

# Clinical Applications

“11:10 AM to 11:50 AM”

September 9, 2019

**Ronald S. Weinstein, M.D.**

Director, Arizona Telemedicine Program

Co-Director Southwest Telehealth Resource Center

President-Emeritus, American Telemedicine Association

**Warren Street Clinic**  
Arizona Telemedicine Program  
Tucson, AZ



Arizona Telemedicine Program  
60+ Applications

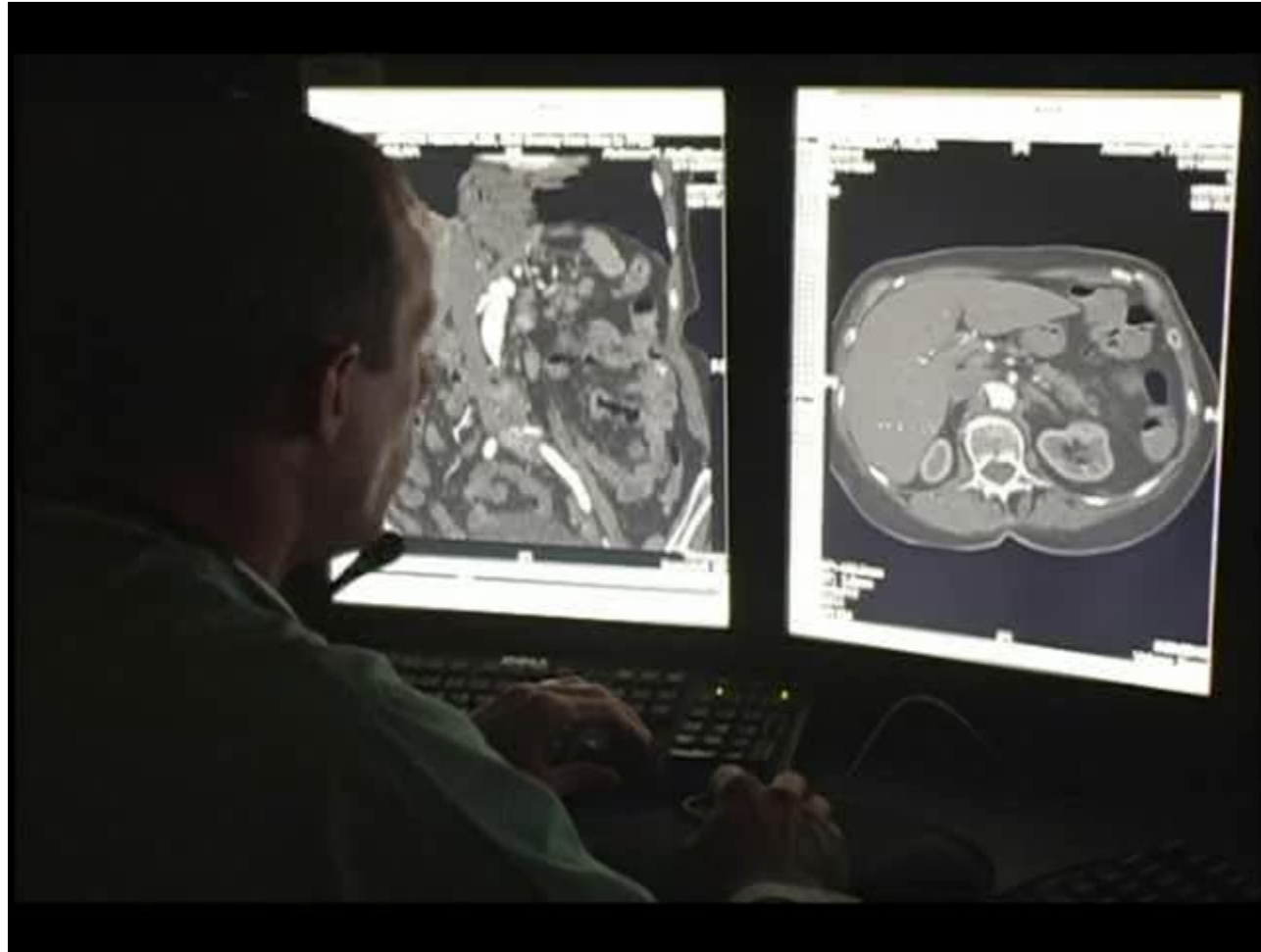
# Major Categories of Services in General Usage

