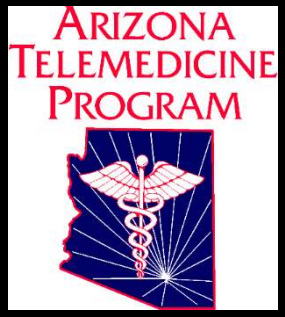


Telemedicine Applications (Part 1): Overview

Ronald S. Weinstein, MD
Director, Arizona Telemedicine Program

Lecture #1

Telemedicine Consultation

Telemedicine Clinic – Spoke site

The Provision of Tele-Medical Care

How are clinics structured?

- Patient/Referring Clinician
- Spoke Site (Originating Site)
  - *Medical Director*
  - *Site Coordinator*
- Hub Site
  - *Medical Director*
  - *Site Coordinator*

What makes a good teleconsultation?

- Complete data
  - *Avoid the incomplete consult!*
- Diagnostic images
- Steps in review:
  - Site Coordinator
  - Medical Director
  - Specialist
  - Professional appearance

Modalities

~~Tactile~~

Visual

Auditory

"Talk is the treatment"

Modalities

Visual

Medical Imaging

- Routine radiology (X-rays)
- Scanners – (CT, MRI, PET)
- Ultrasound – (Sound Waves)

- Telemammography (breast)
- Tele-echocardiology (heart)
- Fetal-ultrasound (fetus)

Teleradiology

Telemammography

Tele-echocardiography

Fetal Ultrasound

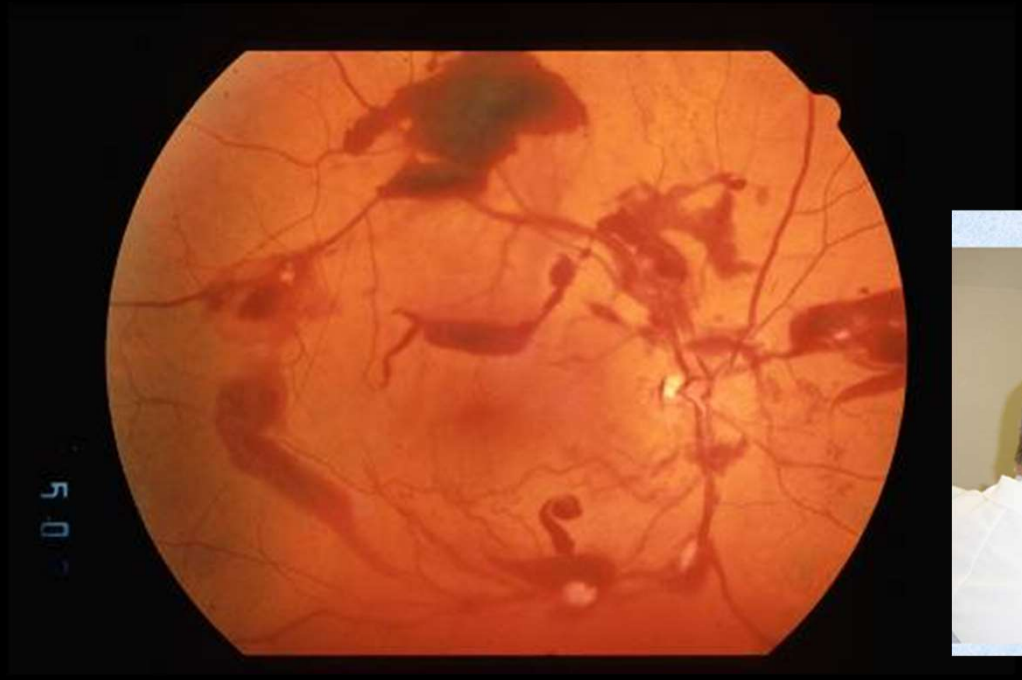
https://www.youtube.com/watch?v=s48-hvFevEw

Imaging Scopes

- General Exam Camera
- Dermatoscope
- Ear Nose and Throat
- Ophthalmoscope
  - Non-mydriatic Retinal Screening
- GI Track (i.e., colonoscope)

