

Appendix Table 1: Specific ICD-9 codes that define each neurological disorder category. A child was considered to have a neurological condition if they had at least one inpatient or outpatient visit with an ICD-9 code identifying a neurological condition during the preceding surveillance year

Group	ICD-9 Code & Description
Cerebral palsy	343 – Infantile cerebral palsy
Muscular dystrophies	359.0 – Muscular dystrophy, Congenital hereditary 359.1 – Muscular dystrophy, Hereditary progressive 359.21 – Muscular dystrophy, Myotonic 359.22* – Myotonia congenita 359.23 – Myotonic chondrodystrophy 359.29* – Other specified myotonic disorder
Motor Neuron Diseases	335 – Anterior horn cell disease 356.0 – Hereditary peripheral neuropathy (Dejerine-Sottas) 356.1 – Peroneal muscular atrophy (Charcot-Marie-Tooth) 356.3* – Refsum's disease 334.0 – Friedreich's ataxia 334.1 – Hereditary spastic paraplegia 334.8* – Other spinocerebellar diseases
Cerebral and other degenerative diseases of the central nervous system	330.0 – Leukodystrophy 330.1 – Cerebral lipidoses 330.2 – Cerebral degeneration in generalized lipidoses 330.3 – Cerebral degeneration of childhood in diseases classified elsewhere 330.8 – Other specified cerebral degenerations in childhood 330.9 – Unspecified cerebral degeneration in childhood 333.0 – Other degenerative diseases of the basal ganglia (PKAN) 333.4* – Huntington's chorea 333.6 – Hereditary torsion dystonia 333.71* – Athetoid cerebral palsy
Neural tube defects	741 – Spina bifida 742** – Other congenital anomalies of nervous system
Metabolic disorders with neuro/muscular involvement	271.0 – Glycogen storage disease type II (Pompe disease) 277.2 – Other disorders of purine and pyrimidine metabolism (Lesch-Nyhan) 277.5 – Mucopolysaccharidosis 277.85* – Disorders of fatty acid oxidation 277.86* – Peroxisomal disorders 277.87 – Disorders of mitochondrial metabolism
Chromosomal abnormalities	758.0 – Down syndrome 758.1 – Patau's syndrome 758.2 – Trisomy 18 758.3 – Autosomal deletion syndromes

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Traumatic brain injury	907.0 – Late effect of intracranial injury without mention of skull fracture 907.2* – Late effect of spinal cord injury 768.7* – Hypoxic-ischemic encephalopathy (HIE)
Epilepsy and recurrent seizures	345 – Epilepsy and recurrent seizures
*Codes not included in Havers et al. **Code categorized as a different neurological disorder category “Other congenital anomalies of the nervous system” in Havers et al.	

Appendix Table 2: ICD-9 codes that define severity indicators among children with neurological disorders.

Group	ICD-9 Code & Description
Severity Indicator	All combined
Scoliosis	737 – Kyphoscoliosis and scoliosis 754 – Certain congenital musculoskeletal deformities
Intellectual Disability	317 – Mild intellectual disabilities 318 – Moderate-severe intellectual disabilities 319 – Unspecified intellectual disabilities
Deafness	389 – Deafness
Blindness/low vision	369 – Blindness and low vision

Appendix Table 3: ICD-9 codes for RSV-specific, bronchiolitis, and pneumonia hospitalizations

Type of code	Definition
RSV-specific codes	466.11 – RSV, bronchiolitis 480.1 – RSV, pneumonia 079.6 – RSV, other
Bronchiolitis codes	466.1 – Acute bronchiolitis 466.19 – Acute bronchiolitis due to an infectious organism
Pneumonia codes	480-486 (excluding 480.1) – Pneumonia

Appendix Table 4: Revenue codes that defined ICU stay during RSV-associated hospitalization

ICU Stay Revenue Codes
0174 – Nursery-newborn-level IV (intensive care)
0200 – Intensive care-general classification
0201 – Intensive care-surgical
0202 – Intensive care-medical
0203 – Intensive care-pediatric
0204 – Intensive care-psychiatric
0206 – Intensive care-post ICU or intermediate ICU
0207 – Intensive care-burn car
0208 – Intensive care-trauma
0209 – Intensive care-other intensive care

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Appendix Table 5: Revenue codes that defined chronic lung disease (CLD), congenital heart disease (CHD), and prematurity <35 weeks

