Telestroke and Teleneurology

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Outline

- Telestroke
- Teleneurology
- Challenges
- Compensation
Estimated Demand for Neurology 2025

Dall et al. Neurology 2013
## Demand for Vascular Neurology

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of new strokes per year in US</td>
<td>795,000</td>
</tr>
<tr>
<td>Number of vascular neurologists</td>
<td>1100</td>
</tr>
<tr>
<td>Primary stroke centers</td>
<td>1092</td>
</tr>
<tr>
<td>Comprehensive stroke centers</td>
<td>110</td>
</tr>
<tr>
<td>Stroke Fellowship programs (2016)</td>
<td>74</td>
</tr>
<tr>
<td>Stroke fellowship positions</td>
<td>123</td>
</tr>
<tr>
<td>% Fellowship positions unfilled</td>
<td>34%</td>
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</tbody>
</table>
Teleneurology

Consult → IP over Internet → Remote control of PTZ camera – Hx, PE → History, exam, recommendations, documentation

Imaging
Teleneurology Anywhere
International Teleneurology
Advantages of Teleneurology

- Direct history by neurological provider
- Observe critical elements of examination
- Order specific tests – done locally
- Review results
- Speak directly to patient regarding assessment and plan
- Team based care
Why Teleneurology in an Academic Dept?

- Better care for patients
- Protect referral relationships
- Endovascular transfers
- Income for faculty
- Alternative work models
- Research potential
- Clinical trials
Components of Teleneurology Program

- Bidirectional real time video and audio
- Protocols / order sets
- In service training
- Stroke/neurology team
- Community education
- EMS awareness
## Reliability of Telestroke Exam - NIHSS

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Pts</strong></td>
<td>17</td>
<td>20</td>
<td>25</td>
<td>20</td>
<td>20</td>
<td>41</td>
<td>2 actor pts / 12 scenarios</td>
</tr>
<tr>
<td><strong>Setting</strong></td>
<td>General Neuro exam</td>
<td>Non-acute stroke</td>
<td>Non-acute stroke</td>
<td>Non-acute stroke</td>
<td>Acute stroke</td>
<td>Acute stroke</td>
<td>Ambulance</td>
</tr>
<tr>
<td><strong>Comparison</strong></td>
<td>ISDN v. bedside</td>
<td>ISDN v. bedside</td>
<td>Web based v. bedside</td>
<td>iPhone 4 v. bedside</td>
<td>Web based v. bedside</td>
<td>Web based v. bedside</td>
<td>Ambulance v. NIHSS training</td>
</tr>
<tr>
<td><strong>Result</strong></td>
<td>Kappa r=.21-1.00</td>
<td>Kappa r=.97</td>
<td>Kappa r=.94</td>
<td>Corr coef r=.98</td>
<td>Pearson r=.95</td>
<td>Kappa r=.85-.92</td>
<td>Kappa r &gt; .5</td>
</tr>
</tbody>
</table>
Teleneurology Examination - Limitations

- Visual fields
- Strength gradation
- Tone / rigidity
- Sensory examination
- Reflexes
- Stethoscope
- Ophthalmoscope
Teleneurology – IT and technology

- Purchased services
  - REACH
  - InTouch
  - $$$
- Self supported
  - Vidyo
  - Polycom
  - 24/7 coverage
  - Response time
  - $
Why Telestroke?

- Only 2-8% of stroke patients receive IV tPA
- Many hospitals don’t have stroke protocols and have never treated a patient with tPA
- 64% of hospitals in US did not give IV tPA *
- Lack of available stroke specialist in rural hospitals major impediment to emergent treatment

* Kleindorfer et al Stroke 2009
UPMC Telestroke

- 23 hospitals – 12 UPMC, 11 non-UPMC
- tPA treatment rate: 31%
- Transfers: 24%
- 6 hospitals teleneurology coverage

Consults - 3525  tPA -1078
Telestroke Before and After: All UPMC Hospitals

1235 Pts Before
2175 Pts After

% strokes Rx with tPA
Before: 2.9%
After: 5.4%

% strokes within 3 hrs
Before: 5.5%
After: 7.2%
Telestroke v. SC Patients Treated with IV tPA
90 day Outcomes

