



Center for  
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**FACES OF MEDICAID**  
DATA SERIES

## Multimorbidity Pattern Analyses and Clinical Opportunities: *Cerebrovascular Accident/Stroke*

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This set of tables is part of the analysis, *Clarifying Multimorbidity to Improve Targeting and Delivery of Clinical Services for Medicaid Populations*, which was undertaken by the Center for Health Care Strategies and The Johns Hopkins University School of Medicine and Bloomberg School of Public Health to help policymakers identify intervention strategies with the potential to both improve quality and reduce costs for Medicaid beneficiaries with multiple chronic conditions. For the full report, visit [www.chcs.org](http://www.chcs.org).

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*The **Center for Health Care Strategies (CHCS)** is a nonprofit health policy resource center dedicated to improving health care quality for low-income children and adults, people with chronic illnesses and disabilities, frail elders, and racially and ethnically diverse populations experiencing disparities in care. CHCS works with state and federal agencies, health plans, providers and consumer groups to develop innovative programs that better serve Medicaid beneficiaries with complex and high-cost health care needs. Its program priorities are: enhancing access to coverage and services; improving quality and reducing racial and ethnic disparities; integrating care for people with complex and special needs; and building Medicaid leadership and capacity.*

## Overview

This set of tables is part of the *Faces of Medicaid* analysis, *Clarifying Multimorbidity to Improve Targeting and Delivery of Clinical Services for Medicaid Populations*, undertaken by the Center for Health Care Strategies (CHCS) and The Johns Hopkins University School of Medicine and Bloomberg School of Public Health. The analysis sought to help policymakers identify intervention strategies with the potential to both improve quality and reduce costs for adult Medicaid beneficiaries with multiple chronic conditions.

The following tables summarize multimorbidity data on cerebrovascular accident/stroke for adult Medicaid-only beneficiaries with disabilities under the age of 65 and inventory potential clinical opportunities for addressing multimorbidity associated with cerebrovascular accident/stroke. For this analysis, “multimorbidity patterns” are defined as the specific and often multiple conditions that a person has (e.g., a person with depression, hypertension, chronic pain, and asthma), as opposed to a simple tally of the number of conditions that someone has (e.g., a person with five chronic conditions). The tables are intended to aid policymakers in identifying subgroups of Medicaid beneficiaries who stand to benefit from targeted care management and tailoring intervention strategies to improve health outcomes and reduce costs. Contents include:

1. **Multimorbidity Summary Table (Table 1):** This table lists the five most costly patterns of multimorbidity (based on total annual costs, excluding long-term care expenditures) for cerebrovascular accident/stroke. These data can be used to help prioritize care management opportunities to improve outcomes and control costs. Prevalence, costs, and hospitalization rates are summarized for:
  - Beneficiaries who *only* have the specific cerebrovascular accident/stroke pattern, without additional comorbidities.
  - Beneficiaries who have the specific cerebrovascular accident/stroke pattern *plus* potentially other comorbidities. In other words, all individuals represented in this group have the conditions specified in the stated multimorbidity pattern, but any individual may have other conditions as well. This broader approach has a greater likelihood of capturing all individuals with cerebrovascular accident/stroke in the population.
2. **Multimorbidity Pattern Table (Table 2):** This table details the 16 most prevalent multimorbidity patterns for cerebrovascular accident/stroke, including prevalence, cost, and hospitalization data for each. Data include beneficiaries who *only* have the specific conditions in each multimorbidity pattern.
3. **Clinical Opportunities Table (Table 3):** A series of literature searches was conducted for the multimorbidity patterns that the analysis identified as high-priority opportunities from a prevalence, clinical, and cost perspective. In addition to presenting actionable, clinical opportunities for Medicaid stakeholders responsible for care management program design, these clinical opportunities tables also help identify gaps in knowledge around clinical management of these conditions. Literature is categorized as follows:
  - Clinical “pearls” that offer recommendations relevant to an aspect of care for individuals with the specified multimorbidity pattern;
  - Single disease-specific models that address processes important to caring for individuals with multimorbidity, such as care coordination and medication management;
  - Relevant clinical practice guidelines and systematic reviews; and
  - Evidence-based models for the specific multimorbidity pattern.

**Table 1: Cerebrovascular Accident/Stroke Multimorbidity Summary Table**

This table lists the five most costly patterns of multimorbidity -- based on total annual costs, excluding long-term care expenditures -- for cerebrovascular accident/stroke. These data can be used to help prioritize care management opportunities to improve outcomes and control costs.