Type of code	Definition
Chronic lung disease	770.7 – Chronic lung disease
Congenital heart disease	1) Any CHD code AND heart failure code OR 2) Any CHD code AND a pulmonary hypertension code OR 3) Any with cyatonic heart disease codes For specific codes, see Chang, 2010
Prematurity	765.21 – Gestational Age: 22-23 weeks 765.22 – Gestational Age: 24 weeks 765.23 – Gestational Age: 25-26 weeks 765.24 – Gestational Age: 27-28 weeks 765.25 – Gestational Age: 29-30 weeks 765.26 – Gestational Age: 31-32 weeks 765.27 – Gestational Age: 33-34 weeks

Appendix Table 6: Prevalence of severity indicators among children with at least one identified neurological disorder enrolled in the MarketScan Databases (2006-2015).†

Severity Indicator	Commercial, N (%) (N=563,135)	Medicaid, N (%) (N=439, 845)	Both Databases, N (%) (N=1,002,980)
Overall*	92,893 (16.5)	125,308 (28.5)	218,201 (21.8)
Scoliosis	50,586 (9.0)	40,110 (9.1)	90,696 (9.0)
Intellectual Disability	15,283 (2.7)	64,967 (14.8)	80,250 (8.0)
Deafness	33,223 (5.9)	30,894 (7.0)	64,117 (6.4)
Blindness/low vision	4,060 (0.7)	12,598 (2.9)	16,658 (1.7)

†See Appendix Table 2 for definitions of severity indicators among children with neurological disorders
* Overall indicates the proportion of children with at least one severity indicator.

Appendix Table 7: Rates of RSV hospitalization by neurological disorder and database.

Conditions	Commercial (N=563,135)				Medicaid (N=439,845)			
	% with severity indicator	P-Y	RSV-specific Rate* (95% CI)	RSV-associated Rate*† (95% CI)	% with severity indicator	P-Y	RSV-specific Rate* (95% CI)	RSV-associated Rate*† (95% CI)
Cerebral Palsy	29.0	89,520	4.6 (4.1, 5.0)	8.2 (7.6, 8.8)	42.2	118,550	6.0 (5.6, 6.5)	10.3 (9.7, 10.9)
Muscular dystrophies	25.8	11,492	6.0 (4.7, 7.6)	10.2 (8.4, 12.2)	35.5	8,441	7.7 (5.9, 9.8)	13.9 (11.5, 16.6)
Motor Neuron Diseases	31.6	8,466	5.9 (4.4, 7.8)	11.6 (9.4, 14.1)	37.8	5,728	7.5 (5.4, 10.1)	14.0 (11.1, 17.4)
Cerebral and other degenerative diseases of the central nervous system	31.8	8,408	6.1 (4.5, 8.0)	10.8 (8.7, 13.3)	45.1	6,721	9.2 (7.1, 11.8)	15.3 (12.5, 18.6)
Neural tube defects	21.6	96,418	4.6 (4.2, 5.1)	7.8 (7.3, 8.4)	33.1	79,765	9.3 (8.6, 10.0)	15.1 (14.3, 16.0)
Metabolic disorders with neuro/muscular involvement	20.0	10,922	6.5 (5.1, 8.2)	11.0 (9.1, 13.1)	31.0	7,558	10.6 (8.4, 13.2)	17.6 (14.7, 20.9)

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Chromosomal abnormalities	27.6	55,884	8.9 (8.1, 9.7)	14.7 (13.7, 15.7)	39.3	48,519	11.8 (10.9, 12.8)	19.0 (17.8, 20.3)
Traumatic brain injury	15.9	7,456	6.4 (4.7, 8.5)	11.3 (9.0, 13.9)	27.3	7,266	18.7 (15.7, 22.1)	30.4 (26.5, 34.7)
Epilepsy and recurrent seizures	11.6	242,276	2.2 (2.0, 2.4)	3.9 (3.6, 4.1)	24.3	189,711	4.4 (4.1, 4.7)	7.6 (7.2, 8.0)

*Hospitalization rate for RSV-associated infections per 1000 person-years

†Adjusted rate includes 38% of bronchiolitis (466.1 excluding 466.11) hospitalizations and 26% of pneumonia codes (480-486 excluding 480.1) among children < 5 and 7% among those ≥ 5 between November and April

Appendix Table 8: Rates of RSV hospitalization in children with neurological disorders, excluding epilepsy, by age and overall in the Medicaid and Commercial Claims databases (2006-2015).