Teledermatology

Teleophthalmology



Otorhinolaryngology (ENT)

Viral otitis media *versus* bacterial otitis media

Physical Exams (Assistants)

- Medicine
- Surgery
- Pediatrics
- Neurology/Neurosurgery
- Rheumatology
- Orthopedics
- Dermatology

Virtual Reality Palpation

Tactile – “virtual” palpation

Teleneurology

Teleneurology

Telestroke

- CT Scan
- Tele-neurology exam

tPA

Modalities

Visual

Auditory

Electronic Stethoscope

Dr. Conrad Clemens uses real-time video conferencing and digital stethoscope technology to evaluate a child's asthma.

Modalities

Visual

Auditory

"Talk is the treatment"

Telepsychiatry

“The talk is the treatment”

- Psychiatry/psychology
- Genetic Counseling
- Pain Management
- Nutrition
- Support group
- Hospice care

Support Groups

Cancer Genetic Counseling

NCC National Coordinating Center for the Regional Genetics Networks

NATIONAL CONSORTIUM OF TELEHEALTH RESOURCE CENTERS

WSRGN Western States Regional Genetics Network

SOUTHWEST TRC TELEHEALTH RESOURCE CENTER

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Alaska
California
Guam
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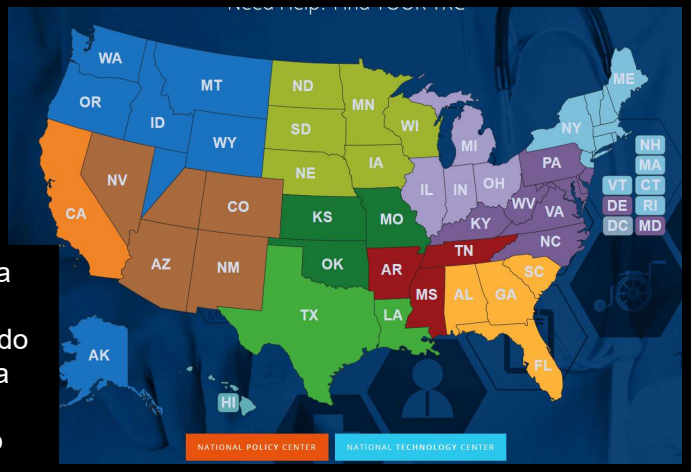
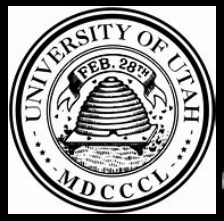
Oregon
Washington



