

Developing Hospital-Specific Risk Adjusted Rates of Stroke Mortality to Support Quality Initiatives in New York

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Objective

Despite decreases in stroke mortality observed over the past two decades, stroke remains a leading cause of death in New York State (NYS) and in the United States. A substantial portion of deaths from stroke occur within 30 days of patients receiving hospital care for stroke. However, there is considerable variation in stroke mortality rates between hospitals. Because differences could be influenced by patient characteristics and by hospital-level factors, to enable meaningful stroke mortality rate comparisons between hospitals, risk adjusted (RA) models are needed. **The purpose of this study was calculation of hospital-specific RA stroke mortality rates (RAMR) to inform hospitals, to aid initiatives to improve hospital quality performance and measurement, and to identify performance outliers for public reporting.**

Study Design

Data Sources: CY 2013 all payer inpatient hospital discharge data reported to the Statewide Planning and Research Cooperative System (SPARCS); NYS Vital Records death records; Paul Coverdell National Acute Stroke Registry.

Study Design and Analysis: In line with the Agency for Health Care Research and Quality (AHRQ) methods for Inpatient Quality Indicators (IQI), V4.5; Retrospective cohort; Multivariate logistic regression; Stepwise backwards elimination; Model performance was assessed using Concordance statistic; hospital-specific RAMR were calculated using method of indirect standardization.

Stroke Definition: Primary Diagnoses (PDx) with ICD-9-CM codes for Subarachnoid (430) and Intracerebral (431) Hemorrhage; Ischemic (433.01-91, 434.01-91) stroke.

Outcome: In-Hospital death or death within 30 days post stroke admission or, if discharged to hospice, death within 30 days of admission to hospice.

Risk Factors Categorization: 3M™ All Patient Refined Diagnosis Related Groups (APR-DRGs) V.30 with risk of mortality (ROM) to account for patient comorbid conditions that were present on admission. Only patient-level risk factors were left in the model, though all available predictors were assessed.

Exclusions: Age under 18; Major Diagnostic Category (MDC) of pregnancy, childbirth, and puerperium; missing data; transfers to a short-term hospital; out of NYS residents; elective admissions; admissions from hospice; readmissions with PDx of stroke within 30 days post initial stroke discharge.

Results

Study Cohort by Stroke Type

Stroke Type	Discharges (N)	Discharges (%)	Died (N)	Died (%)
Subarachnoid	1,317	4.7	317	24.1
Hemorrhagic	3,402	12.1	1,152	33.9
Ischemic Stroke	23,424	83.2	2,474	10.6
All Stroke	28,143	100.0	3,943	14.0

Outcome Composition: Timing of Death

Timing of Death	Died (N)	Of Total (%)
In-Hospital	2,506	63.6
30-Days Post Stroke Admission	662	16.8
30-Days Post Stroke Admission, Discharged to Hospice	725	18.4
Discharged to Hospice, 30-Day Post Admission to Hospice	50	1.3
Total Deaths	3,943	100.0