- Gap Services

- Urgent Services

- Mandated Services

# Teleradiology – 1,400,000+ cases



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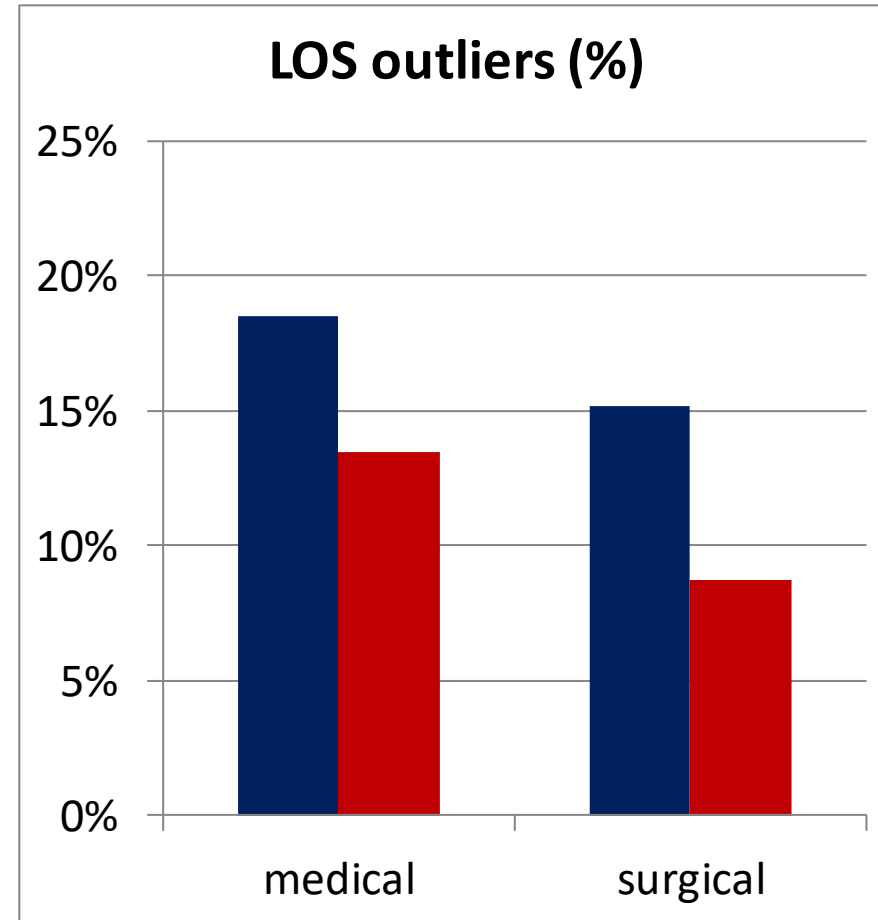
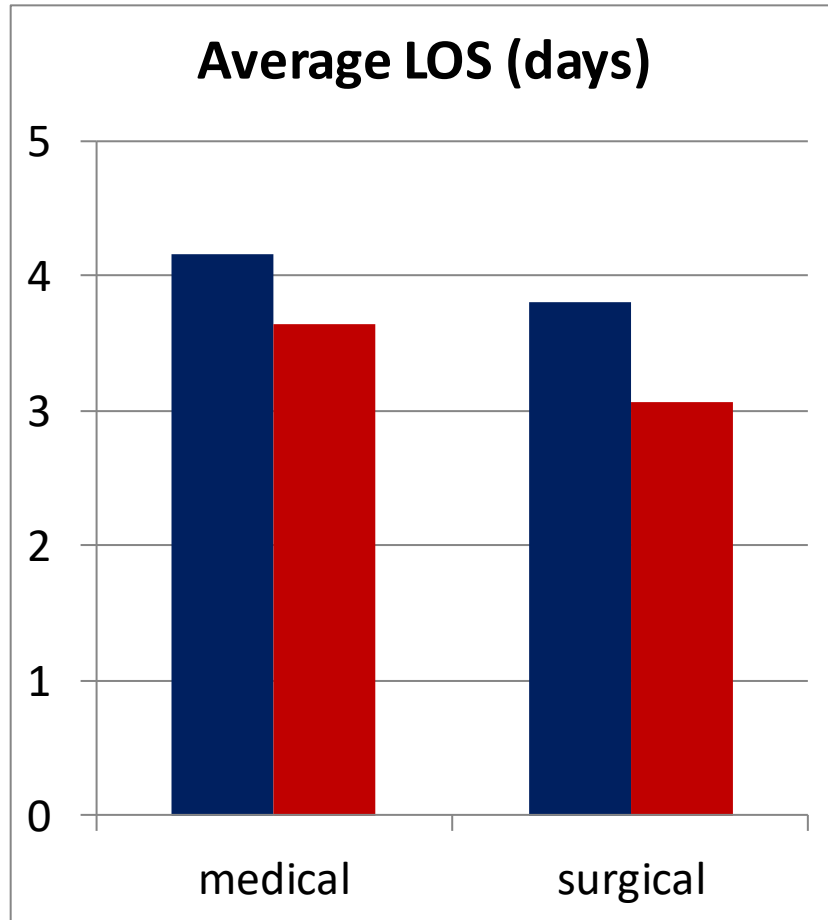
- Mandated Services

