



Telestroke Practices

Emerging Innovations

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What Year is This?

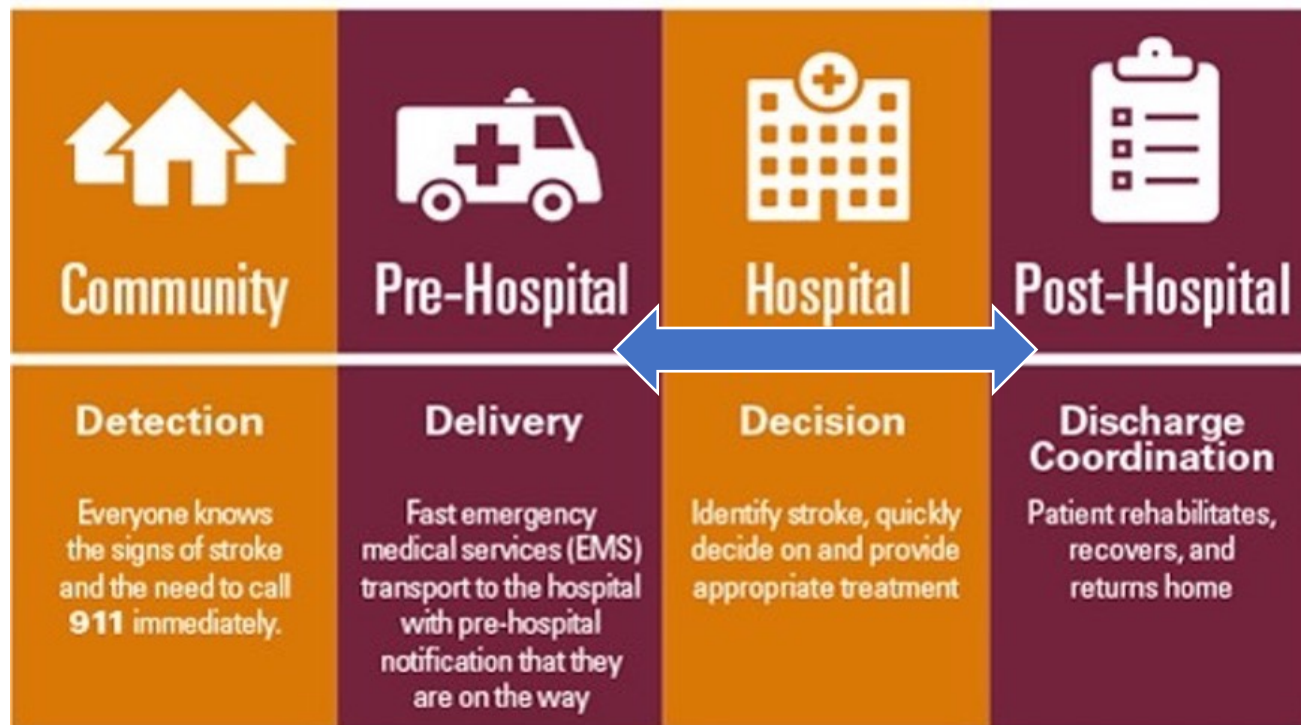


1924 – Science Fiction



1964 – Bell System “Picture Phone”

