Clinical Applications

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Major Categories of Services in General Usage

• Gap Services

• Urgent Services

• Mandated Services
Teleradiology – 1,300,000+ cases

Emergency Medicine – Banner Health
Courtesy, Debbie Dahl, EE

- Tele-stroke
- Trauma triage
- Tele-psychiatry
- Specialty call coverage
- Intensivist & Hospitalist

Initiate TX asap

Referring sites
Clnics

ED

eED
iCare BGMC MedSurg LOS

Average LOS (days)

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<tbody>
<tr>
<td>medical</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>surgical</td>
<td>3</td>
<td>2</td>
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LOS outliers (%)

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<th></th>
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</thead>
<tbody>
<tr>
<td>medical</td>
<td>20%</td>
<td>15%</td>
</tr>
<tr>
<td>surgical</td>
<td>15%</td>
<td>10%</td>
</tr>
</tbody>
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Courtesy of Debbie Dahl, R.N. Banner Health
Stroke telemedicine network at Mayo Clinic in Arizona

Mayo Clinic in Phoenix, Ariz., serves as the hub for several remote locations in a stroke telemedicine network.
Background and Purpose

- ResolutionMD mobile application runs on a Smartphone and affords vascular neurologists access to radiological images of patients with stroke from remote sites in the context of a telemedicine evaluation.
- Although reliability studies using this technology have been conducted in a controlled environment, this study is the first to incorporate it into a real-world hub and spoke telestroke network.
- The study objective was to assess the level of agreement of brain CT scan interpretation in a telestroke network between hub vascular neurologists using ResolutionMD, spoke radiologists using a Picture Archiving and Communications System, and independent adjudicators.

Stroke. 2012; 43:3271-3277

Reliability of Real-Time Video Smartphone for Assessing National Institutes of Health Stroke Scale Scores in Acute Stroke Patients

Bart M. Demaerschalk, MD, MSc, FRCP(C), Sravanthi Vegunta, BS; Bert B. Vargas, MD; Qing Wu, ScD; Dwight D. Charnier, MS; Joseph G. Heute, MS

Background and Purpose—Telestroke reduces acute stroke care disparities between urban stroke centers and rural hospitals. Current technologies used to conduct remote patient assessments have high start-up costs, yet they cannot consistently establish quality timely connections. Smartphones can be used for high-quality video teleconferencing. They are inexpensive and ubiquitous among health care providers. We aimed to study the reliability of high-quality video teleconferencing using smartphones for conducting the National Institutes of Health Stroke Scale (NIHSS).

Methods—Two vascular neurologists assessed 100 stroke patients with the NIHSS. The remote vascular neurologist assessed subjects using smartphone videoconferencing with the assistance of a bedside medical aide. The bedside vascular neurologist scored patients contemporaneously. Each vascular neurologist was blinded to the other’s NIHSS score. We tested the inter-method agreement and physician satisfaction with the device.

Results—We demonstrated high total NIHSS score correlation between the methods (r=0.949; P<0.001). The mean total NIHSS scores for bedside and remote assessments were 7.93±8.10 and 7.38±7.85, with ranges, of 0 to 35 and 0 to 37, respectively. Eight categories had high agreement: level of consciousness (questions), level of consciousness (commands), visual fields, motor left and right (arm and leg), and best language. Six categories had moderate agreement: level of consciousness (consciousness), best gaze, facial palsy, sensory dysesthesia, and extinction/intention. Anosmia had poor agreement. Patients had high physician satisfaction with the smartphone.

Conclusions—Smartphone high-quality video teleconferencing is reliable, easy to use, affordable for telestroke NIHSS administration, and has high physician satisfaction. (Stroke. 2012;43:3271-3277.)
CT Interpretation in a Telestroke Network
Agreement Among a Spoke Radiologist, Hub Vascular Neurologist, and Hub Neuroradiologist

Bart M. Demaerschalk, MD, MSc; Bentley J. Bobrow, MD; Ruma Raman, PhD; Karin Ermert, MD; Joseph M. Horwitz, MD; Annet C. Patel, MD; Tone-Ellen J. Kinnamon, MSN; Maria J. Ahuja, MD; Timothy J. Ingall, MD, PhD; David W. Dodick, MD; Bart C. Meyer, MD; for the Stroke Team Remote Evaluation Using a Digital Observation Camera (STROKE DOC) in Arizona—The Initial Mayo Clinic Experience (AZ TIME) Investigators

Background and Purpose—The American Stroke Association guidelines emphasized the need for further high-quality studies that assess agreement by radiologists and neuroradiologists engaged in emergency telestroke assessments and diagnosis making. Therefore, the objective of this study was to determine the level of agreement of baseline brain CT scan interpretations of patients with acute stroke presenting to telestroke spoke hospitals between central reading committee neuroradiologists and each of 2 groups, spoke (hospital radiologists and hub hospital vascular neurologists/neuroradiologists).

