Geographic Access to Acute Stroke Care in the United States

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Disclosures

- Research/Salary – NIH/NINDS
  - OA, KCA, BC, MM, PK, CB, DK
- Research/Salary – Genentech
  - PK
- Research/Salary – Penumbra
  - PK
- Speakers’ Bureau – Genentech
  - DK
Acknowledgments – CDC/AHRQ

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Background

- Only 3-5% of acute ischemic stroke (AIS) patients receive intravenous (IV) recombinant tissue plasminogen activator (rt-PA)

- Less than 1% receive endovascular therapy

Adeoye Stroke 2011; Hassan Stroke 2012
Background

- The ASA recommends designation of Acute Stroke Ready Hospitals (ASRH), Primary Stroke Centers (PSC) and Comprehensive Stroke Centers (CSC)

- PSC certified hospitals are more likely to treat AIS patients with rt-PA and treatment at designated stroke centers is associated with lower 30-day mortality

Alberts JAMA 2000; Mullen JAHA 2013
Background

- **Goal - inform planning for stroke certification for US hospitals**

- **Describe access of the US population to all hospitals that actually deliver acute stroke care (IV and endovascular therapy)**
Methods - Medicare Provider and Analysis Review (MEDPAR)

- A claims-based dataset that contains every fee-for-service Medicare-eligible hospital discharge in the US
- Fiscal year 2011 data were used
Methods - Medicare Provider and Analysis Review (MEDPAR)

- Acute ischemic stroke primary discharge diagnosis ICD-9 codes:
  - 433.xx (occlusion and stenosis of precerebral arteries)
  - 434.xx (occlusion of cerebral arteries)
  - 436 (acute, but ill-defined, cerebrovascular disease)
Among ICD-9 codes 433, 434 and 436:

- Patients receiving IV thrombolysis were identified using ICD-9 code 99.10 (thrombolytic use)
- Patients receiving endovascular therapy were identified by ICD-9 code 39.74 (endovascular removal of obstruction from head and neck vessels)
- Hospitals that gave a single dose of rt-PA or performed a single thrombectomy procedure were considered capable
Methods – Population Data

- 2010 Neilsen Claritas Census Estimations
- Rely on a regularly refined and validated projection methodology based on the most recent decennial Census data
Methods – Access Calculations

- Block groups, or subdivisions within Census tracts, of 600 to 3000 people were used as the primary geographic unit for analysis.

- A population-weighted center point (centroid) was assigned within each block group.
Methods – Access Calculations

- The shortest road distance was determined between each block group centroid and each hospital
- Distances were converted to total prehospital ambulance transport times
- Travel times were computed based on posted speed limits for roads in each path
Results

- 370,351 AIS primary diagnosis discharges
  - 14,926 (4%) received IV rt-PA
  - 1,889 (0.5%) received endovascular therapy

- 4,583 acute care hospitals in MEDPAR
  - 2,895 (63%) did not give any doses of IV rt-PA
  - 4,252 (93%) did not perform thrombectomy
  - 327 (7%) hospitals gave at least one dose of IV rt-PA and performed at least one thrombectomy
Results

- The 327 hospitals that gave at least one dose of rt-PA and performed one thrombectomy procedure discharged approximately 28% of all AIS cases.

- Hospitals that did not give any doses of IV rt-PA discharged 17% of all AIS cases.
Results - Access

- **By ground:**
  - 81% percent of the US population had 60-minute access to IV rt-PA capable hospitals
  - 66% had access to PSCs
  - 56% had access to endovascular capable hospitals
Results - Access

- **By air:**
  - 97% percent had 60-minute access to IV capable hospitals
  - 91% had access to PSCs
  - 85% had access to endovascular capable hospitals
Discussion

- Despite adequate geographic access, acute stroke treatment rates in the US remain extremely low.

- These data should inform the planning and optimization of stroke systems in the US.
Discussion

- Given that one in five US stroke discharges were from hospitals that did not give any rt-PA, there’s much room for improvement in the current US system of stroke triage.
Limitations

- Calculations reflect potential access and not true access
- Use of an administrative dataset to estimate rt-PA and endovascular thrombectomy treatment rates
- Reliability of rt-PA and thrombectomy ICD-9 codes
- PSC designation is a continually evolving process
Conclusion

- To reduce time from symptom onset to an acute stroke capable hospital:
  - Public education to ensure 911 called
  - EMS should transport quickly to appropriate hospital
  - Hospitals that do not provide acute stroke care should have plans in place to facilitate rapid evaluation and treatment by stroke experts
Conclusion

- Monitoring and reporting of regional stroke outcomes could help to incentivize hospitals and prehospital systems to work together to collaboratively facilitate acute stroke care.
Addendum

- PSCs were hospitals designated as such as of December 2010
- Of the 327 hospitals, 278 (85%) were PSCs
- Of 821 PSCs, 93% administered at least one dose of IV rt-PA; 23% of non-PSCs administered at least one dose of IV rt-PA.
- Thirty three percent of PSCs performed at least one thrombectomy while 1.5% of non-PSCs performed at least one thrombectomy procedure.
Addendum

- Crossing state lines was allowed in access calculations
- Time to scene and time from scene to hospital were calculated using Euclidian distances