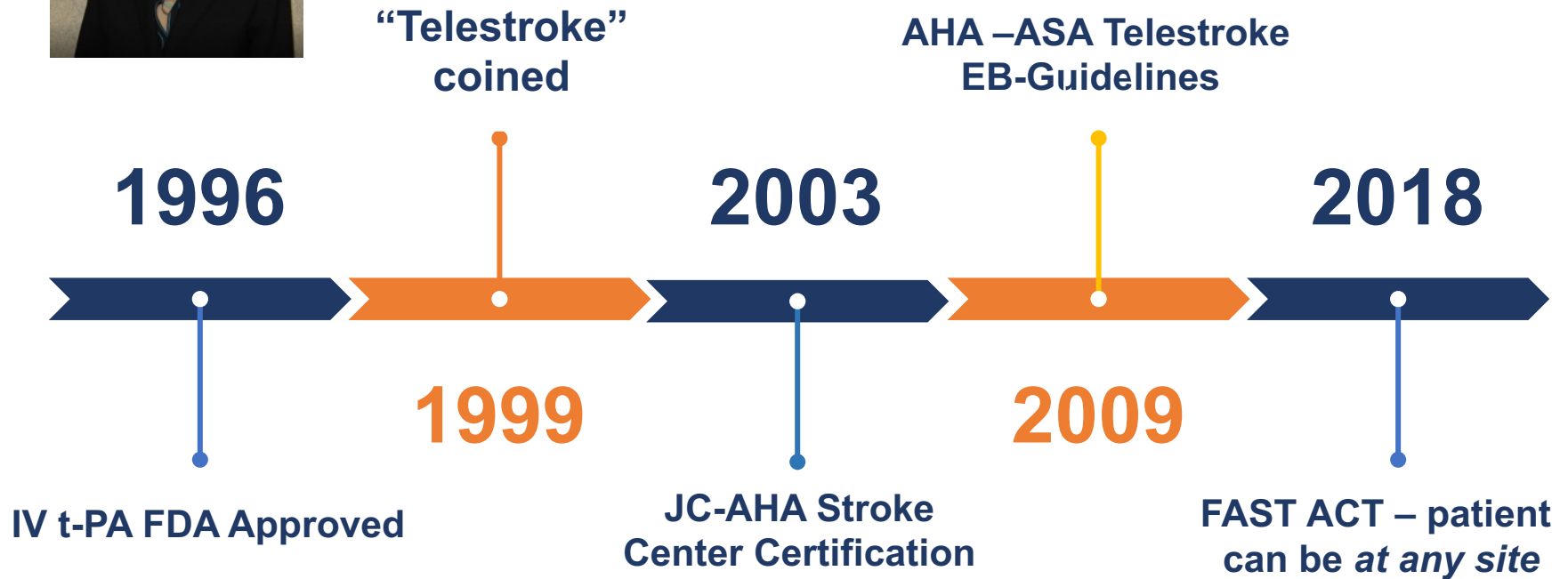
Telemedicine in the Stroke Continuum of Care



Telestroke 1988 to Present



1988 “TeleBAT” University of Maryland



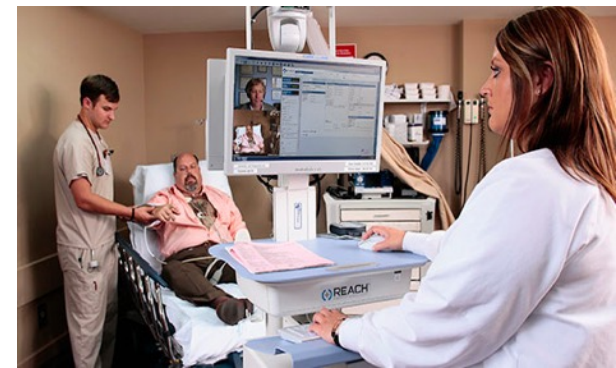
Current Technology Options



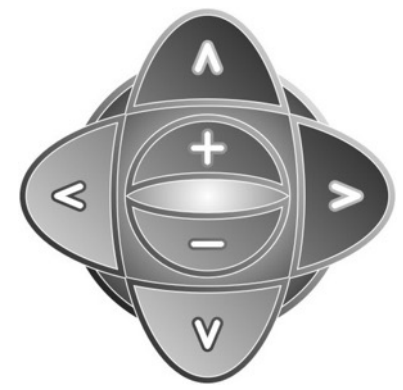
Provider



Patient



Technology – Pan Tilt Zoom Camera



Tele-EMS – Mobile-CT Stroke Units



Pre-Hospital

Delivery

Fast emergency medical services (EMS) transport to the hospital with pre-hospital notification that they are on the way



Intervent Neurol 2018;7:347–358

2003 R&D; 2008 first MSU in Saarland University Germany

Tele-EMS: Economical, Scalable Models



Pre-Hospital

Delivery

Fast emergency medical services (EMS) transport to the hospital with pre-hospital notification that they are on the way