# Electronic ICU

“Urgent Services”



# iCare BGMC MedSurg LOS



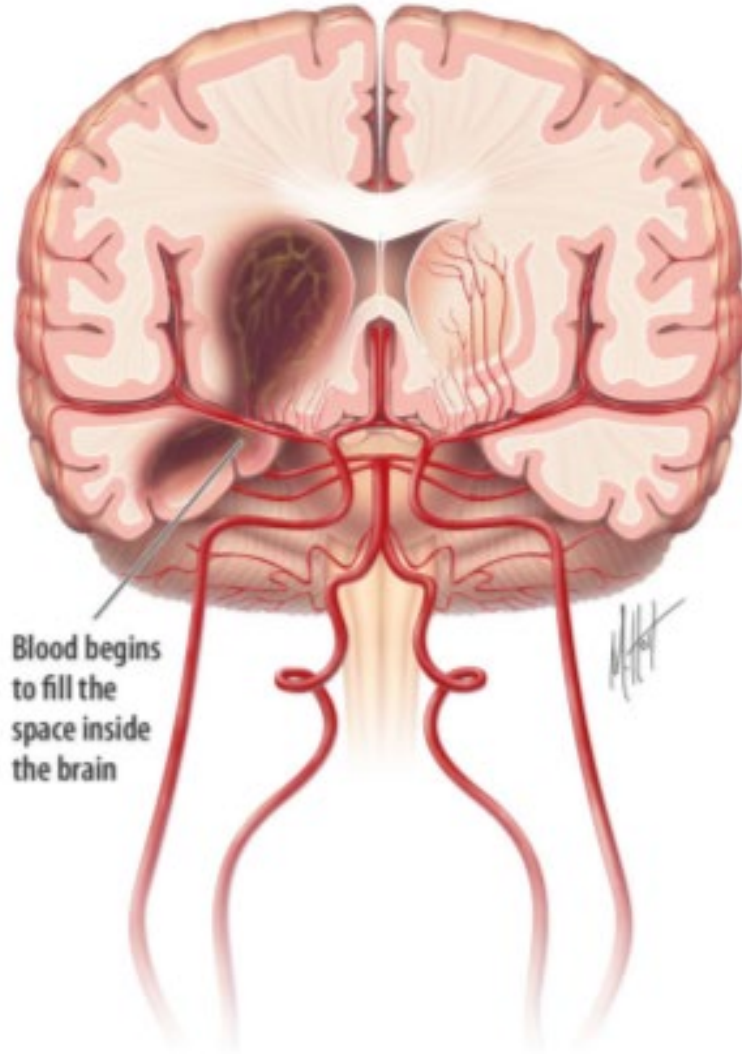
Pre (2008)  
Post (2010)

*Courtesy of Debbie Dahl, E.E  
Banner Health*



# Strokes

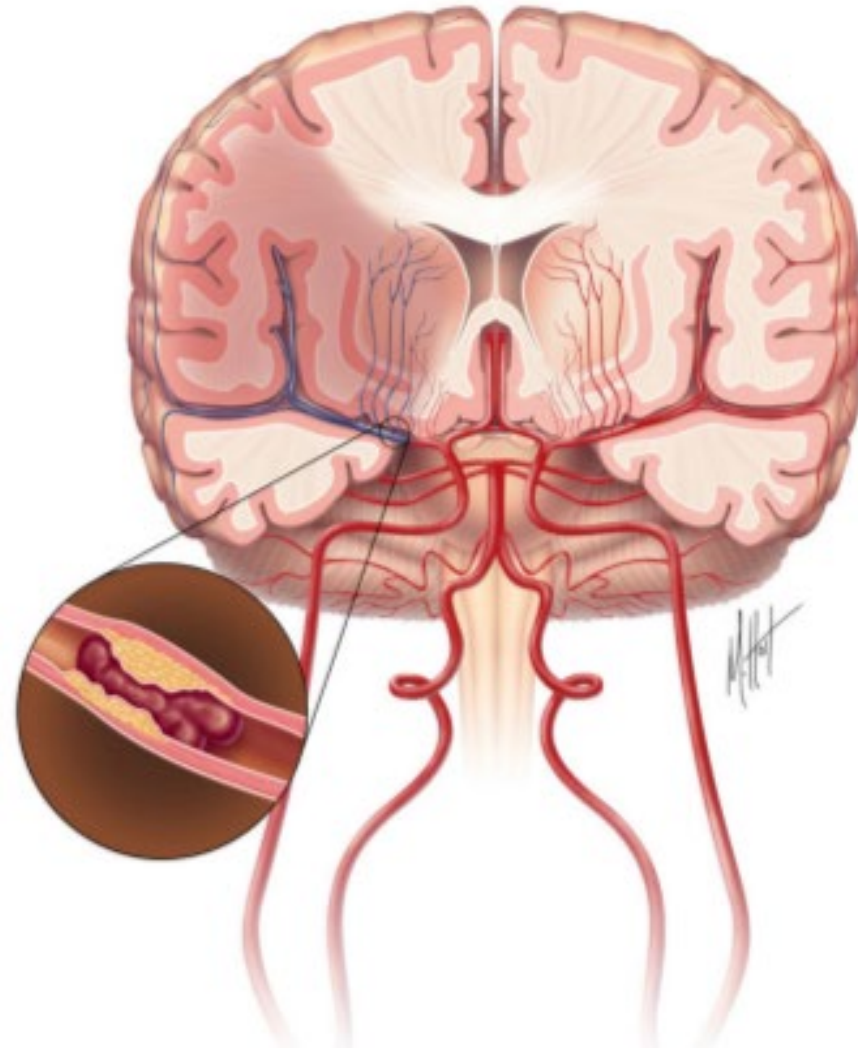
Haemorrhagic (13%)



