45% of cases) and increasing among black patients (from 8% to 11% of cases)

### Case Fatality Rates (Figure 1)

- Overall case fatality rates remained relatively unchanged during the study period, declining slightly from 4.7% in 2000 to 4.3% in 2009
- A noticeable spike in fatality occurred in 2003, however, when 5.8% of patients died
- Although fatality rates were stable for most age groups, there was a substantial rise in fatality rates from 2000 to 2009 for patients aged 5-10 years (from 0% in 2000 to 4.1% in 2009) and 19-20 years (from 4.2% in 2000 to 12.2% in 2009)

### LOS and Costs (Figures 2 and 3)

- Mean (standard deviation [SD]) LOS for MD hospitalizations was 8.4 (12.9) days in 2000
- Mean LOS decreased modestly to 7.7 (9.6) and 7.9 (8.3) days in 2003 and 2006, respectively, before a substantial increase to 9.3 (13.9) days in 2009
- Mean (SD) cost per admission increased by 30% over the study period, from \$25,739 (\$60,929) in 2000 to \$33,530 (\$62,499) in 2009

Table 1. Characteristics of Inpatient Admissions for MD in the US in 2000-2009

Characteristic	2000		2003		2006		2009	
	Weighted n	Weighted %	Weighted n	Weighted %	Weighted n	Weighted %	Weighted n	Weighted %
<b>Total</b>	1,684	100.00	1,100	100.00	749	100.00	587	100.00
<b>Sex</b>								
Male	924	54.85	625	56.80	426	56.83	356	60.69
Female	760	45.15	449	40.83	313	41.86	224	38.12
Unknown/missing	—	—	26	2.37	10	1.31	7	1.19
<b>Age in years</b>								
< 1	290	17.20	251	22.76	195	26.10	153	26.00
1-4	416	24.70	301	27.35	178	23.76	120	20.47
5-10	284	16.87	167	15.17	102	13.58	77	13.17
11-18	529	31.43	272	24.75	199	26.62	161	27.42
19-20	161	9.57	98	8.94	71	9.52	70	11.98
Unknown/missing	4	0.22	11	1.04	3	0.42	6	0.95
<b>Race/ethnicity</b>								
White	944	56.08	501	45.50	309	41.24	263	44.79
Black	131	7.81	96	8.72	63	8.38	66	11.29
Hispanic	193	11.46	120	10.87	112	14.90	67	11.43
Asian/Pacific Islander	22	1.33	12	1.13	15	2.02	11	1.82
Native American	2	0.13	3	0.28	4	0.58	7	1.16
Other	59	3.50	34	3.08	38	5.05	37	6.35
Unknown/missing	332	19.69	335	30.42	208	27.83	136	23.16
<b>Geographic region</b>								
Northeast	280	16.63	154	14.03	128	17.12	68	11.52
Midwest	396	23.50	257	23.36	142	18.99	150	25.55
South	496	29.43	354	32.14	231	30.88	194	32.98
West	513	30.44	335	30.47	247	33.01	175	29.95
<b>Primary payer</b>								
Medicare	5	0.28	2	0.14	2	0.27	—	—
Medicaid	586	34.79	475	43.14	337	44.96	289	49.28
Private insurance	905	53.75	511	46.41	331	44.18	231	39.33
Self-pay	118.0	7.00	66.0	6.00	40.0	5.38	37.0	6.30
No charge	10.0	0.58	2.0	0.16	4.0	0.50	4.0	0.76
Other	53	3.12	44	3.95	34	4.49	25	4.33
Unknown/missing	8	0.48	2	0.19	2	0.22	—	—

