

Recent Trends in Congenital Cytomegalovirus-Related Hospitalization in the United States

Sean D. Candrilli,¹ Laurel Trantham¹

¹RTI Health Solutions, Research Triangle Park, NC, United States

BACKGROUND

- Cytomegalovirus (CMV) is a common infection prevalent in approximately 6 out of 10 people in the United States (US) and which belongs to the group of herpes viruses.¹
- CMV can be transmitted from a pregnant woman to her fetus during pregnancy, termed congenital CMV infection (cCMV).²
 - cCMV occurs in approximately 1 in every 150 births.³
- Transmission of CMV to the fetus may cause an increased risk of fetal loss, and approximately 1 in 10 may be affected by related complication (e.g., enlarged spleen or liver, premature birth, low birth weight, microcephaly).²
- Furthermore, among children born with cCMV, roughly 1 out of 5 may develop permanent problems such as hearing or vision loss, or developmental disabilities due to CMV infection.³
 - In the US, cCMV causes more permanent disabilities and deaths than other medical conditions occurring at birth.²
- While aspects of the epidemiology of cCMV have been documented in the scientific literature, limited real-world evidence exists that describes the economic burden associated with the infection.
 - Such information may help decision makers raise awareness of the condition and develop sound strategies for addressing this public health concern.

OBJECTIVE

- This study sought to document recent trends in cCMV-related infant hospitalizations in the US, as well as to describe attributes of these hospitalizations, including patient characteristics and economic measures.

METHODS

Study Design

- Retrospective database analysis

Data Source

- Hospital discharge data from the 2004 through 2013 Healthcare Cost and Utilization Project (HCUP) Nationwide Inpatient Databases (NIS)⁴
- The NIS is the largest inpatient-care database in the US and the only national inpatient database with charge information on all patients, regardless of payer
- NIS-provided clinical and nonclinical variables for each hospitalization, including patient demographics, diagnosis codes, length of stay (LOS), total charges, admission and discharge status, and payer
- Sampling weights to allow for generating nationally representative estimates

Inclusion Criteria

- A diagnosis of cCMV (ICD-9-CM code 771.1)
- Less than 1 year of age at admission

Study Measures and Analytical Methods

- Weighted, descriptive analyses were carried out using the SAS[®] (Version 9.4) statistical software package
- For each of the years assessed, the following measures were calculated:
 - Weighted estimates of the rate of cCMV-related hospitalization
 - Per-discharge total costs, in 2016 US dollars (charge data converted to costs⁵), and LOS for cCMV-related hospitalizations
 - Patient-level characteristics (i.e., sex, race, primary payer, mortality)

REFERENCES

- Staras SA, Dollard SC, Radford KW, Flanders WD, Pass RF, Cannon MJ. Seroprevalence of cytomegalovirus infection in the United States, 1988-1994. *Clin Infect Dis*. 2006 Nov 1; 43(9):1143-51.
- Centers for Disease Control and Prevention (CDC). Cytomegalovirus (CMV) and congenital CMV infection. 2016. Available at: <http://www.cdc.gov/cmvi/index.html>. Accessed April 20, 2017.
- Manicklal S, Emery VC, Lazzarotto T, Boppana SB, Gupta RK. The "silent" global burden of congenital cytomegalovirus. *Clin Microbiol Rev*. 2013 Jan; 26(1):86-102.
- Healthcare Cost and Utilization Project. Overview of the National (Nationwide) Inpatient Sample (NIS). Available at: <https://www.hcup-us.ahrq.gov/nisoverview.jsp>. Accessed October 19, 2017.
- Friedman B, La Mare J, Andrews R, et al. Practical options for estimating cost of hospital inpatient stays. *J Health Care Finance*. 2002; 29: 1-13.
- Markus AR, Andres E, West KD, Garro N, Pellegrini C. Medicaid covered births, 2008 through 2010, in the context of the implementation of health reform. *Womens Health Issues*. 2013 Sep-Oct; 23(5):e273-80.

CONTACT INFORMATION

Sean D. Candrilli, PhD
Head, Health Economics
RTI Health Solutions, 300 Park Offices Drive, Research Triangle Park, NC 27709
Phone: +1.412.384.2790 Fax: +1.919.541.7222 E-mail: scandrilli@rti.org

RESULTS

Rates of cCMV-Related Hospitalization (Figure 1)

- cCMV-related hospitalization rates among infants in the US fell from 20.9/100,000 in 2004 to 17.8/100,000 in 2013.
- The study period included two inflection points, in 2008 and 2011, at which the rate fell appreciably and then increased substantially the next year.