Blood begins to fill the space inside the brain

Caused by blood vessel rupture.

Ischemic (87%)



Caused by blockage of blood vessel.



**“The Golden Hour”**

**TeleStroke**  
Supporting Community Hospitals

# Stroke

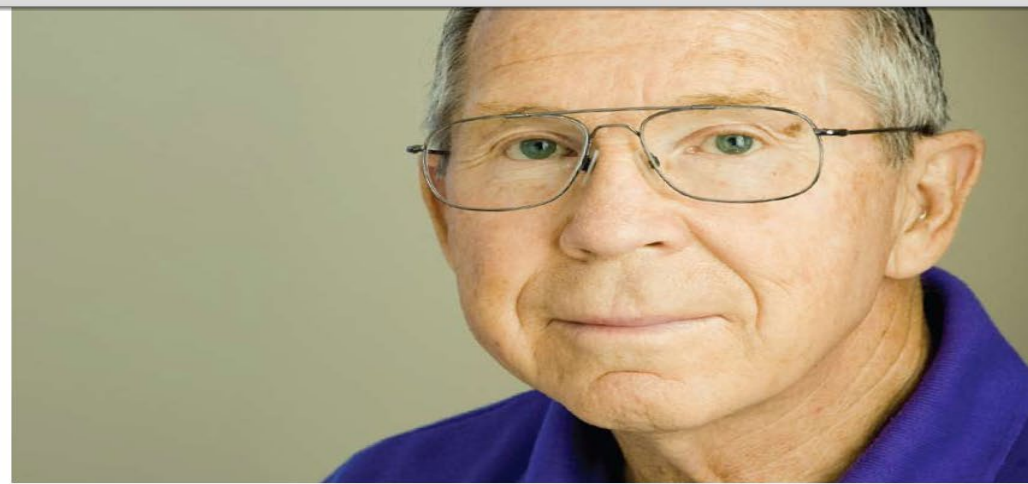
is the third leading cause of death in the United States and the leading cause of adult disability.

Approximately 795,000 strokes occur each year, and delays in diagnosis contribute to the mortality and disability associated with stroke.

# TeleStroke

supports community hospitals by providing:

- 24-hour on-call stroke specialist
- Emergency department acute stroke consultation
- Bedside follow-up (depending on site needs)
- Stroke follow-up appointments (depending on site needs)



## WHEN STROKE BEGINS, EVERY SECOND COUNTS

Stroke is a medical emergency that requires early assessment and early treatment. Rapid identification of acute stroke patients enables the timely administration of effective and appropriate stroke therapies that can improve patient outcomes. It also allows for initiation and coordination of strategies to prevent stroke progression, recurrent stroke, and common complications.

and transportation barriers with reliable technology that allows immediate access to stroke experts who can provide consultation with on-site providers to manage acute stroke as needed.