Nevada
Utah
Colorado
Arizona
New Mexico

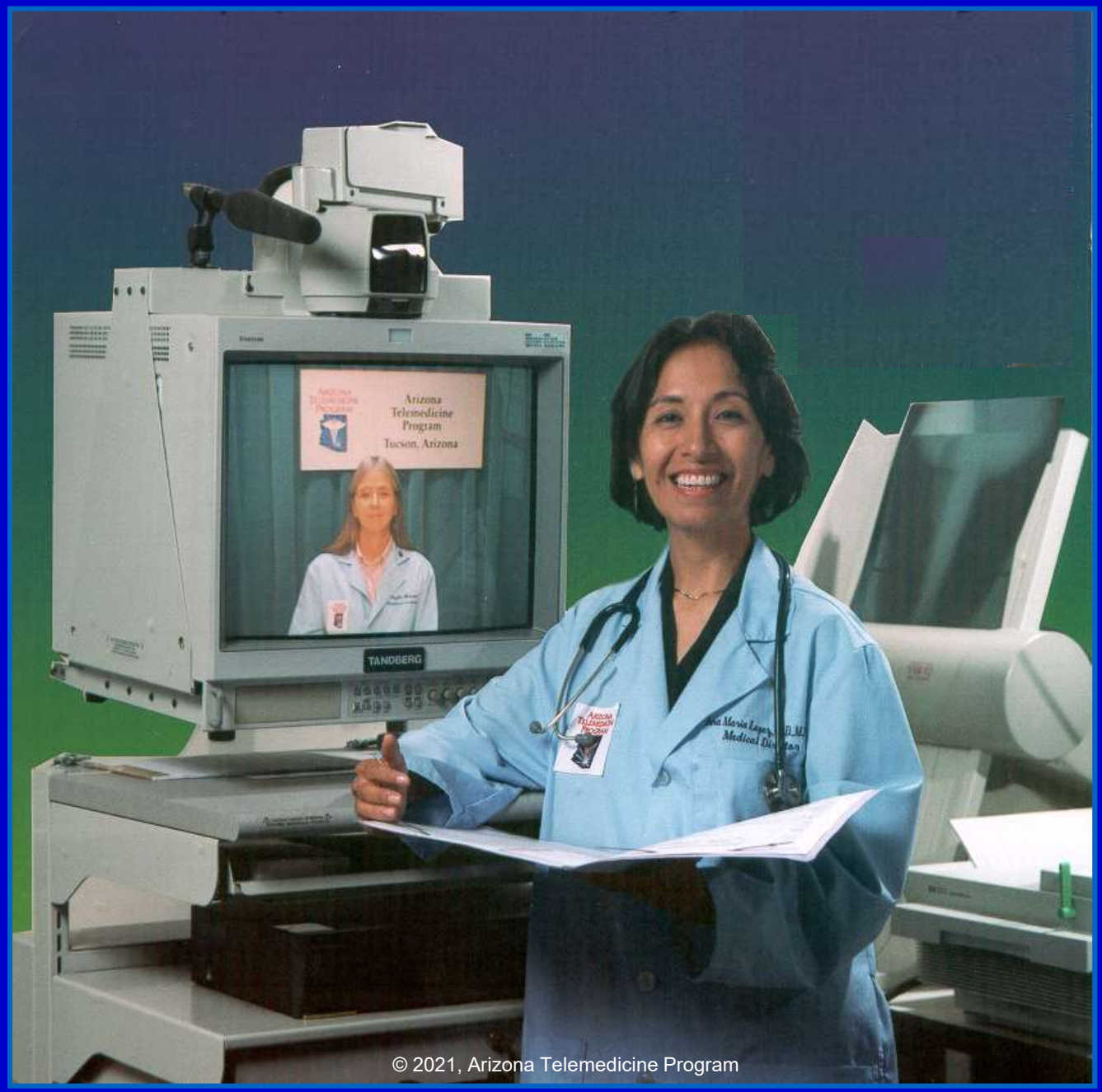
Workshop Locations:
State Universities of Arizona, Hawaii, Iowa, Utah, Massachusetts, Southern California @ Irvine
and Health Departments of Hawaii & Washington



Telegenetics Counseling Training




This training was in coordination with the University of Arkansas and the University of Arizona. Participants came from Washington, Hawaii, Arkansas and Kansas. This was a two-day training session with AMA and CEU credits.



Telemedicine Services (Customers)

1. Rural Telemedicine Projects
2. Direct-to-Hospital Telemedicine (DTH)
3. Direct-to-Consumer Telemedicine (DTC)

Specialty Services Telemedicine

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- Teledermatology 
- Teleinfectious disease
- Teleophthalmology 
- Telepathology 
- Telepsychiatry 
- Teleradiology 
- Teletrauma 