Age groups (y)	Commercial (N=273,149)			Medicaid (N=228,265)		
	P-Y	RSV-specific Rate* (95% CI)	RSV-associated Rate*† (95% CI)	P-Y	RSV-specific Rate* (95% CI)	RSV-associated Rate*† (95% CI)
<1	7,178	26.1 (22.4, 30.1)	43.5 (38.8, 48.6)	7,513	35.7 (31.5, 40.2)	52.3 (47.3, 57.7)
1	20,349	16.9 (15.1, 18.7)	27.9 (25.7, 30.3)	21,296	26.9 (24.7, 29.2)	45.3 (42.5, 48.2)
2-4	48,099	11.8 (10.9, 12.8)	20.8 (19.5, 22.1)	53,481	14.8 (13.8, 15.9)	25.7 (24.4, 27.1)
5-9	78,675	2.8 (2.4, 3.2)	4.4 (4.0, 4.9)	80,807	3.3 (2.9, 3.7)	5.0 (4.5, 5.5)
10-18	135,807	0.94 (0.79, 1.12)	2.0 (1.7, 2.2)	116,518	1.0 (0.8, 1.2)	2.3 (2.1, 2.6)
Total	290,109	5.0 (4.7, 5.2)	8.6 (8.3, 9.0)	279,616	7.2 (6.9, 7.5)	12.2 (11.8, 12.6)

*Hospitalization rates per 1000 person-years

†Adjusted rate includes 38% of bronchiolitis (466.1 excluding 466.11) hospitalizations and 26% of pneumonia codes (480-486 excluding 480.1) among children < 5 and 7% among those ≥ 5 between November and April

Appendix Table 9: Summary of logistic models, estimating the log odds and corresponding 95% confidence intervals of RSV-specific hospitalization among those with neurological disease compared to the general pediatric population, adjusting for chronic lung disease (CLD), congenital heart disease (CHD), prematurity <35 weeks, age <2 years in the Commercial and Medicaid databases.

Variable	Commercial (N=7,065,871)*			Medicaid (N=2,936,350)*		
	Estimate	95% Confidence Interval	p-value	Estimate	95% Confidence Interval	p-value
Intercept	-9.19	-9.26, -9.12	<0.0001	-8.21	-8.28, -8.14	<0.0001
Neurological disorder	1.80	1.70, 1.89	<0.0001	1.53	1.45, 1.62	<0.0001
CLD	1.20	0.93, 1.47	<0.0001	1.27	1.07, 1.47	<0.0001
CHD	1.03	0.79, 1.26	<0.0001	1.26	1.07, 1.46	<0.0001
Prematurity <35 weeks	0.49	0.28, 0.71	<0.0001	0.60	0.44, 0.76	<0.0001
Age <2 years	3.03	2.94, 3.12	<0.0001	2.61	2.53, 2.69	<0.0001

*For children eligible for inclusion during multiple seasons, one season was randomly selected

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Appendix Table 10A: Rates of RSV hospitalization among children in Commercial database with neurological disorders and among a simple random sample by RSV season.

Commercial								
	Children w/ neurological (N=563,135)			Comparison group (N=7,859,751)			Rate Ratio (RR)	
Season	P-Y	RSV-specific Rate* (95% CI)	RSV-associated Rate* [†] (95% CI)	P-Y	RSV-specific Rate* (95% CI)	RSV-associated Rate* [†] (95% CI)	RR RSV-specific (95% CI)	RR RSV-associated (95% CI)
2006-07	20,427	2.8 (2.1, 3.6)	5.1 (4.2, 6.2)	313,887	0.3 (0.2, 0.35)	0.5 (0.4, 0.6)	9.8 (7.1, 13.7)	9.8 (7.7, 12.5)
2007-08	35,110	3.3 (2.7, 3.9)	6.3 (5.5, 7.2)	562,816	0.3 (0.28, 0.38)	0.6 (0.51, 0.64)	10.1 (8.0, 12.7)	11.0 (9.2, 13.0)
2008-09	46,802	3.0 (2.5, 3.5)	5.4 (4.7, 6.1)	666,700	0.3 (0.27, 0.36)	0.5 (0.48, 0.59)	9.5 (7.6, 11.7)	10.1 (9.6, 11.9)
2009-10	51,283	3.3 (2.9, 3.9)	5.6 (5.0, 6.3)	724,445	0.3 (0.31, 0.40)	0.6 (0.53, 0.64)	9.5 (7.9, 11.6)	9.7 (8.3, 11.3)
2010-11	60,868	3.4 (3.0, 3.9)	5.8 (5.2, 6.4)	875,110	0.3 (0.28, 0.35)	0.5 (0.44, 0.54)	11.0 (9.2, 13.2)	11.9 (10.3, 13.7)
2011-12	71,774	3.1 (2.7, 3.6)	5.5 (5.0, 6.1)	975,896	0.3 (0.24, 0.30)	0.4 (0.41, 0.49)	11.6 (9.7, 13.8)	12.3 (10.8, 14.1)
2012-13	67,301	3.8 (3.3, 4.3)	5.5 (4.9, 6.1)	868,812	0.34 (0.31, 0.39)	0.5 (0.48, 0.57)	10.9 (9.2, 12.9)	10.4 (9.1, 12.0)
2013-14	62,007	2.9 (2.5, 3.4)	5.0 (4.5, 5.6)	807,903	0.27 (0.24, 0.31)	0.4 (0.37, 0.46)	10.8 (8.9, 13.2)	12.1 (10.3, 14.1)
2014-15	54,786	3.1 (2.7, 3.6)	5.1 (4.5, 5.7)	696,119	0.26 (0.23, 0.30)	0.4 (0.37, 0.47)	11.9 (9.7, 14.7)	12.3 (10.4, 14.5)
Total	470,358	3.2 (3.07, 3.4)	5.5 (5.3, 5.7)	6,491,688	0.3 (0.29, 0.32)	0.5 (0.47, 0.51)	10.7 (10.0, 11.4)	11.1 (10.5, 11.7)