**Keep stroke patients close to home.**

With TeleStroke, community hospitals can provide stroke care to

## HOW TELESTROKE WORKS

### COMMUNITY HOSPITAL

- 1 Doctor reviews patients status, determining need for stroke evaluation
- 2 Telestroke mobile unit brought in to patient
- 3 Patient speaks directly to the TeleStroke doctor and follows examination instructions
- 4 If necessary, hospital staff prepares patient for AirMed transport



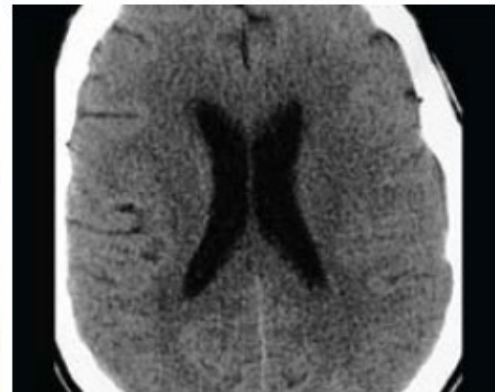
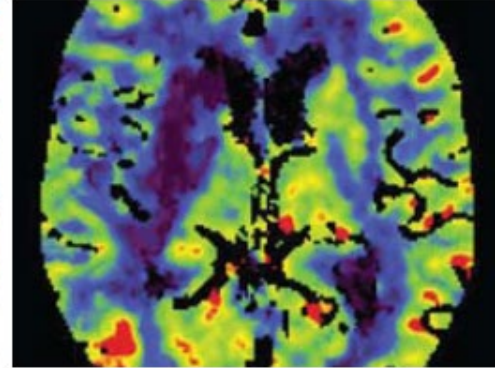
### TELESTROKE DOCTOR

- A 24-7 on-call TeleStroke doctor receives call or page
- B Doctor begins video conferencing and evaluates patient data
- C Exam given via TeleStroke system to evaluate presence or severity of stroke
- D Consultation with community hospital on best treatment plan for patient

## Reduced Costs

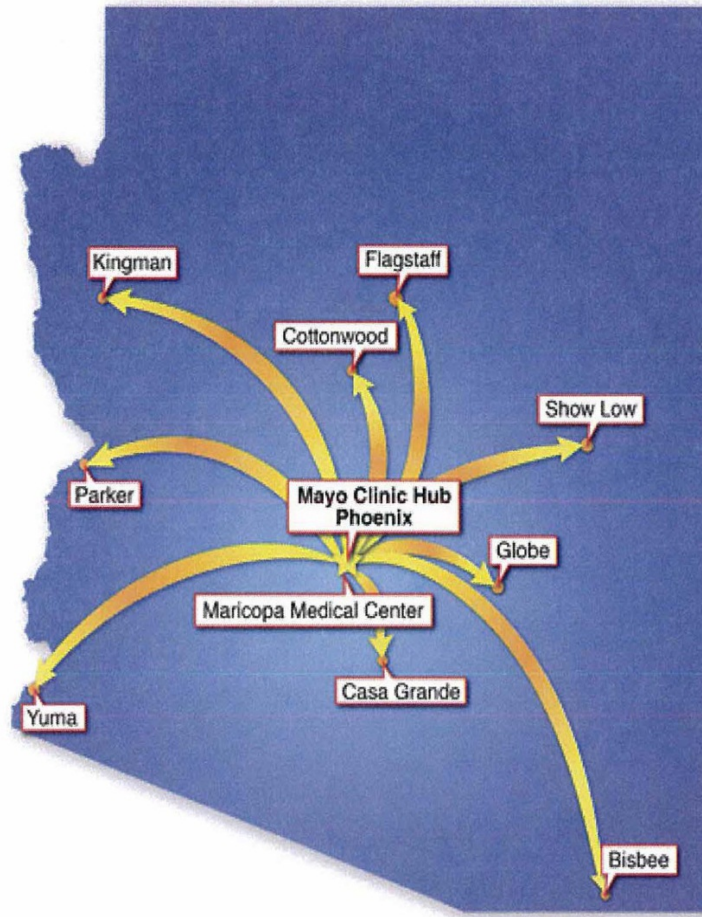
The efficient use of available health care resources is of paramount concern for all health care centers. And, the costs associated with establishing a comprehensive stroke care system may prevent smaller or more rural facilities from implementing effective stroke management.

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 round-the-clock specialty stroke care to more patients.





## 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.

## 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; Rema Raman, PhD; Karin Ernstrom; Joseph M. Hoxworth, MD; Ameet C. Patel, MD; Terri-Ellen J. Kiernan, MSN; Maria I. Aguilar, MD; Timothy J. Ingall, MD, PhD; David W. Dodick, MD; Brett 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 nonradiologists engaged in emergency telestroke assessments and decision-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 (telestrokeologists).

**Methods**—The Stroke Team Remote Evaluation Using a Digital Observation Camera Arizona trial was a prospective, urban single-hub, rural 2-spoke, randomized, blinded, controlled trial of a 2-way, site-independent, audiovisual 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 telestrokeologist and in the telephone arm by the spoke radiologist. All subjects' CT scans were subsequently interpreted centrally, independently, and blindly by 2 hub neuroradiologists. The primary CT outcome was determination of a CT-based contraindication to thrombolytic treatment. Kappa statistics and exact agreement rates were used to analyze interobserver agreement.