**Medicaid-Only Adult Beneficiaries with Disabilities, Under Age 65**

Multimorbidity Pattern		Prevalence among beneficiaries with cerebrovascular accident/stroke	Prevalence among overall population	Per capita cost	Percent of total annual costs among beneficiaries with cerebrovascular accident/stroke	Percent of total annual costs among overall population	Per capita hospitalizations
<b>Cerebrovascular Accident/Stroke</b>							
1	+Psychiatric Disorders	2.59%	0.14%	\$11,265	1.51%	0.15%	0.21
		70.26%	3.92%	\$21,645	78.90%	8.01%	1.22
2	+Psychiatric Disorders, Hypertension	1.75%	0.10%	\$10,125	0.92%	0.09%	0.32
		45.53%	2.54%	\$23,028	54.39%	5.52%	1.45
3	+Psychiatric Disorders, Hypertension, Coronary Heart Disease, Diabetes	0.99%	0.06%	\$14,430	0.74%	0.08%	0.72
		14.73%	0.82%	\$29,781	22.76%	2.31%	2.06
4	+Psychiatric Disorders, Hypertension, Diabetes	1.13%	0.06%	\$12,110	0.71%	0.07%	0.48
		20.63%	1.15%	\$27,153	29.07%	2.95%	1.77
5	Cerebrovascular Accident/Stroke only (no comorbidities among conditions considered )	2.10%	0.12%	\$6,232	0.68%	0.07%	0.15
		100.00%	5.58%	\$19,274	100.00%	10.15%	1.07

**Co-occurring conditions that were considered include:** Depressive disorders, hypertension, coronary heart disease, asthma and/or chronic obstructive pulmonary disease, back or spine disorders, antipsychotic or mood stabilizer drugs, drug and alcohol disorders, diabetes, anxiety disorder or benzodiazepam use, congestive heart failure, hepatitis or chronic liver disease, stroke, prednisone use, dizziness, gastrointestinal bleed, anticoagulation drugs (warfarin), chronic renal failure/end stage renal disease, HIV or AIDS, and personality disorders.

**KEY**

- Beneficiaries with only cerebrovascular accident/stroke and the specified multimorbidity pattern (no other comorbidities).
- Beneficiaries with cerebrovascular accident/stroke, the specified multimorbidity pattern, and potentially other additional comorbidities, varying by individual.

## Table 2: Cerebrovascular Accident/Stroke Multimorbidity Pattern Table

This table presents the 16 most prevalent co-occurring conditions for cerebrovascular accident/stroke (columns in the left half), and prevalence, hospitalization, and cost data for each pattern (columns in the right half). These data reveal patterns that are prime for targeted interventions across a number of variables of interest: population prevalence, per capita costs, and annual hospitalization rates. For each pattern, these variables are calculated for individuals who have the specified conditions and no other comorbidities. The condition columns are ordered from most prevalent (left) to least prevalent (right) in the cerebrovascular accident/stroke population. A checkmark represents the presence of the specified condition. Unless noted, all cost estimates exclude long-term care costs.

### Medicaid-Only Adult Beneficiaries with Disabilities, Under Age 65

Cerebrovascular Accident/Stroke +																													
	Psychiatric disorders	Hypertension	Coronary heart disease	Asthma and/or chronic obstructive pulmonary disease	Diabetes	Chronic pain	Back or spine disorders	Congestive heart failure	Drug and alcohol disorders	Dizziness	Antiepileptic drugs	Anticoagulation drugs (warfarin)	Chronic renal failure/end stage renal disease	Hepatitis or chronic liver disease	Gastrointestinal bleed	Prednisone use	Home oxygen therapy	Non-stroke plegias and palsies	Hospital bed distributed	Developmental disorders	Pattern Prevalence, % <sup>1</sup>	Cumulative Prevalence, %	Annual Hospitalization Rate Per Capita	Per Capita Costs, excl. Long-term Care	% Total Annual Costs, excl. Long-term Care <sup>2</sup>	Cumulative % of Total Annual Costs, excl. Long-term Care	% Total Annual Long-term Care costs	Very High-Cost Prevalence, % <sup>3</sup>	High-Cost Prevalence, % <sup>4</sup>
1	✓																				2.59%	2.59%	0.21	\$11,265	1.51%	1.51%	3.73%	2.91%	13.67%
2																					2.10%	4.69%	0.15	\$6,232	0.68%	2.19%	2.94%	1.05%	5.68%
3	✓	✓																			1.75%	6.44%	0.32	\$10,125	0.92%	3.11%	2.23%	4.25%	16.60%
4		✓																			1.73%	8.18%	0.20	\$6,798	0.61%	3.73%	1.48%	1.93%	6.99%
5	✓	✓			✓																1.13%	9.31%	0.48	\$12,110	0.71%	4.43%	1.55%	5.16%	28.83%
6	✓	✓	✓																		1.04%	10.35%	0.49	\$10,632	0.57%	5.01%	0.98%	4.22%	21.01%
7		✓			✓																0.99%	11.34%	0.33	\$8,168	0.42%	5.43%	0.70%	2.79%	13.08%
8	✓	✓	✓		✓																0.99%	12.33%	0.72	\$14,430	0.74%	6.17%	0.98%	7.89%	32.44%
9		✓	✓																		0.86%	13.19%	0.40	\$7,297	0.33%	6.50%	0.49%	2.21%	10.63%
10	✓									✓											0.72%	13.91%	0.40	\$13,011	0.49%	6.98%	1.54%	4.77%	21.22%
11		✓	✓		✓																0.68%	14.59%	0.62	\$11,725	0.41%	7.40%	0.42%	5.34%	22.33%
12	✓		✓																		0.63%	15.22%	0.34	\$10,720	0.35%	7.75%	0.81%	4.52%	16.57%
13	✓						✓														0.54%	15.77%	0.21	\$9,809	0.28%	8.03%	0.20%	1.58%	16.32%
14	✓	✓	✓				✓														0.51%	16.28%	0.39	\$9,970	0.27%	8.29%	0.14%	2.41%	21.34%
15	✓				✓																0.50%	16.78%	0.27	\$11,787	0.31%	8.60%	0.81%	3.06%	20.27%
16			✓																		0.46%	17.24%	0.24	\$6,728	0.16%	8.76%	0.29%	2.92%	7.50%