System Components

- ▶ Tablet-based telemedicine endpoint
- ▶ Cisco Jabber (Movi)[™] video conferencing application (HIPAA compliant)
- ▶ 4G LTE CradlePoint[®] modem
- ▶ Multiple-Input-Multiple-Output Antenna (x2)
- ▶ Blue tooth portable speaker
- ▶ Suction cradle mount
- ▶ Verizon[®] 4G Mini SIM card
- ▶ Durable Pelican case



Tele-EMS - Community

Community EMS Paramedicine

ETHAN –Emergency Telehealth And Navigation 2014-2017

- Houston Fire Department (15,300) – tablet-based
- 20-40% non-urgent – triage PCP/clinic
- Reduction 81% unnecessary transports (4 years)

Project ETHAN Average Costs:



Additional \$

148.08

1.25

0-

300

75

50.08

[Department of Emergency Medicine, University of Texas Health Science Center](#)



Community

Detection

Everyone knows
the signs of stroke
and the need to call
911 immediately.

Tele-EMS Community



Community

Detection

Everyone knows the signs of stroke and the need to call **911** immediately.

Future Directions

Artificial Intelligence (AI) assisted neuro exams

- EMS App - Facial palsy
- Company



Machine learning app scans faces and listens to speech to quickly spot strokes

By **Dave Muoio** | October 26, 2020


MobileHealth News
Penn State/Houston Methodist
“79%” accuracy acute stroke



Andy Southerland, Omar Uribe, Mark MacDonald

“Fatal Recognition”

Smart phone app - computer algorithm detects minute signs of face-drooping
If detected, the user will receive an alert to call



FATAL RECOGNITION
Using facial recognition to detect early warning signs of a stroke

BACKGROUND
A stroke can happen to anyone at any time. According to the World Health Organization, someone has a stroke every 2 seconds. It claims the lives of over 8 million every year. Of those who survive, two-thirds are left with brain damage or permanent disability.

INSIGHT
The key to safety is spotting the early warning signs. The most common warning sign of a stroke is face-drooping. But since some strokes are less severe than others, it's incredibly hard for the human eye to detect.

IDEA
Fatal Recognition is a white scan app that uses facial recognition technology to detect early warning signs of a potentially fatal stroke.

EXECUTION
Working with the national stroke organisation, we saw it was a matter of time before technology that already built into our phones, the average person unlocks their phone 20 times a day. During the morning, how many times you scan to unlock, a computer algorithm detects to remove signs of face-drooping—signs that are unrecognizable to the human eye. If early warning signs are detected, you'll receive an alert offering to call emergency services whilst dialling your preset emergency contact.

RESULTS
For the first time, potentially fatal strokes can be detected early by simply using your phone as you normally would. It's an idea that won't change your life, but it might just save it. At the time of writing, 37 emergency alerts have been triggered.

HOW IT WORKS

1. To be able to use your phone as you would.
2. In the morning you unlock, it scans for changes to your face-drooping.
3. If signs are detected, it will send you an alert offering to call emergency services.