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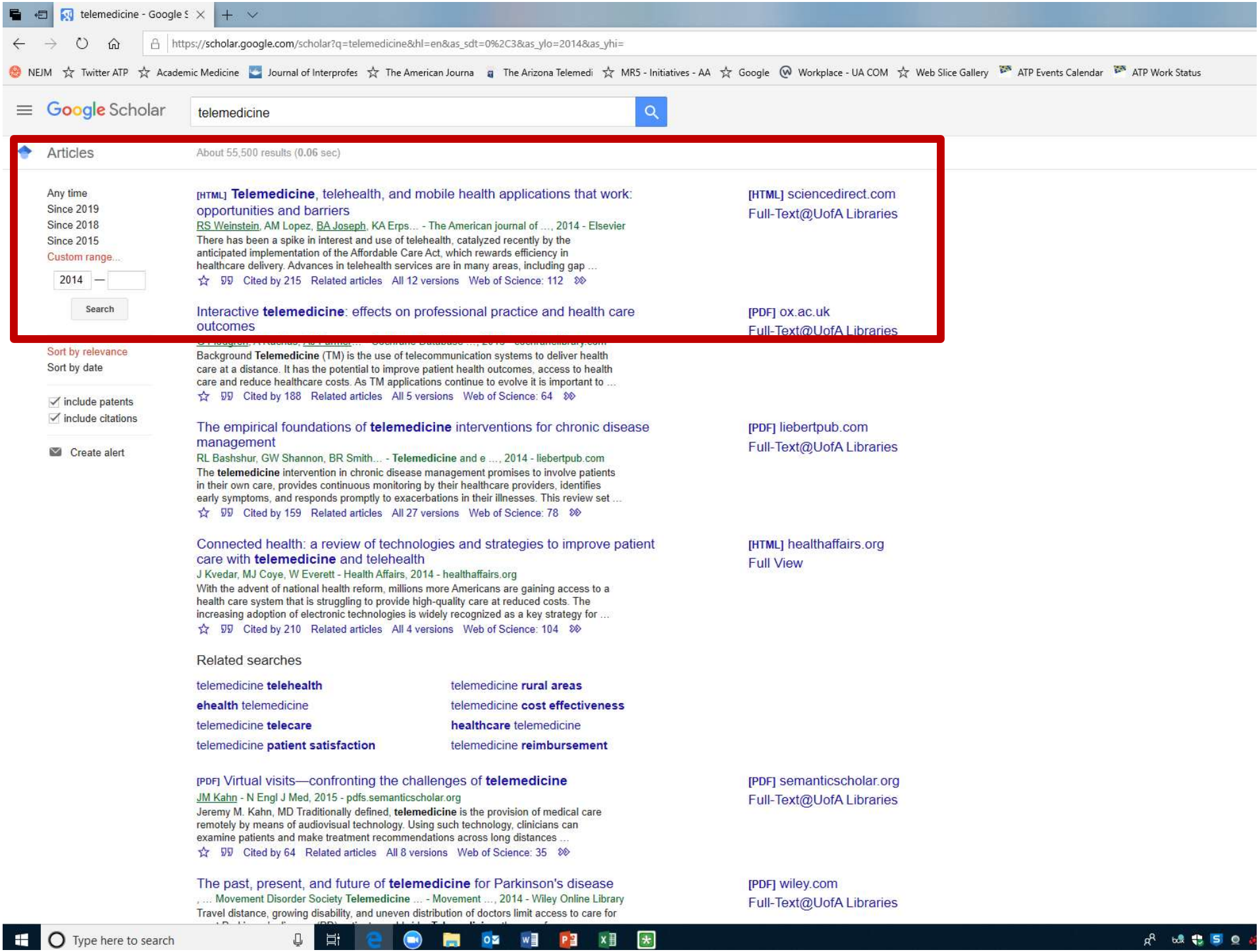
- Pediatric Tele-echocardiology 
- Telegenetics 
- Telehematology/ Oncology 
- Teleneurology 
- Tele-orthopaedics 
- Telerheumatology 
- Tele-wound Management 

Gap Service and Tele-urgent Services

1. Gap Services
2. Urgent Services
3. Mandatory Services

Weinstein RS, Lopez AM, Joseph BA, Erps KA, Holcomb M, Barker GP, Krupinski EA. Telemedicine, telehealth, and mobile health applications that work: opportunities and barriers. **The American Journal of Medicine.** 2014 Mar 1;127(3):183-7.


