“There’s An App For That”

Technologies to Enhance Acute Stroke Assessment

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Technology Enables Use

https://www.iphonelife.com/content/evolution-iphone-every-model-2007-2016

iPhone
June 29, 2007
Display: 3.5”
Storage: 4, 8, or 16gb
Memory: 128MB
Camera: 2.0mp rear

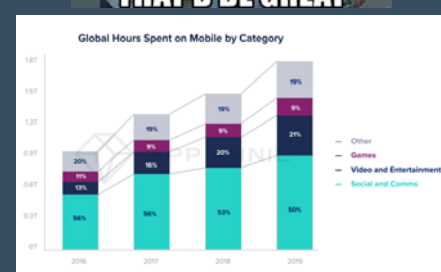
iPhone 11 Pro Max
September 20, 2019
Display: 6.5”
Storage: up to 512gb
Memory: 4GB
Camera: 3-12mp rear and dual 12mp front
Connectivity: 4G

Smartphones

- ✓ Connect
- ✓ Functional
- ✓ Entertain
- ✓ Efficient

Smartphone Usage

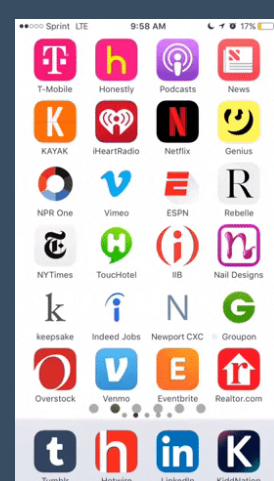
- In US smartphones checked ~160 times per day
- 90% of time spent on Apps
- 85% of users prefer mobile devices than desktops
- 56% of internet traffic generated through mobile phones



https://techcrunch.com/2020/01/15/app-stores-saw-record-204-billion-app-downloads-in-2019-consumer-spend-of-120-billion/?guccounter=1&guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xlLmNvbSB&guce_referrer_sig=AQAAAfdmYvOwx1aiX1H0v68LeEhW2AbtCN_48oYGQzTqM0qRCOMeg2hjkevHLCZh8MUr6tGWCtO1scb7Rf19Zr0BMSwhu0cg6eAT9xJ7k8zyiuv2U6X5HqphEAEXEF2Lh4ChEc6lvhn0Q_6KaK4gHshFjfeqmvHnu1d2wq05vWgQ#~:text=Consumers%20downloaded%20a%20record%20204,hours%20per%20day%20using%20apps.

Apps by the Numbers..

- July 2008: Apple's App Store went live
  - **10m downloads** in 1st week
- 204 billion apps downloaded in 2019
  - 45% increase from 2016
- 1.83m Apple + 2m Google Apps
- 2.71 billion smartphone users
- $189b spent on apps in 2020

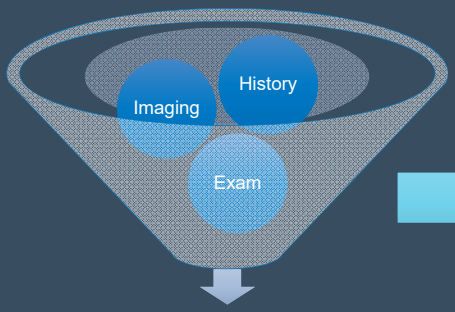


Apps Use In Healthcare

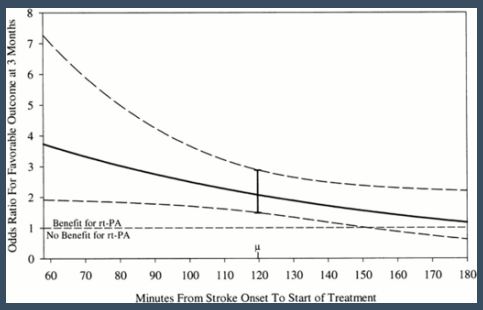
- 2/3 Large US hospitals offer Mobile Health Apps
- 90% of US physicians use a smartphone
  - Electronic Health Record
  - Communication
  - Imaging
  - Scheduling

Ozdalga E, Ozdalga A, Ahuja N. The smartphone in medicine: a review of current and potential use among physicians and students. *J Med Internet Res*. 2012;14(5):e128. Published 2012 Sep 27. doi:10.2196/jmir.1994

Does Stroke Need Apps?