90-Day Clinical Outcomes

Zaidi et al. Stroke 2011
**Telestroke: Post tPA care**

**tPA Treated Pts – Hub v. Spoke**

<table>
<thead>
<tr>
<th></th>
<th>Hub</th>
<th>Drip and ship</th>
<th>Drip and stay</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients</td>
<td>272</td>
<td>73</td>
<td>134</td>
<td></td>
</tr>
<tr>
<td>Median NIHSS</td>
<td>11</td>
<td>11</td>
<td>8</td>
<td>&gt;0.001</td>
</tr>
<tr>
<td>Mean age</td>
<td>72</td>
<td>71</td>
<td>76</td>
<td>0.008</td>
</tr>
<tr>
<td>Onset to needle</td>
<td>156 min</td>
<td>134</td>
<td>148 min</td>
<td>0.072</td>
</tr>
<tr>
<td>Door to needle</td>
<td>72 min</td>
<td>75</td>
<td>77 min</td>
<td>0.151</td>
</tr>
<tr>
<td>Sx ICH</td>
<td>5%</td>
<td>7%</td>
<td>2%</td>
<td>0.79</td>
</tr>
<tr>
<td>LVO</td>
<td>36%</td>
<td>33%</td>
<td>12%</td>
<td>&gt;0.001</td>
</tr>
<tr>
<td>LOS (days)</td>
<td>6.2</td>
<td>4.6</td>
<td>7.2</td>
<td>0.56</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>14%</td>
<td>10%</td>
<td>8%</td>
<td>0.077</td>
</tr>
<tr>
<td>Intubation</td>
<td>19%</td>
<td>19%</td>
<td>2%</td>
<td>&gt;0.001</td>
</tr>
<tr>
<td>In-hosp death</td>
<td>11%</td>
<td>11%</td>
<td>10%</td>
<td>0.859</td>
</tr>
</tbody>
</table>

Heffner et al. Stroke 2015
Reorganization of System Stroke Care

- **Stroke neurology evaluation by telemedicine:**
  - Initial hospital evaluation
  - 2 day follow-up
  - Hospital pre-discharge visit
  - Outpatient follow-up

- **Outcomes to be monitored**
  - Mortality
  - Readmissions
  - LOS
  - Patient Transfers
Telestroke Workflow

- Portal for calls from originating site
- Receiving calls and response time
- Time of onset, stroke severity, tPA exclusions
- Telephone discussion and triage
- Activation of video
- Confirmation of history
- NIHSS exam
- Consent
- tPA orders
- Transfer decision
- CTA
Teleneurology

- Stroke
- TIA
- Seizures
- Confusion
- Dizziness
Teleneurology Issues

- EMR access
- Immediate v. scheduled
- Imaging review
- Documentation
- Guidelines for acute stroke calls
- Telepresenter
- Follow-up: new v. same problem
- Communication with originating team
- Transfer agreements (stroke, non-stroke)
Staffing Models

- On call physician
- Dedicated physician
- Stroke v. general neuro
- Triage by fellow/NP
- Call center
- Urgent v. Non urgent
- Backup and surge coverage
Imaging Access

- Direct spoke PACS signin
- Push imaging studies to central hub PACS
- Push imaging to teleneurology software
- 3<sup>rd</sup> party cloud based imaging solutions
Reimbursement for Teleneurology

- E&M codes with GT modifier
- Most require real time video conferencing
- Medicare – rural areas only
- Medicaid – state mandates with variable definitions
- National insurers - limited
- Other private insurers
- 32 states with parity laws
Billing Models

- Flat monthly fee – unlimited consults
- Tokens
- Monthly fee plus per case fee
- Tiered charges based on ED volume
- Who pays for equipment and software
- Hub hospital support
Compensation

- Physician Salary
- Per case fee
- Coverage fee per day, per night or per shift
- Combinations
Reporting: Process Measures
849 tPA Treatments

- Mean NIHSS: 12
- Onset to Rx: 140 min
- Door to Rx: 77 min
- DTN < 60 Min: 62% (2015)
- OTT < 2 Hrs: 37%
- OTT < 90 Min: 11%
- Sx Hem: 4%
Reporting: 90 Day Outcomes
711 tPA Treatments

- Mean NIHSS: UPMC 11, NINDS (benchmark) 14
- mRS 0-1: UPMC 39%, NINDS (benchmark) 39%
- mRS 0-2: UPMC 47%, NINDS (benchmark) 48%
- Asx Hem: UPMC 4%, NINDS (benchmark) 6%
- Sx Hem: UPMC 6%, NINDS (benchmark) 5%
ROI of Teleneurology: Hub and Spoke

<table>
<thead>
<tr>
<th></th>
<th>Hub Hospital</th>
<th>Spoke Hospital</th>
<th>Societal</th>
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<tbody>
<tr>
<td>+ Neurology transfers</td>
<td>+ Avoid transfers</td>
<td>+ Improved outcomes: tPA</td>
<td></td>
</tr>
<tr>
<td>+ Endovascular and surgery</td>
<td>+ No EMS bypass</td>
<td>+ Reduced disability</td>
<td></td>
</tr>
<tr>
<td>- Network support</td>
<td>+ High quality patient care</td>
<td>+ Return to work</td>
<td></td>
</tr>
<tr>
<td>- Neurology support</td>
<td>- Greater cost of care</td>
<td>+ Less caregiver burden</td>
<td></td>
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<tr>
<td>- IT costs</td>
<td>- Quality monitoring</td>
<td>- Higher upfront costs</td>
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Summary

- Telestroke and teleneurology bring expertise to areas without stroke and neurology coverage
- Network models vary and several technologies available
- Staffing and compensation are challenging issues
- Insurance reimbursement limited
- Telemedicine now routine component of systems of care