telemedicine - Google S
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Academic Medicine
Journal of Interprofes
The American Journa
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About 55,500 results (0.06 sec)
Any time
Since 2019
Since 2018
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Custom range...
2014
Search
Sort by relevance
Sort by date
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include citations
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[HTML] Telemedicine, telehealth, and mobile health applications that work: opportunities and barriers
RS Weinstein, AM Lopez, BA Joseph, KA Erps... - The American journal of ..., 2014 - Elsevier
There has been a spike in interest and use of telehealth, catalyzed recently by the anticipated implementation of the Affordable Care Act, which rewards efficiency in healthcare delivery. Advances in telehealth services are in many areas, including gap ...
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[HTML] sciencedirect.com
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Interactive telemedicine: effects on professional practice and health care outcomes
Background Telemedicine (TM) is the use of telecommunication systems to deliver health care at a distance. It has the potential to improve patient health outcomes, access to health care and reduce healthcare costs. As TM applications continue to evolve it is important to ...
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The empirical foundations of telemedicine interventions for chronic disease management
RL Bashshur, GW Shannon, BR Smith... - Telemedicine and e ..., 2014 - liebertpub.com
The telemedicine intervention in chronic disease management promises to involve patients in their own care, provides continuous monitoring by their healthcare providers, identifies early symptoms, and responds promptly to exacerbations in their illnesses. This review set ...
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Connected health: a review of technologies and strategies to improve patient care with telemedicine and telehealth
J Kvedar, MJ Coye, W Everett - Health Affairs, 2014 - healthaffairs.org
With the advent of national health reform, millions more Americans are gaining access to a health care system that is struggling to provide high-quality care at reduced costs. The increasing adoption of electronic technologies is widely recognized as a key strategy for ...
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telemedicine reimbursement
[PDF] Virtual visits—confronting the challenges of telemedicine
JM Kahn - N Engl J Med, 2015 - pdfs.semanticscholar.org
Jeremy M. Kahn, MD Traditionally defined, telemedicine is the provision of medical care remotely by means of audiovisual technology. Using such technology, clinicians can examine patients and make treatment recommendations across long distances ...
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[PDF] semanticscholar.org
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The past, present, and future of telemedicine for Parkinson's disease
, ... Movement Disorder Society Telemedicine ... - Movement ..., 2014 - Wiley Online Library
Travel distance, growing disability, and uneven distribution of doctors limit access to care for
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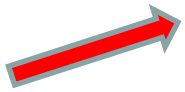
Gap Service and Tele-urgent Services