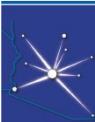
**Results**—Fifty-four subjects underwent random assignment. The overall agreement for the presence of radiological contraindications to thrombolysis was excellent (0.91) and did not differ substantially between the hub telestrokeologist to neuroradiologist and spoke radiologist to neuroradiologist (0.92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

**Clinical Trial Registration**—URL: <http://www.clinicaltrials.gov>. Unique identifier: NCT00623350.

(*Stroke*. 2012;43:3095-3097.)

**Key Words:** computed tomography ■ randomized controlled trials ■ rural health ■ rural hospitals ■ stroke  
■ telemedicine ■ telestroke



# The cost-effectiveness of telestroke in the treatment of acute ischemic stroke



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## 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 experts).

**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 western states' telestroke experiences. Costs were gathered using a societal perspective and converted to 2008 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 \$108,363/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

## 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. Channer, MS; Joseph G. Hentz, MS

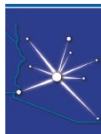
**Background and Purpose**—Telestroke reduces acute stroke care disparities between urban stroke centers and rural hospitals. Current technologies used to conduct remote patient assessments have high start-up costs, yet they cannot consistently establish quality timely connections. Smartphones can be 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 scores. 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  $7.93\pm 8.10$  and  $7.28\pm 7.85$ , 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, dysarthria, and extinction/inattention. Ataxia had poor agreement. There was 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.)





# Stroke

JOURNAL OF THE AMERICAN HEART ASSOCIATION



## **Smartphone Teleradiology Application Is Successfully Incorporated Into a Telestroke Network Environment**

**Bart M. Demaerschalk, Jason E. Vargas, Dwight D. Channer, Brie N. Noble, Terri-Ellen J. Kiernan, Elizabeth A. Gleason, Bert B. Vargas, Timothy J. Ingall, Maria I. Aguilar, David W. Dodick and Bentley J. Bobrow**

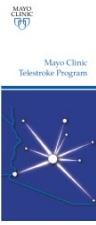
*Stroke*. 2012;43:3098-3101; originally published online September 11, 2012;

doi: 10.1161/STROKEAHA.112.669325

*Stroke* is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231

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Print ISSN: 0039-2499. Online ISSN: 1524-4628



# Photograph depicting the bedside National Institutes of Health Stroke Scale (NIHSS) assessment scenario.



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

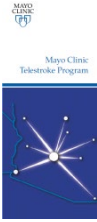




# ResolutionMD mobile.



**Demaerschak B M et al. Stroke 2012;43:3098-3101**



# Conclusions

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

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



Activase for Acute Ischemic Stroke

Stroke Centers and Telestroke

Resource Center

Reimbursement

Patients and Families

Home > Stroke Centers and Telestroke > Telestroke Networks

Stroke Centers and Telestroke

Stroke Centers

Certification Information

Joint Commission Primary Stroke Center Certification

- Acute Stroke Process
- t-PA Training
- Mock Stroke Codes
- Outcomes

Comprehensive Stroke Centers

Stroke Center Best Practices

- Time-Saving Practices
- Stroke Center Fundamentals

Telestroke Networks

What Is Telestroke?

- Hub and Spoke Model
- Third-Party Consult Model

Key Elements of a Telestroke System

- Equipment and Personnel
- Common Challenges
- Best Practices

Telestroke Resources

- Telemedicine Providers
- Link to Organizations

Telestroke Network Map

### Telestroke Networks

The American Heart Association/American Stroke Association (AHA/ASA) recommends the use of telemedicine, or telestroke, to improve stroke care in rural, remote, or underserved areas.<sup>21</sup>

Discover how telestroke allows for specialized stroke care in underserved areas:

<a href="#">▶ What Is Telestroke?</a>	Learn about the different telestroke models.
<a href="#">▶ Key Elements of a Telestroke System</a>	Find out about equipment, challenges, and best practices associated with telemedicine.
<a href="#">▶ Telestroke Resources</a>	Explore resources on telestroke.
<a href="#">▶ Telestroke Network Map</a>	View telestroke networks on a national scale.

**Safety First!**  
 Before you start exploring, please read the Important Safety Information.  
[Download Full Prescribing Information](#)

### Education and Training



Free access to educational materials and training on acute ischemic stroke and Activase for your stroke center.

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### Dosing and Administration

View videos and instructions for the appropriate dosing and administration of Activase for acute ischemic stroke.



[View Now ▶](#)

### Register for Updates

Receive updates and gain free access to order educational resources.