Methods—This study (Telestroke Remote Evaluation Using a Digital Observation Camera) was a prospective, cross-sectional, single-center trial of 2-point, randomized, blinded, controlled trial of a 2-way, site-independent, multimedia telemedicine and teleradiology system designed for remote evaluation of adult patients with acute stroke versus telephone consultation to assess eligibility for treatment with intravenous thrombolysis. In the telemedicine arm, the subjects’ CT scans were interpreted by the hub neuroradiologist and the telephone arm by the spoke radiologist. All subjects’ CT scans were subsequently interpreted centrally, independently, and blindly by 2 additional neuroradiologists. The primary CT outcome was determination of a CT-based contraindication for thrombolytic treatment. Kappa statistics and exact agreement rates were used to analyze interobserver agreement.

Results—Fifty-four subjects underwent random assignment. The overall agreement for the presence of radiological contraindications to thrombolysis was excellent (0.91) and did not differ substantially between the hub neuroradiologist and spoke radiologist (0.92 and 0.89, respectively).

Conclusions—In the context of a telestroke network designed to assess patients with acute stroke syndromes, agreement over the presence or absence of radiological contraindications to thrombolysis was excellent whether the comparison was between a neuroradiologist and neuroradiologist or between spoke radiologist and neuroradiologist.

Clinical Trial Registration—URL: http://www. clinicaltrials.gov. Unique identifier: NCT00323393.

Key Words: computed tomography • randomized controlled trials • stroke • radiology • neuroradiology

Demaerschalk B M et al. Stroke 2012;43:3271-3277

Photograph depicting the bedside National Institutes of Health Stroke Scale (NIHSS) assessment scenario.
The cost-effectiveness of telestroke in the treatment of acute ischemic stroke

ABSTRACT

Objective: To conduct a cost-effectiveness analysis of telestroke—a 2-way, audiovisual technology that links stroke specialists to remote emergency department physicians and their stroke patients—compared to usual care i.e., remote emergency departments without telestroke consultation or stroke expertise.

Methods: A decision-analytic model was developed for both 90-day and lifetime horizons. Model inputs were taken from published literature where available and supplemented with estimated telestroke experiences. Costs were gathered using a societal perspective and converted to 2006 US dollars. Quality-adjusted life-years (QALYs) gained were combined with costs to generate incremental cost-effectiveness ratios (ICERs). In the lifetime horizon model, both costs and QALYs were discounted at 3% annually. Both one-way sensitivity analyses and Monte Carlo simulations were performed.

Results: In the base case analysis, compared to usual care, telestroke results in an ICER of $109,365/QALY in the 90-day horizon and $2,449/QALY in the lifetime horizon. For the 90-day and lifetime horizons, 37.5% and 99.7% of 10,000 Monte Carlo simulations yielded ICERs <$50,000/QALY, a ratio commonly considered acceptable in the United States.

Conclusion: When a lifetime perspective is taken, telestroke appears cost-effective compared to usual care, since telestroke costs are upfront but benefits of improved stroke care are lifelong. If barriers to use such as low reimbursement rates and high equipment costs are reduced, telestroke has the potential to diminish the striking geographic disparities of acute stroke care in the United States.

Neurology 2011;77:1590–1598
Reduced Costs

The efficient use of available health care resources is of paramount concern for all health care centers. Also, the cost associated with establishing a comprehensive stroke care system may prevent smaller or more rural facilities from implementing effective stroke management. Resource constraints no longer need to be an obstacle to acute stroke services. For community hospitals and other facilities that cannot afford 24/7 coverage by a neurologist, the Telestroke program is a cost-effective way to deliver around-the-clock specialty stroke care to more patients.
ResolutionMD mobile infrastructure and algorithm.

Demaerschalk B M et al. Stroke 2012;43:3098-3101
Conclusions

- Telestroke is cost-effective (cost-savings)
- Telestroke by smartphone is possible

Demaerschalk B M et al. Stroke 2012;43:3271-3277
Major Categories of Services in General Usage

• Gap Services
• Urgent Services
• Mandated Services
• Direct-to-Consumer

“Care Beyond Walls and Wires is the best thing ever for me, and the best thing for my dad.”
Rita Yazzie
• GET GREAT CARE YOU NEED
• Cold & flu symptoms
• Allergies
• Pink eye
• Ear infections
• Respiratory infection
• Sinus problems
• Skin problems
• ... and more

Massachusetts General Hospital – Department of Pathology – 1960s
Massachusetts General Hospital – Department of Pathology – 1960s
Thank you!

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