In-Hospital/30-Day Stroke Mortality Risk Adjustment Model

Patient Risk Factors	(%)	Regr. Coeff.	Odds Ratio	95% Lower	95% Upper	p-Value
Age, Years						
18-49	8.6		Ref			
50-59	14.2	0.38	1.46	1.15	1.86	**
60-69	19.7	0.604	1.83	1.46	2.29	***
70-79	22.6	0.877	2.4	1.93	2.99	***
80-89	25.3	1.409	4.09	3.3	5.08	***
90+	9.5	2.199	9.01	7.17	11.33	***
Race						
White, Non Hispanic	56.8	0.373	1.45	1.33	1.59	***
All Other	43.2		Ref			
APR-DRG with ROM						
APR-021-1-Craniotomy Except for Trauma	0.5	2.464	11.75	5.43	25.42	***
APR-021-2	0.2	3.354	28.61	13.31	61.52	***
APR-021-3	1.8	3.983	53.69	37.92	76.01	***
APR-021-4	0.8	5.593	268.63	180.48	399.83	***
APR-022-1-4-Ventricular Shunt Procedures	0.1	4.554	94.98	41.3	218.4	***
APR-024-1-2-Extracranial Vascular Procedures	2.5	1.567	4.79	3.03	7.59	***
APR-024-3	0.6	2.894	18.06	10.8	30.21	***
APR-024-4	0.2	4.151	63.48	31.75	126.92	***
APR-026-1-4-Other Nervous System & Related Proc.	0.6	1.774	5.89	3.04	11.43	***
APR-044-1-2-Intracranial Hemorrhage	5.6	2.379	10.8	7.77	15.02	***
APR-044-3	3.1	3.403	30.05	21.71	41.59	***
APR-044-4	3.3	6.111	450.66	324.72	625.44	***
APR-045-1-CVA & Pre-Cerebral Occlusion w/Infarct.	25.8		Ref			
APR-045-2	35.4	1.658	5.25	3.886	7.09	***
APR-045-3	12.2	2.825	16.86	12.463	22.81	***
APR-045-4	4.7	4.644	104	76.512	141.36	***
Other APR-DRG	2.7	3.144	23.19	16.392	32.82	***

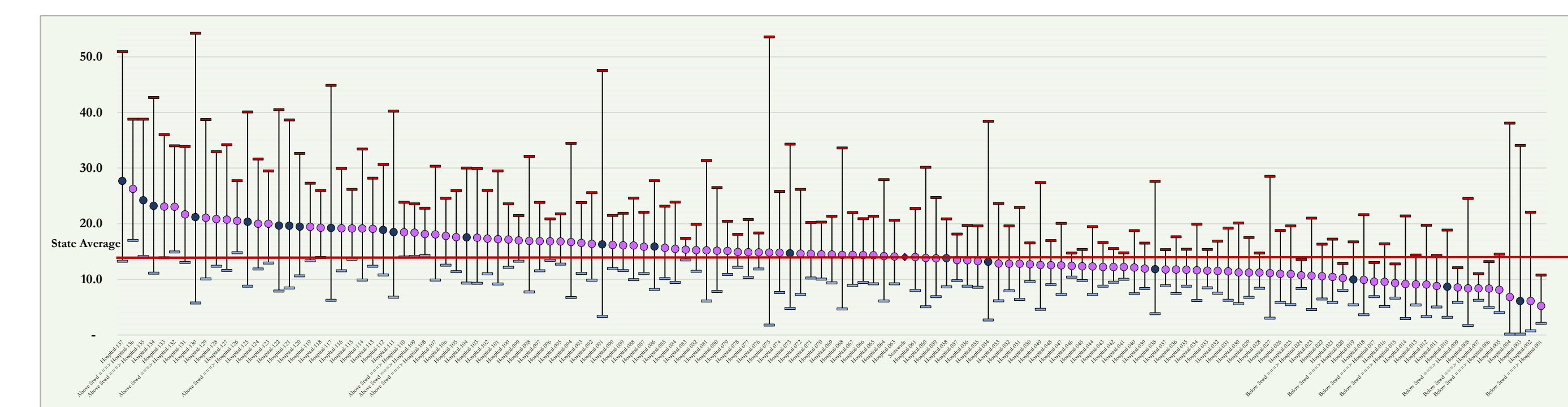
** - p < 0.01; *** - p < 0.001

Model Performance

Models	Sample Size (N)	Major Predictors	C-Statistic
NYS	28,143	APR-DRG + ROM	0.87
AHRQ (2012 Data)	422,518	APR-DRG + ROM	0.90
NYS, Coverdell Hospitals	8,812	APR-DRG + ROM	0.86
NYS, Coverdell Hospitals	8,812	NIHSS Score	0.88