Figure 1. cCMV Hospitalization Rate, by Year

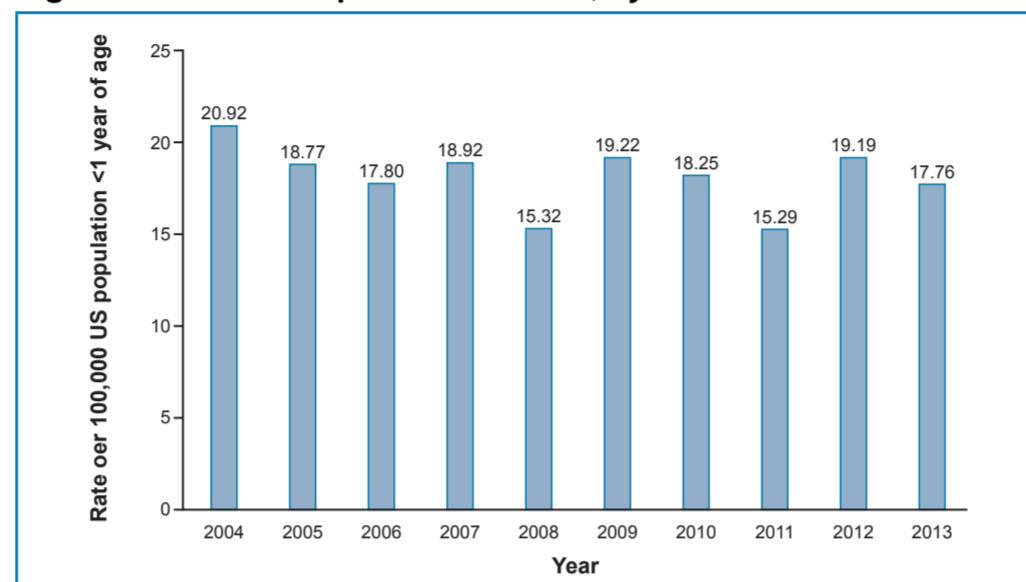


Table 1. Characteristics of cCMV-Hospitalized Patients

	2004		2005		2006		2007		2008		2009		2010		2011		2012		2013	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Mean (SD) age, in days	35.2	(70.1)	41.7	(80.2)	38.0	(80.2)	35.9	(80.9)	37.4	(76.7)	30.2	(69.3)	19.1	(53.3)	36.8	(80.8)	NA ^a	NA ^a	NA ^a	NA ^a
Female	383	47.6	317	43.6	308	44.2	364	48.6	271	44.1	356	45.6	365	48.7	332	52.0	345	42.6	395	52.0
Race																				
White	315	39.2	170	23.4	251	35.9	198	26.5	295	48.1	288	36.9	261	34.7	202	31.8	365	45.1	355	46.7
Nonwhite	332	41.2	295	40.6	214	30.6	238	31.8	237	38.6	361	46.2	415	55.3	299	46.8	385	47.5	355	46.7
Unknown/missing	158	19.6	262	36.1	233	33.5	313	41.7	82	13.4	132	16.9	75	10.0	136	21.4	60	7.4	50	6.6
Primary Payer																				
Medicaid	494	61.4	446	61.3	399	57.2	428	57.2	366	59.6	531	68.1	490	65.3	17	2.6	515	63.6	535	70.4
Private insurance	271	33.6	257	35.3	236	33.9	267	35.7	191	31.2	225	28.9	211	28.1	7	1.2	240	29.6	165	21.7
Other	40	5.0	25	3.4	62	8.9	54	7.2	57	9.2	24	3.0	49	6.6	613	96.2	55	6.8	60	7.9
Died during hospitalization	41	5.1	44	6.1	55	7.8	43	5.7	52	8.5	32	4.2	49	6.6	37	5.7	20	2.5	35	4.6
Total	805	100.0	728	100.0	697	100.0	749	100.0	614	100.0	780	100.0	750	100.0	637	100.0	810	100.0	760	100.0

^a Age in days for patients < 1 year of age was not reported in the 2012 or 2013 NIS datasets.
Note: Across the years with age data reported, the median age was 0 days (i.e., newborn). NA = not applicable.

Table 2. Length of Stay and Costs of cCMV-Related Hospitalizations

Year	N	Length of Stay			Cost			Total Cost (Summed Across All Hospitalizations)
		Median	Mean	SD	Median	Mean	SD	
2004	805	12	28.7	36.2	\$31,403	\$93,683	\$138,604	\$72,762,153
2005	728	13	24.5	29.9	\$30,319	\$83,048	\$134,929	\$57,174,317
2006	697	12	30.1	38.6	\$35,924	\$102,678	\$143,608	\$69,459,030
2007	749	17	29.8	30.2	\$46,498	\$90,847	\$110,436	\$66,861,937
2008	614	16	32.3	42.4	\$41,083	\$103,383	\$158,876	\$61,540,893
2009	780	16	36.7	52.4	\$40,725	\$111,931	\$168,206	\$84,521,058
2010	750	15	27.2	33.7	\$39,155	\$81,915	\$122,301	\$59,008,820
2011	637	12	32.9	42.3	\$33,767	\$128,052	\$202,961	\$80,898,631
2012	810	13	26.9	35.1	\$32,581	\$105,941	\$198,028	\$83,163,475
2013	760	13	29.1	39.2	\$36,639	\$103,773	\$175,737	\$77,310,920

CONCLUSIONS

- cCMV-related hospitalization rates in the US decreased during the study period observed (overall, -15%), but the total cost burden per stay increased slightly during this period (+11%).
- In the US, roughly half of all births are covered by Medicaid,⁶ but our results show that nearly two-thirds of cCMV-related hospitalizations among children less than 1 year of age (of which a large proportion are births) are paid for by the program, suggesting that the economically disadvantaged are disproportionately affected by the condition.
- Further research is warranted to better understand factors that may be influencing the observed decrease in rates of cCMV-related hospitalization among the very young in the US, as well as the modest increase in the direct economic burden of inpatient stays for these events (even as LOS remains relatively constant).
 - Such research may help in planning optimal resource allocation both in inpatient settings and across the entire cCMV continuum of care.

LIMITATIONS

- Patient discharges were identified based upon diagnosis codes that, if recorded inaccurately, may cause misidentification of cCMV.