Treatment
IV tPA
Endovascular Therapy

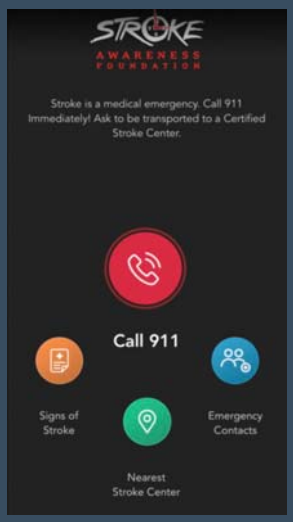


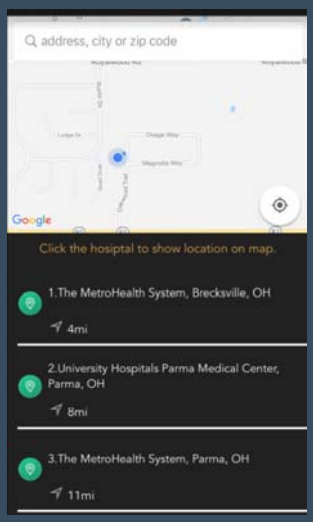
Patient Awareness

Stroke Awareness Foundation

- ¼ patients recognize stroke s/s
- Patients often don't recognize emergent nature of stroke
- Patients don't know where to go for stroke

Admission to designated stroke center associated with **more frequent stroke therapy and **lower mortality.**

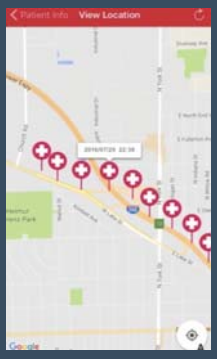


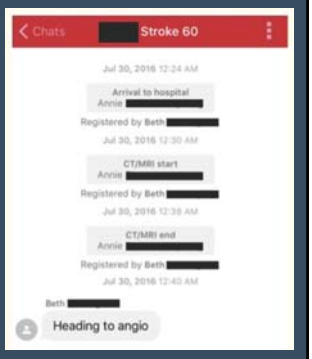


Pre-Hospital

Mobile Real-time Tracking of Acute Stroke Patients and Instant, Secure Inter-team Communication - the Join App

- Join Mobile Application studied between July 2016 and July 2017 to improve team communication and efficiency
  - Automated time stamps
  - geographic tracking of patients
  - Secure messaging
- Favorable impression of Join Application.
  - 95.2% of users felt app was easy to use
  - 85.7% recommended continued use
  - Reduced number of handoffs



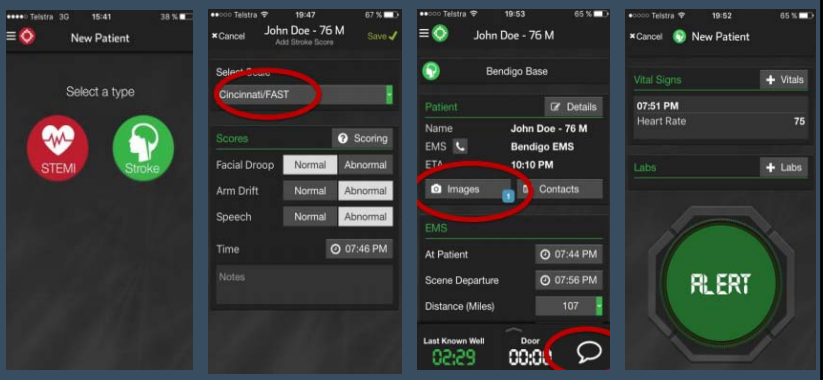


Munich SA, Tan LA, Nogueira DM, et al. Mobile Real-time Tracking of Acute Stroke Patients and Instant, Secure Inter-team Communication - the Join App. *Neurointervention*. 2017;12(2):69-76. doi:10.5469/neuroint.2017.12.2.69

Pre-Hospital

pulsara®

- Prehospital HIPPA-compliant EMS communication tool
- Facilitates communication between EMS and stroke team (ED/Neurology)
- Reduce redundant communication using different tools (phone, fax, pager, in person)
- Live video calling, secure messaging, data/benchmarking, image capture, and more.
- App use resulted:
  - DTCt: 23 min faster
    - Pre: 46min
    - Post: 23 min
  - DTN: 33 min faster
    - Pre: 111 min (n=5)
    - Post: 78 min (n=9)