Figure 1. Case Fatality Rate of MD in the US in 2000-2009, by Age

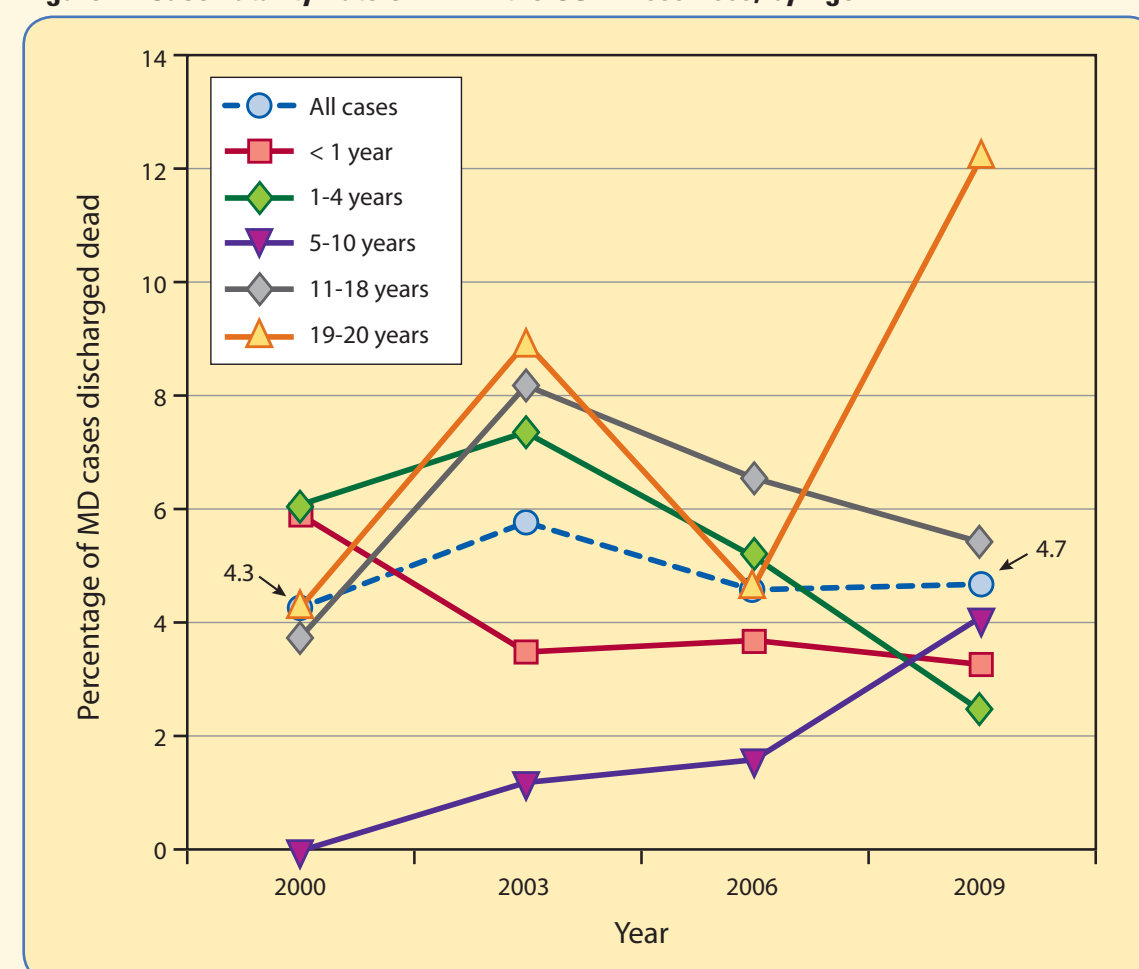
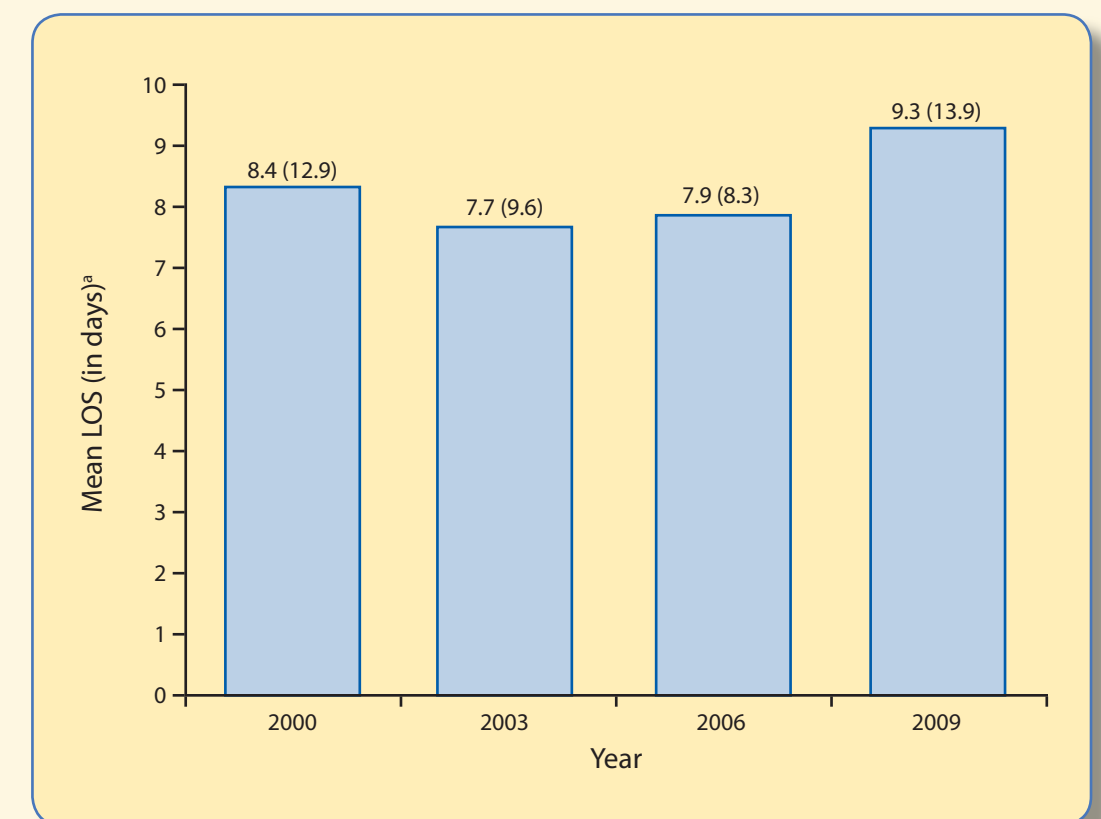
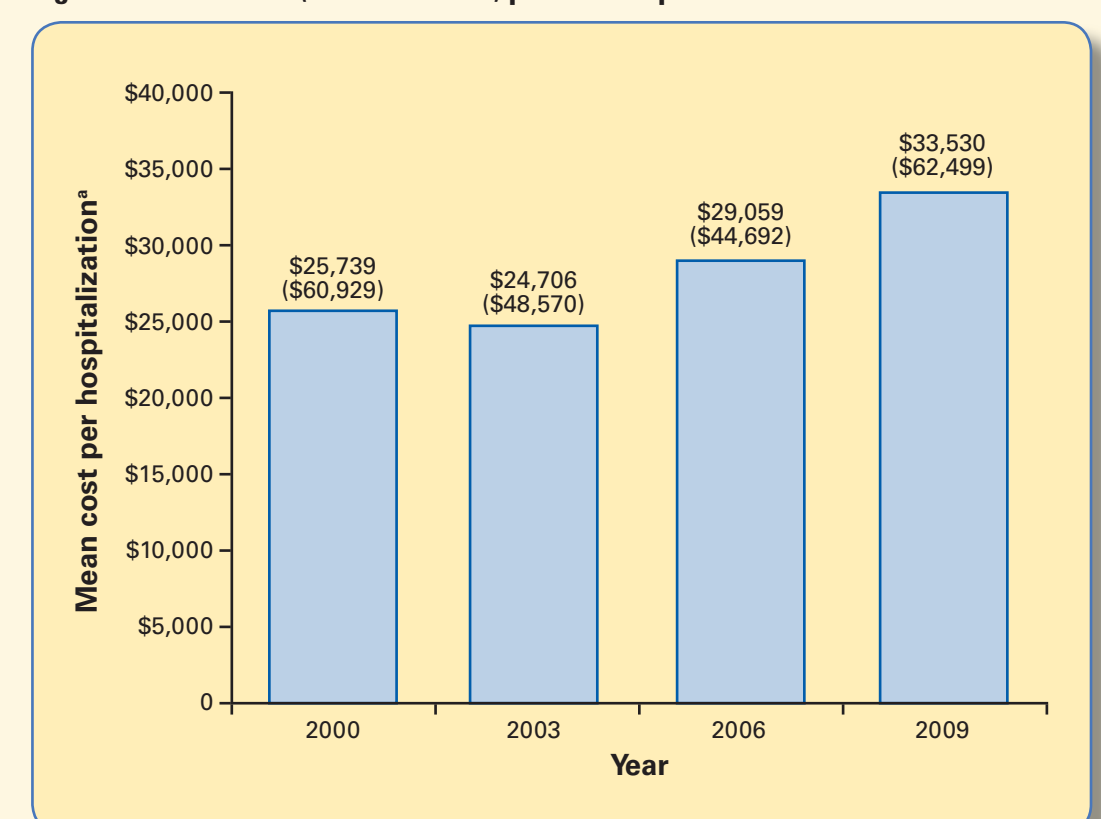