Hospital Compare

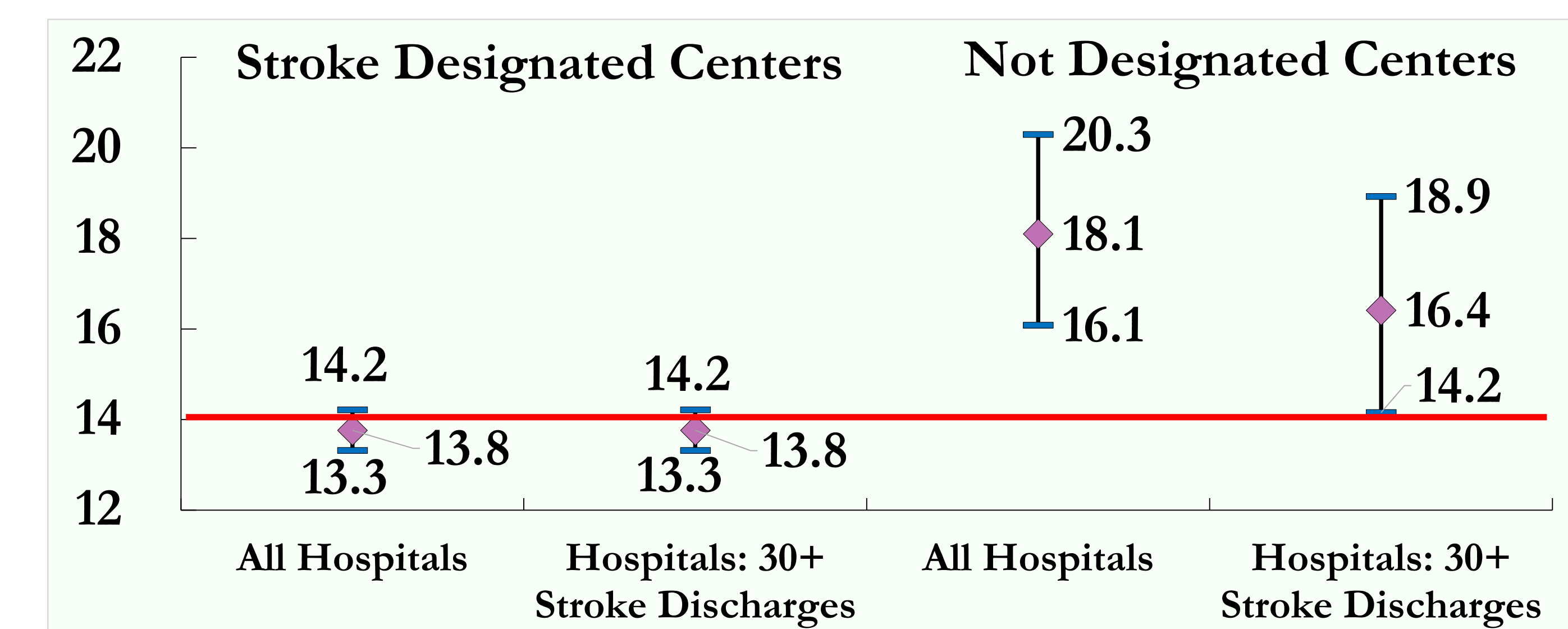
Hospital-Specific Stroke RAMR, NYS 2013



Hospitals with 30+ Stroke Discharges in 2013

Top performers: eight hospitals
Bottom performers: seven hospitals

In-Hospital/30-Day Stroke RAMR by Stroke Designation and Volume



All Hospitals (N=184), Hospitals with 30+ Stroke Discharges (N=136)

Conclusions and Next Steps

- Risk Adjustment is a necessary process for meaningful comparison of health care outcomes.
- 3M™ APR-DRGs with ROM are very strong patient-level predictors for in-hospital/30-day stroke mortality, on par with NIHSS score.
- Mortality information obtained from Vital Records enhances measures of stroke mortality.
- Hospital-specific RAMR data will be made available on NYS Hospital Profiles - <http://profiles.health.ny.gov/hospital/index>.

Collaborators

- NYSDOH Office of Quality and Patient Safety
- NYSDOH Bureau of Chronic Disease Evaluation & Research

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