



Does Primary Stroke Center Certification Change Emergency Department Utilization and Disposition Patterns of Patients with Acute Stroke?



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Background

Establishment of Primary Stroke Centers (PSCs) has the potential to improve patient care. However, there is little evidence that PSC certification results in measurably improved Emergency Department (ED) care processes or outcomes.

Objective

Within an integrated delivery system (IDS), we examined the impact of PSC certification on utilization, disposition and mortality.

Methods

- 17 IDS medical centers (8 PSC certified)
- Study period: 2005-2008
- N=27,993 patients
- Primary ICD-9 diagnosis of transient ischemic attack (TIA), hemorrhagic (ICH) or ischemic stroke (iCVA)
- 3 PSC certification process stages: before certification process (Pre), preparing for certification (Intra) and PSC certified (Post)
- Logistic and linear regression models adjusted for co-morbidities, patient characteristics, and calendar time to examine major outcomes (hospital admission rates, radiographic imaging utilization (and time to imaging), ED throughput time, and patient mortality)
- Hypothesis: stroke patients presenting to post-certification medical centers would have higher hospital admission rates and radiographic utilization and faster ED and radiographic throughput times

Table 1: Stroke Center status of Medical Centers and Patient Visits

	TIA			Ischemic Stroke			Hemorrhagic Stroke		
	Pre	Intra	Post	Pre	Intra	Post	Pre	Intra	Post
Medical Centers	14	11	9	14	11	9	14	11	9
Total Medical Center Months	477	113	238	477	113	238	477	113	238
Total Months Per Medical Center	34	10	26	34	10	26	34	10	26
Total Patient Visits	5,981	1,401	4,047	6,976	1,539	4,339	1,847	488	1,375

Table 2: Stroke Patient Characteristics

	TIA		Ischemic Stroke		Hemorrhagic Stroke	
	Pre	Post	Pre	Post	Pre	Post
Total Patient Visits	5,981	4,047	6,976	4,339	1,847	1,375
Age						
<18	0.2%	0.1%	0.2%	0.2%	3.7%	2.4%
19-65	30.4%	27.7%	26.6%	27.0%	35.4%	35.7%
65-80	31.3%	38.6%	37.6%	38.3%	31.2%	33.2%
80+	32.1%	33.5%	35.7%	36.5%	29.7%	28.7%
Gender						
Female	54.9%	53.4%	53.3%	52.3%	48.4%	47.8%
Male	45.1%	46.6%	46.3%	47.7%	51.6%	52.2%
Race/Ethnicity						
White	63.6%	73.2%	59.5%	68.3%	52.5%	60.6%
Black	11.9%	5.0%	15.3%	4.8%	12.8%	6.3%
Hispanic	9.9%	8.8%	9.7%	10.2%	13.2%	14.5%
Asian	8.5%	7.2%	11.0%	10.5%	16.4%	14.9%
Other	3.2%	2.9%	3.7%	3.6%	3.5%	2.9%
Unknown	2.9%	2.9%	0.8%	0.6%	1.7%	0.8%
Neighborhood SES						
Non-low	71.1%	79.3%	70.5%	76.6%	68.5%	74.9%
Low	22.7%	15.0%	23.7%	18.0%	26.4%	19.8%
Unknown	6.2%	5.7%	5.7%	5.4%	5.1%	5.3%
Insurance						
Commercial	35.7%	32.9%	33.4%	31.8%	45.4%	43.0%
Medicaid	1.1%	0.9%	1.2%	1.4%	1.4%	1.3%
Medicare	63.2%	66.2%	65.3%	66.8%	53.1%	55.7%

Results

- There were 14,804 patient visits to pre-certification centers, 3,428 to intra-certification centers and 9,761 to post-certification centers (Table 1)
- Study patient characteristics are shown in Table 2 and co-morbidities and risk factors in Table 3
- Our analysis demonstrated significant changes in outcome measures over time, regardless of PSC status (Figures 1 and 2)
- After adjusting for time, there was significantly improved efficiency due to PSC certification process, including:
 - 1) faster ED throughput time for ICH patients (48-min improvement, 95%CI 11-85 min), and iCVA patients (20-min improvement, 95%CI 1-38 min)
 - 2) decrease in time to radiographic imaging (Table 4)
 - 3) increased rates of hospital discharge to assisted care facilities for iCVA patients at post-certification facilities (OR 1.28, 95%CI 1.04-1.58)
- We did not find any significant PSC-stage related improvements in mortality (Table 5)