Figure 2. Mean LOS of MD Hospitalizations in the US in 2000-2009



\* Standard deviation shown in parentheses.

Figure 3. Mean Cost (in 2012 Dollars) per MD Hospitalization in the US in 2000-2009



\* Standard deviation shown in parentheses.

## LIMITATIONS

- Patient discharges were identified based on diagnosis codes that, if recorded inaccurately, may cause misidentification of MD
- 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

- MD in the US pediatric population is associated with high costs resulting from hospital stays that typically exceed 1 week
- Our estimated case fatality rate (~5%), while high, is lower than the 10% to 15% fatality rate estimated by the US Centers for Disease Control and Prevention, which includes estimates from all age groups combined (pediatrics and adults).
- Although pediatric MD incidence has steadily decreased in the US and overall fatality rates have remained stable, the marked increase in fatality for certain age groups (5-10 and 19-20 years) is alarming; future studies assessing reasons for this finding (e.g., increased antibiotic resistance) are needed
- In light of these findings, recent efforts to raise awareness of MD as a serious public health concern should be continued

## REFERENCE

O'Brien JA, Caro JJ, Getsios D. Managing meningococcal disease in the United States: Hospital case characteristics and costs by age. *Value in Health* 2006;9(4):236-42.

## CONTACT INFORMATION

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