*Hospitalization rates per 1000 person-years
[†]Adjusted rate includes 38% of bronchiolitis (466.1 excluding 466.11) hospitalizations and 26% of pneumonia codes (480-486 excluding 480.1) among children < 5 and 7% among those ≥ 5 between November and April

Appendix Table 10B: Rates of RSV hospitalization among children in Medicaid database with neurological disorders and among a simple random sample by RSV season.

Medicaid claims								
	Children w/ neurological (N=439,845)			Comparison group (N=3,401,863)			Rate Ratio (RR)	
Season	P-Y	RSV specific Rate* (95% CI)	RSV-associated Rate* [†] (95% CI)	P-Y	RSV specific Rate* (95% CI)	RSV-associated Rate* [†] (95% CI)	RR RSV-specific (95% CI)	RR RSV-associated (95% CI)
2006-07	31,590	4.8 (4.1, 5.7)	8.6 (7.6, 9.7)	238,018	1.1 (0.9, 1.2)	1.6 (1.4, 1.8)	4.5 (3.7, 5.5)	5.4 (4.6, 6.3)
2007-08	31,219	5.3 (4.5, 6.2)	8.8 (7.8, 9.9)	217,576	1.1 (1.0, 1.3)	1.7 (1.5, 1.9)	4.8 (3.9, 5.8)	5.2 (4.4, 6.1)
2008-09	43,274	5.6 (4.9, 6.4)	9.5 (8.6, 10.5)	301,909	1.1 (1.0, 1.2)	1.8 (1.6, 1.9)	5.1 (4.3, 6.0)	5.4 (4.8, 6.1)
2009-10	43,917	5.8 (5.1, 6.6)	9.0 (8.1, 9.9)	312,430	1.1 (1.0, 1.2)	1.4 (1.4, 1.7)	5.4 (4.6, 6.3)	5.8 (5.1, 6.6)
2010-11	38,768	5.0 (4.3, 5.7)	8.0 (7.2, 9.0)	280,426	0.8 (0.7, 1.0)	1.3 (1.2, 1.5)	5.9 (4.9, 7.2)	6.1 (5.2, 7.0)
2011-12	37,723	4.2 (3.6, 4.9)	6.7 (5.9, 7.6)	267,924	0.7 (0.6, 0.8)	1.1 (1.0, 1.3)	6.0 (4.9, 7.5)	6.0 (5.1, 7.1)
2012-13	51,180	6.4 (5.7, 7.1)	9.3 (8.5, 10.2)	373,080	0.9 (0.8, 1.0)	1.4 (1.3, 1.5)	6.8 (5.9, 7.9)	6.8 (6.0, 7.7)
2013-14	53,632	4.9 (4.3, 5.6)	8.2 (7.5, 9.0)	387,754	0.6 (0.5, 0.7)	1.0 (0.9, 1.1)	8.0 (6.7, 10.0)	8.3 (7.2, 9.5)
2014-15	62,530	5.8 (5.2, 6.4)	8.5 (7.8, 9.3)	508,543	0.7 (0.6, 0.8)	1.0 (0.9, 1.1)	8.2 (7.1, 9.5)	8.6 (7.6, 9.7)
Total	393,834	5.4 (5.2, 5.6)	8.6 (8.3, 8.9)	2,887,660	0.9 (0.84, 0.91)	1.3 (1.29, 1.37)	6.1 (5.8, 6.5)	6.4 (6.2, 6.7)

*Hospitalization rates per 1000 person-years
[†]Adjusted rate includes 38% of bronchiolitis (466.1 excluding 466.11) hospitalizations and 26% of pneumonia codes (480-486 excluding 480.1) among children < 5 and 7% among those ≥ 5 between November and April