Table 3: Co-morbidities and Risk Factors

	TIA		Ischemic Stroke		Hemorrhagic Stroke	
	Pre	Post	Pre	Post	Pre	Post
Total Patient Visits	5,981	4,047	6,976	4,339	1,847	1,375
Atrial fibrillation	10.9%	12.7%	14.6%	15.4%	13.8%	14.7%
Cardiomyopathy	3.8%	2.6%	5.0%	3.1%	4.3%	2.9%
Obesity	20.5%	17.4%	18.9%	16.8%	14.0%	12.4%
Acute myocardial infarction	1.6%	2.0%	2.7%	1.8%	2.1%	1.4%
Hypertension	21.9%	37.4%	18.6%	11.2%	14.0%	25.2%
Stroke	19.4%	16.9%	20.1%	14.3%	11.6%	11.1%
Peripherical vascular disease	6.6%	7.0%	8.3%	8.3%	4.9%	5.7%
Valvular heart disease	4.8%	5.5%	4.7%	6.3%	4.2%	5.7%
Coronoid disease	2.7%	3.3%	2.1%	2.6%	1.3%	2.1%
Alcohol abuse	0.4%	0.4%	0.9%	0.3%	1.5%	0.7%
Smoking	7.4%	4.8%	9.6%	5.9%	8.0%	5.6%
CAD	23.4%	24.9%	25.9%	26.3%	18.2%	18.4%
CHF	11.3%	11.7%	15.9%	14.4%	13.5%	11.1%
Hypertension	68.0%	67.1%	70.6%	70.3%	58.4%	57.3%
DM-AD	10.0%	10.2%	12.3%	12.0%	8.3%	7.8%
DM-CAD	17.0%	15.6%	21.1%	19.9%	15.0%	14.1%
Anticoagulation	6.0%	6.4%	5.8%	5.5%	9.0%	10.8%
Hormone-replacement	2.1%	2.8%	2.3%	2.0%	1.8%	2.0%

Table 4: Decrease in time to radiographic imaging (in minutes)

		Pre-Certification	Post-Pre
		(Mean)	Difference (95% CI)
TIA	Time to DUP	1,066	-154 (266, -41)
	Time to Neuro	875	-548 (821, -275)
Ischemic Stroke	Time to MRI	1438.2	-195.6 (-298, -93)

Discussion

Our results show significant changes in ED admission and radiographic utilization patterns for stroke patients over a four-year time period. Some PSC effects, primarily related to throughput measures, were consistent with process changes, such as "ED stroke alerts" and PSC core measures (e.g. the requirement to consider an assisted care facility prior to discharge). Our findings suggest changing practice patterns in stroke care are potentially spurred by the evolution of evidence regarding the time-sensitive nature of work-up for stroke and the publicizing of the PSC certification process. Limitations of this study included: retrospective data collection, analysis of a single delivery system, inability to accurately track rates of t-PA administration.

Figure 1: Unadjusted Hospital Admission Rates Across all Centers

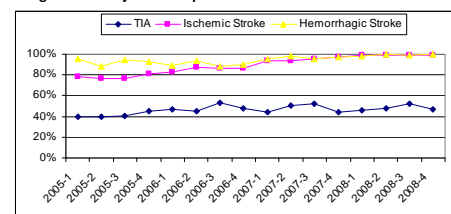


Figure 2: Brain MRI Utilization Across all Centers

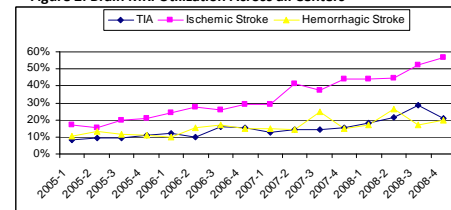


Table 5: Hospital Disposition and Mortality

	TIA		Ischemic Stroke		Hemorrhagic Stroke			
	Unadjusted rate Pre	Adjusted OR (95% CI) Post	Unadjusted rate Pre	Adjusted OR (95% CI) Post	Unadjusted rate Pre	Adjusted OR (95% CI) Post		
Transfer to Acute Care Facility	10.4%	17.7%	1.14 (0.77, 1.68)	12.9%	20.1%	1.12 (0.87, 1.43)	17.8%	1.13 (0.80, 1.61)
Discharge to Assisted Care	6.9%	6.8%	1.19 (0.69, 2.05)	28.2%	22.2%	1.28 (1.04, 1.58)	16.9%	1.48 (0.92, 2.31)
30-day mortality	0.9%	1.3%	1.31 (0.55, 3.12)	11.3%	11.6%	1.04 (0.80, 1.35)	21.9%	1.32 (0.89, 1.96)
180-day mortality	4.8%	5.1%	1.38 (0.91, 2.09)	18.6%	18.8%	0.99 (0.80, 1.23)	27.7%	29.3%

About CREST Network

Clinical Research in Emergency Services & Treatments (CREST) Network is a multi-center, collaborative network at Kaiser Permanente, that encourages, enables and executes research in Emergency Medicine. Its goals are to support a cooperative platform for the emergency medicine research community, encourage quality research in emergency medicine and disseminate evidence based knowledge to refine current community emergency care standards.

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