PLEASE SEE OUR CASE STUDY PAGE AT: www.hkstroke.org/en/our-services/technology

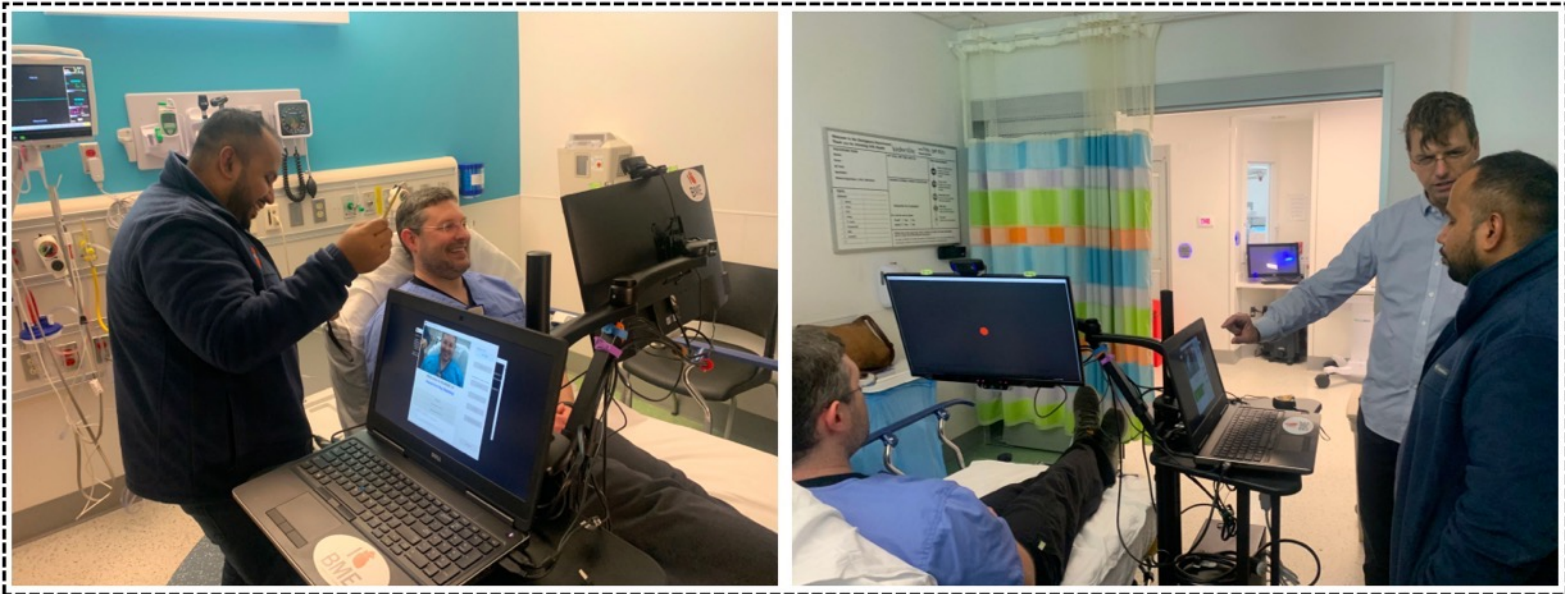
Available on Google play

<https://www.lbbonline.com/news/fatal-recognition-is-an-app-that-uses-facial-recognition-to-detect-warning-signs-of-a-stroke>

Hong Kong Stroke Association 2019

Camera + AI Assisted Neuro Diagnosis:

- Facial weakness
- Eye movements (BANDIT – posterior stroke recognition)
- Motor drift



<http://imagedatascience.com/stroke/index.html>

Post-Hospital Telestroke Home-Health

“iHEAL”: Innovative Home Evaluation and Active Living

- Continuous Home Monitoring
 - Pharmacist, PT, OT, Speech, Neuro NP
 - Reminders
 - Rehab Apps
 - Stroke Education
 - Telehealth visits