1. Gap Services
2. Urgent Services
3. Mandatory Services

Gap Service and Tele-urgent Services

1. Gap Services  **Teleradiology**
2. Urgent Services
3. Mandatory Services

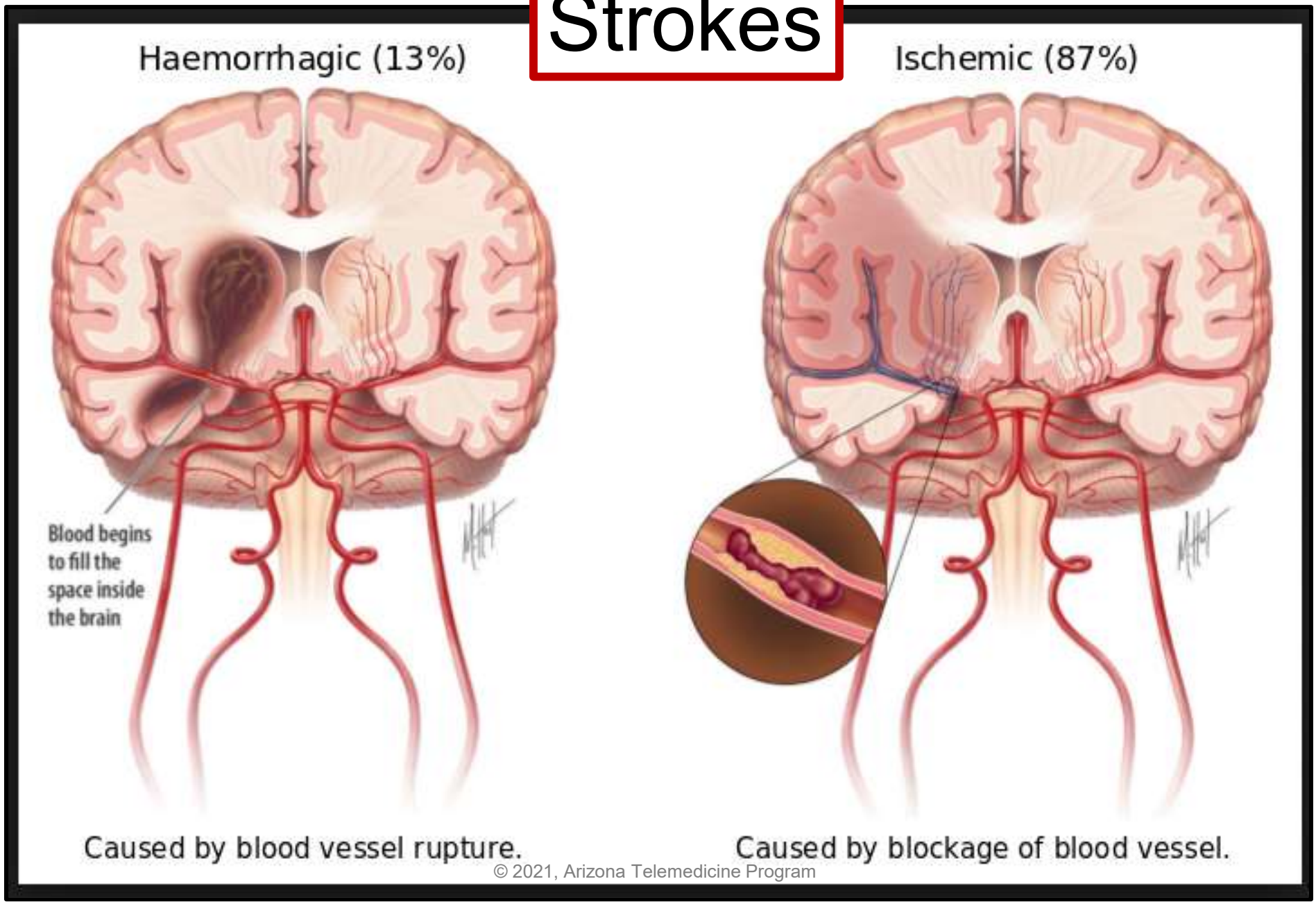
Teleradiology – 1,400,000+ cases

Gap Service and Tele-urgent Services

1. Gap Services → **Teleradiology**
2. Urgent Services → **Telestroke**
3. Mandatory Services

Barrow 24/7 Telestroke Service

Strokes



ARTICLES

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

R.E. Nelson, PhD
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E.J. Skalabrin, MD
B.M. Demaerschalk, MD, MSc, FRCP(C)
J.J. Majersik, MD, MS

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jennifer.majersik@hsc.utah.edu

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

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

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

American Heart Association
Learn and Live

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. 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±8.10 and 7.28±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.)**

ResolutionMD mobile.

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

American Heart Association
Learn and Live

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Stroke 2012: 43; 3095-3097

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 (telestrokologists).

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 telestrokologist 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 telestrokologist 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 telestrokologist and neuroradiologist or between spoke radiologist and neuroradiologist.