**KEY**

- Index condition with no comorbidity in identified conditions.
- Patterns with the top three highest total annual costs.
- Patterns with the top three highest annual hospitalization rates.
- Patterns with the top three high-cost prevalence rates.

<sup>1</sup>Prevalence of this pattern among beneficiaries with cerebrovascular accident/stroke.  
<sup>2</sup>\$2 billion, excluding Long-Term Care costs, was spent by Medicaid on 104,787 disabled Medicaid-only beneficiaries with cerebrovascular accident/stroke. Results are presented for the top 16 out of 15,092 total patterns observed for people with cerebrovascular accident/stroke.  
<sup>3</sup>The proportion of beneficiaries with this specific multimorbidity pattern who are represented among beneficiaries in the top 1st to 5th percentile of costs.  
<sup>4</sup>The proportion of beneficiaries with this specific multimorbidity pattern who are represented among beneficiaries in the top 5.01st to 20th percentile of costs.

## Table 3: Cerebrovascular Accident/Stroke Clinical Opportunities

The following table inventories evidence-based models of care for cerebrovascular accident/stroke and associated multimorbidity patterns, including references published since 2000. This resource provides an actionable complement to the multimorbidity cost and prevalence data presented earlier. It is intended to guide Medicaid stakeholders in tailoring implementation strategies to improve care for beneficiaries with these multimorbidity patterns.

A bibliography of full citations alphabetized by author is available at [www.chcs.org](http://www.chcs.org).

Clinical pearl for specific multimorbidity pattern	Single-disease focused clinical care delivery model for multimorbid patients	Clinical practice guidelines or systematic review for multimorbidity pattern	Model for specific multimorbidity pattern
<b>Cerebrovascular Accident / Stroke + Psychiatric Conditions</b>			
	Williams 2007. The Activate-Initiate-Monitor intervention care management program improved post-stroke depression outcomes.	Hackett 2008. Two careful reviews of preventing and treating post-stroke depression.	
		National Stroke Foundation 2005. Practice guidelines for mood disorders following stroke.	
<b>Cerebrovascular Accident / Stroke + Hypertension</b>			
	Gaede 2003. See below.	Papademetriou 2009. Non-industry sponsored review of drug combinations for HTN to prevent stroke.	
		Wright 2009. Discusses first-line treatment of HTN to prevent stroke.	
<b>Cerebrovascular Accident / Stroke + Dementia</b>			
	Williams 2007. See above.	AMDA 2008. Algorithm to assess delirium and acute problematic behavior in the long-term care setting.	Stewart 2006. Qualitative results for telesupport program for caregivers of person with new stroke or worsening dementia.
<b>Cerebrovascular Accident / Stroke + Coronary Heart Disease</b>			
	Williams 2007. See above.		
	Gaede 2003. See below.		
<b>Cerebrovascular Accident / Stroke + Diabetes Mellitus</b>			
Rachmani 2002. A patient participation program was successful at improving cardiovascular outcomes in diabetics at low cost.	Gaede 2003. A multifactorial intervention focusing on modifiable cardiovascular risk factors reduced cardiovascular events, including stroke.		
<b>Cerebrovascular Accident / Stroke + Antiepileptic Medications</b>			
Slapo 2006. Review of post-stroke epilepsy.		French 2004a, French 2004b. Guideline that discusses interactions with drugs and comorbidities.	
Pugh 2006. Discussion of epilepsy treatment post-stroke in older adults.		Kwan 2010. Systematic review of medications for post-stroke epilepsy.	

Clinical pearl for specific multimorbidity pattern	Single-disease focused clinical care delivery model for multimorbid patients	Clinical practice guidelines or systematic review for multimorbidity pattern	Model for specific multimorbidity pattern
<b>Cerebrovascular Accident / Stroke + Antiepileptic Medications (continued)</b>			
Zaccara 2009. Discussion of treatment of post-stroke neurologically comorbid epilepsy.			
Pugh 2010. Discussion of epilepsy in older adults, most of which is post-stroke.			
Ferro 2004. Discussion of post-stroke epilepsy.			
Myint 2006. Proposed algorithm for post-stroke epilepsy.			
<b>Cerebrovascular Accident / Stroke + Plegias</b>			
		Brousseau 2006. Systematic review of health care organization and delivery to maximize movement after stroke.	Sirtori 2009. Systematic review of constraint-induced movement therapy for plegia after stroke.
			Coupar 2010. Systematic review of simultaneous bilateral arm training after stroke.