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### Acute Ischemic Stroke Indication

Activase is indicated for the management of acute ischemic stroke in adults for improving neurological recovery and reducing the incidence of disability. **Treatment should only be initiated within 3 hours after the onset of stroke symptoms, and after exclusion of intracranial hemorrhage by a cranial computerized tomography (CT) scan or other diagnostic imaging method sensitive for the presence of hemorrhage (see CONTRAINDICATIONS in the full prescribing information).**



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- **Connected Health**
- **Direct-to-Consumer**



# Connected Health/Mobile Health





<https://ihealthlabs.com/wireless-scales/ihealth-core/>

Images intended as examples of technology and not as an endorsement of companies or products.

## ‘Care Beyond Walls and Wires’ Enhances Life for Patients with Congestive Heart Failure



More than 5 million people in the U.S. suffer from congestive heart failure (CHF), according to the Centers for Disease Control and Prevention (CDC). The annual cost is estimated at more than \$32 billion in health care services, medications, and lost earnings, the CDC says. Northern Arizona Healthcare’s “Care Beyond Walls and Wires” can improve CHF patients’ health and reduce health care costs.

Woody Smith and his daughter, Rita Yazzie, used to drive as often as twice a month from their home on the Navajo Reservation to Flagstaff Medical Center, nearly two hours away. Mr. Smith is living with congestive heart failure, with symptoms so severe he required frequent hospitalizations.

But Mr. Smith can no longer travel for months without hospitalizations. His condition has resulted from congestive heart failure, a condition called Care Beyond Walls and Wires, a telemedicine-enabled program that has helped improve the health of patients with congestive heart failure.

The program also reduces hospital readmissions, and allows patients to stay for those who are hospitalized.

“It’s phenomenal,” says a registered nurse at Flagstaff-based Northern Arizona Healthcare, which runs Care Beyond Walls and Wires at Flagstaff Medical Center.

Ms. Yazzie says the program “is the best thing for my dad. It’s saved me two hospital readmissions since the program more than a year ago.”

And at 90, Mr. Smith has been able to return to his favorite activity: riding his horse.

Care Beyond Walls and Wires provides patients with a backpack containing the equipment they need to check their blood pressure, measure their oxygen level, and check their weight daily; the latter because patients with CHF can gain and drop weight suddenly. The data are automatically

transferred to a smart phone that transmits the information to Northern Arizona Healthcare’s care coordination office, which provides the smart phone, monitoring equipment and backpack to every patient enrolled in Care Beyond Walls and Wires.

Some of the program’s patients have no electricity at home, so they also are given

The San Diego telecommunications company Qualcomm was chosen to lead the project, with Maryland-based Zephyr Technology and Verizon providing software, smart phones and remote-monitoring hardware.

Northern Arizona Healthcare agreed to conduct a pilot project involving 50 patients. The project got under way in

*“Care Beyond Walls and Wires is the best thing ever for me, and the best thing for my dad.”*

Rita Yazzie

the study if you lived in a rural area. “We could live in Supai (and Canyon) or on the reservation. Our patients are Hispanic, and white, and in their 50s to early 90s.”

Care Beyond Walls and Wires ended on November 1, 2018. Northern Arizona Healthcare is continuing the program.

The program costs around \$650,000 a year, says Ms. Sorenson, which covers cell phone charges.

“With the investment,” she says, “patients benefiting, we penalize hospitals for readmissions, including those who are readmitted and discharged.”

“It’s a tremendous patient benefit. Patients like the feeling that they have more control over their health,” Ms. Sorenson says. “We couldn’t have asked for anything more. It’s a global win.”

perspective, the idea for Care Beyond Walls and Wires originated with the National Institutes of Health Office of Public and Private Partnerships, which was looking for better ways to monitor patients with CHF who live in rural areas. The goal was to provide better care while keeping the patients out of the hospital, thus reducing health-care costs.

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- **Direct-to-Consumer**

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Arizona Daily Star / Sunday, January 6, 2019 A7




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# Tucson Daily Star January 6, 2019

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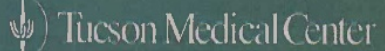
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- Pink eye
- Ear infection
- Respiratory infection
- Sinus problems
- Skin problems
- ...and more.

- **GET GREAT CARE YOU NEED**
- Cold & flu symptoms
- Allergies
- Pink eye
- Ear infections
- Respiratory infection
- Sinus problems
- Skin problems
- ... and more



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- No appointment necessary
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- Get a diagnosis and treatment recommendation, including a prescription\* if needed
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#### Why Use VirtualHealthConnect?

##### See A Doctor From Anywhere

Use your smartphone, tablet, or desktop computer to visit with a doctor face-to-face.