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

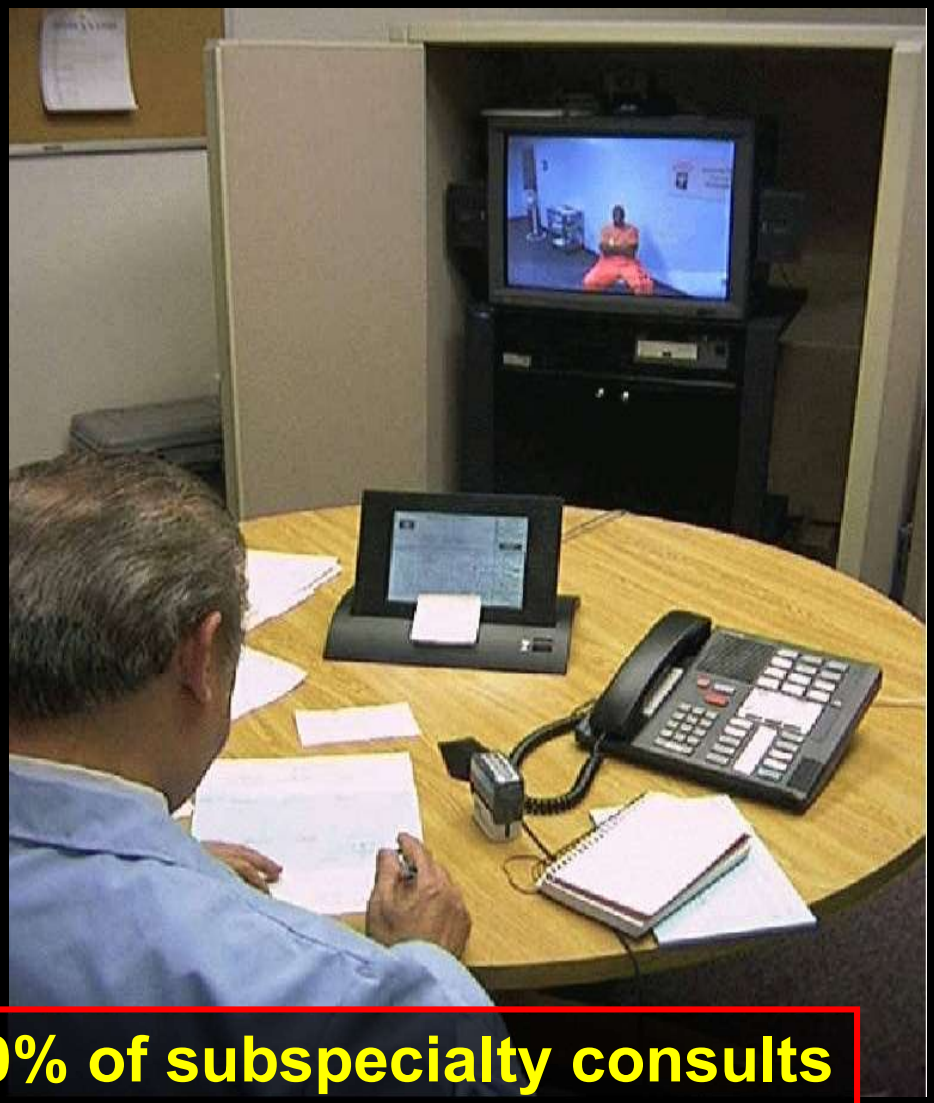
(*Stroke*. 2012;43:3095-3097.)

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

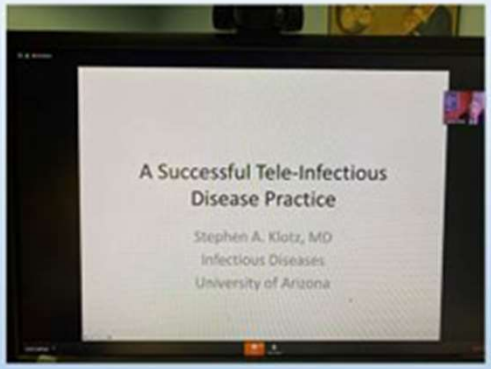
Gap Service and Tele-urgent Services

1. Gap Services → **Teleradiology**
2. Urgent Services → **Telestroke**
3. Mandatory Services → **Tele-everything**

Corrections Telemedicine



80% of subspecialty consults done by telemedicine



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Fredda Kremes, Director Clinical Projects and Carolyn Jacobs, Chief Nursing Officer

Telemedicine Services (Customers)

1. **Rural Telemedicine Projects**
2. **Direct-to-Hospital Telemedicine (DTH)**
3. **Direct-to-Consumer Telemedicine (DTC)**

Congratulations to Fredda Kermes
Director of Clinical Projects, Telemedicine and Professional Development

Show Low, AZ, November 8, 2019