Patient receives equip DC



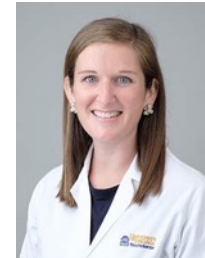
Sessions 4-6 weeks



Sessions 10-12 weeks



Patient returns equip at 3 mo



iHEAL – Telestroke Home-Health



“pilldrill”®

Remind

Track

Notify



Scan Tags
Alarm lights

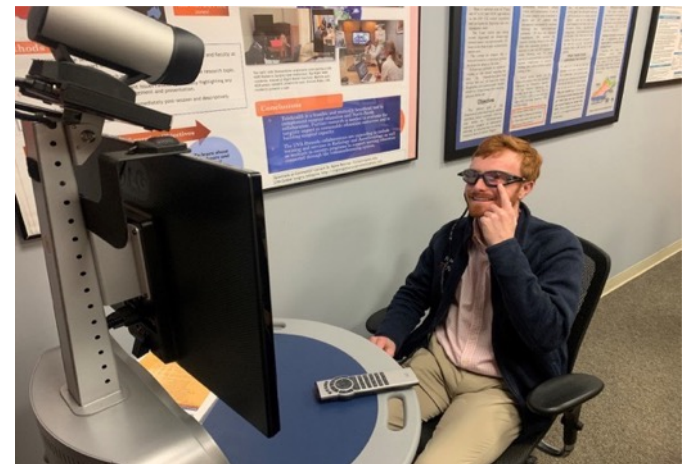
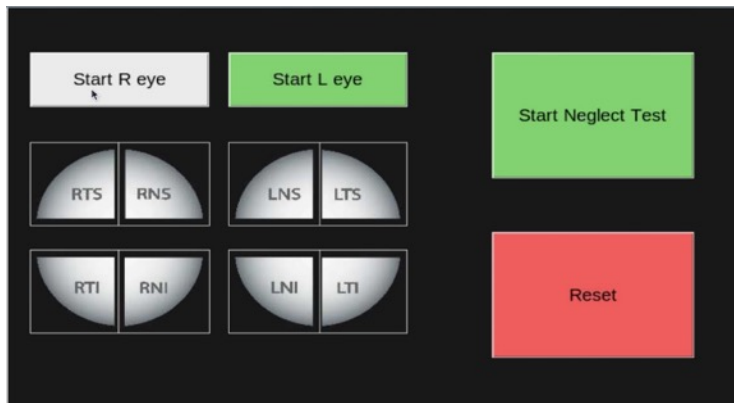


Notify – text
family/physician
when taken or
missed

Future Directions

VRAD – Visual fields Rapid Assessment Device

- Phase I – Human factors: safety, ease, comfort
- Phase II – Non-inferiority, validation
- Cost-effective? Transfers/INR



Summary

- **Telemedicine is old 70+ years!** – Telestroke took 40 years to be main-stream
- **Technology and reimbursement both drive & limit**, telestroke growth
- **Expanding pre- and post-hospital telestroke models**
 - **Mobile stroke units** – costly, useful in urban setting
 - **iTREAT models** – cheaper, reduce time to treatment
 - **iHEAL – post discharge home telehealth**– lower high risk stroke readmissions; promotes education & drug adherence
- **Future pre- and post hospital technology**
 - **AI assisted smart phone applications** – home/EMS assisted diagnosis
 - **Neuro Exam Peripherals: VRAD** - Acute visual field assessments – NIHSS points



Resources:

1) Evans MRB, White P, Cowley P, Werring DJ. Revolution in acute ischaemic stroke care: a practical guide to mechanical thrombectomy. Practical Neurology. 2017;17(4):252-265.

Comprehensive review of the trials and the technique

2) <https://www.pcworld.idg.com.au/slideshow/350404/history-video-calls-from-fantasy-flops-facetime/>

Review of the History of Video Calls

3) <https://www.jems.com/patient-care/mobile-stroke-units-a-device-in-search-of-an-indication/>

4) <https://pubmed.ncbi.nlm.nih.gov/30159610/>

5) Grotta, J.C., Yamal, J.-M., Parker, S.A., et. al., 2021. Prospective, Multicenter, Controlled Trial of Mobile Stroke Units. *New England Journal of Medicine* 385, 971–981. doi:10.1056/nejmoa2103879

Review of the data using Mobile Stroke Units 2017

6) The Efficacy of Community Paramedicine: A National Review of 1st Responder Attitudes, Misconceptions, and Advocacy for CP Programs; December 2019

DOI:[10.13140/RG.2.2.36079.36002](https://doi.org/10.13140/RG.2.2.36079.36002)

7) Champagne-Langabeer T, Langabeer JR, et.al. Telehealth Impact on Primary Care Related Ambulance Transports. *Prehosp Emerg Care*. 2019 Sep-Oct;23(5):712-717. doi: 10.1080/10903127.2019.1568650. Epub 2019 Feb 8. PMID: 30626250.

Telehealth paramedic programs including ETHAN

7) Chapman, Sherita, et al, A tablet-based option for prehospital neurologic assessment: The iTREAT Study, Neurology, 2016 Jul 5;87(1):19-26.