##### Doctors Available 24/7

Our doctors are always on. See a doctor on your schedule, 24/7/365

##### No Appointments Necessary

Once you set up your free account, just log on, choose a provider and start your visit.

##### Local Prescriptions

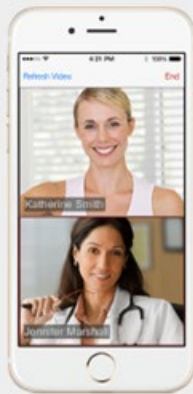
If a prescription is necessary, one will be called into the pharmacy of your choice.

##### Your Privacy Is Our Priority

Rest easy. We keep your information and health records safe and secure.

##### Because You Want Care Fast

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Tucson, AZ

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## When you don't want to wait to feel better

BeWellNow, Northern Arizona Healthcare and PathfinderHealth's virtual urgent care service, is a faster, easier way to see a doctor. BeWellNow lets you talk with a doctor from the comfort of your own home or on-the-go. It's easy to use, free to enroll and the cost is just \$49 per visit.

BeWellNow offers:

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You can use BeWellNow any time, day or night. It's perfect when your doctor's office is closed; when you're too sick or busy to see someone in person; or even when you're traveling.

#### Sign up now:

1. Download the BeWellNow app or sign up on the website:



[www.NAHBeWellNow.com](http://www.NAHBeWellNow.com) 

Flagstaff, AZ

# Direct-to-Consumer Telehealth

## United HealthCare Virtual Visits

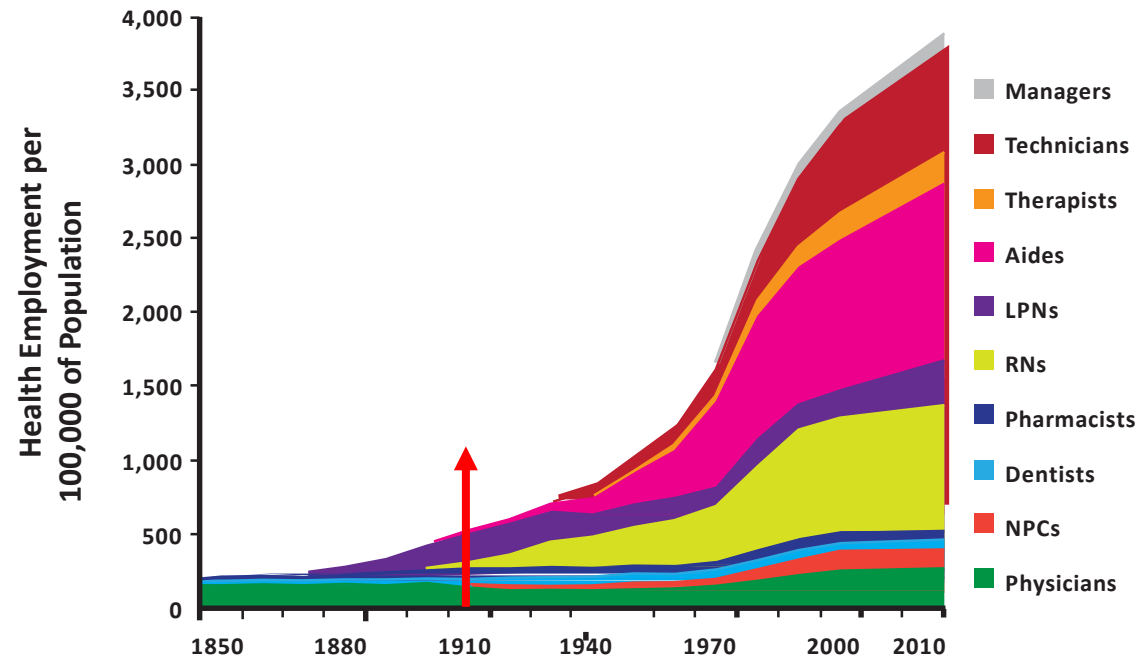


# Direct-to-Consumer Telemedicine

American Well

<https://www.youtube.com/watch?v=sBryMAxi5tE>

## Physicians, Non-physician Clinicians,



Adapted from Kendix and Getzen, and the Bureau of Labor Statistics

# ARIZONA *Telemedicine*

Mayo Clinic - Telestroke

Yuma NICU Tele-echo-cardiology

Banner eICU program

Diabetes retinal screen

Flagstaff Navajo/  
CHF Program

Administrative VC

Telecardiology

Tele-infectious  
disease - AIDS

Breast Cancer  
"Virtual" Survivor Groups



To contact us call  
1-877-535-6166



Thank you!

Questions?

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[rweinstein@telemedicine.arizona.edu](mailto:rweinstein@telemedicine.arizona.edu)