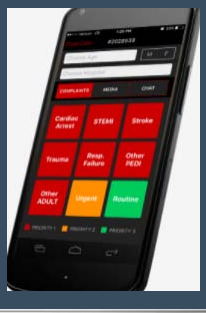


https://www.pulsara.com/

Pre-Hospital

twiage

- Secure, HIPPA-compliant mobile and web dashboard that communicates real-time info from EMS to hospital
- Reduces radio calls by 95%
- Track EMS via GPS for more accurate ETA

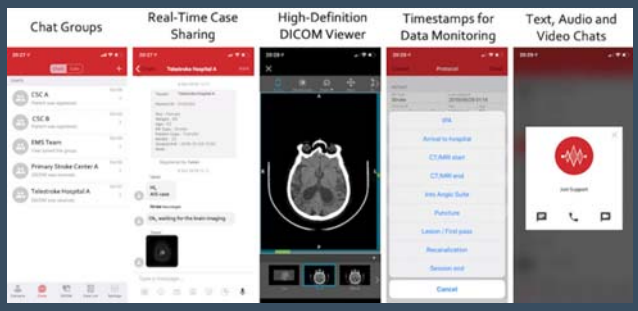


https://www.twiagemed.com/ed/

Hospital

Validation of a Smartphone Application in the Evaluation and Treatment of Acute Stroke in a Comprehensive Stroke Center

- JOIN App evaluated to expedite decision making in acute stroke
- 720 code strokes from 12/2014 to 12/2015 evaluated by residents then JOIN teleconsult by stroke neurologist
- Stroke neurologist viewed images on mobile dicom viewer
- Reduced DTN (90min pre, 63min post p= 0.03)
- 100% agreement between PACS image and mobile app dicom image interpretation

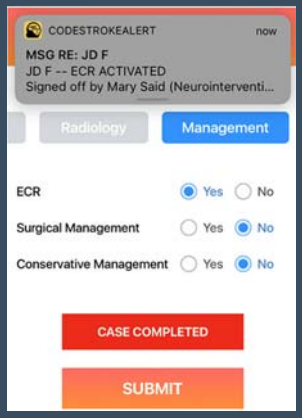


https://doi.org/10.1161/STROKEAHA.119.026727Stroke. 2020;51:240–246

Hospital

CODE STROKE ALERT

- Multidisciplinary team designed a mobile application that links all relevant stroke team members
  - Geotagging
  - Tiered notifications
  - Clinical scores (NIHSS, mRS)
  - HIPPA-compliant secure messaging
  - Web application
- Pathway from paramedic to hospital admission
  - Paramedics complete stroke scale and input basic information
  - ED staff triage and arrange for bed, IV, serology, and transfer to CT
  - Radiographers receive code stroke and prepare scanner
  - Radiologist receives notification and prioritizes review of images
  - Stroke Team receives early notification and logs NIHSS, reviews imaging with neuroradiology, and makes treatment decision
  - Neurointerventional team notified by app if EVT candidate.
  - Stroke ward notified of final treatment decisions
- Currently being studied in Australia



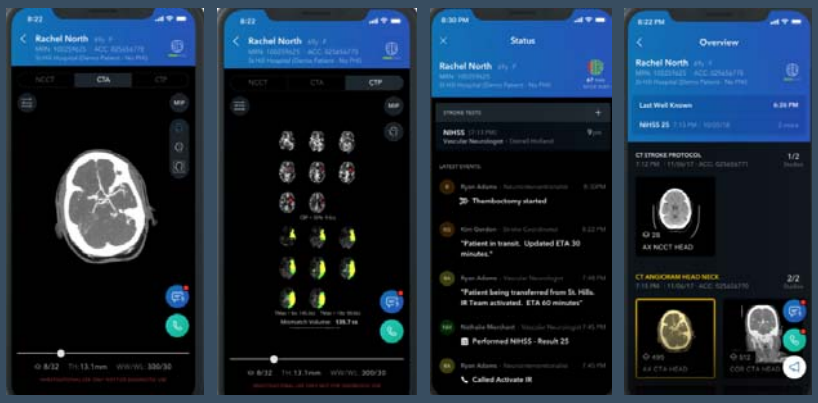
https://doi.org/10.3389/fneur.2019.00725

Imaging

- AI powered mobile application provides automated image analysis in minutes

- Imaging
  - CTH
  - CTA
  - CTP analysis
  - LVO detection
  - ICH detection

- Communication
  - Forum messaging
  - Involve pertinent team members
  - Call directly within APP



https://www.viz.ai/

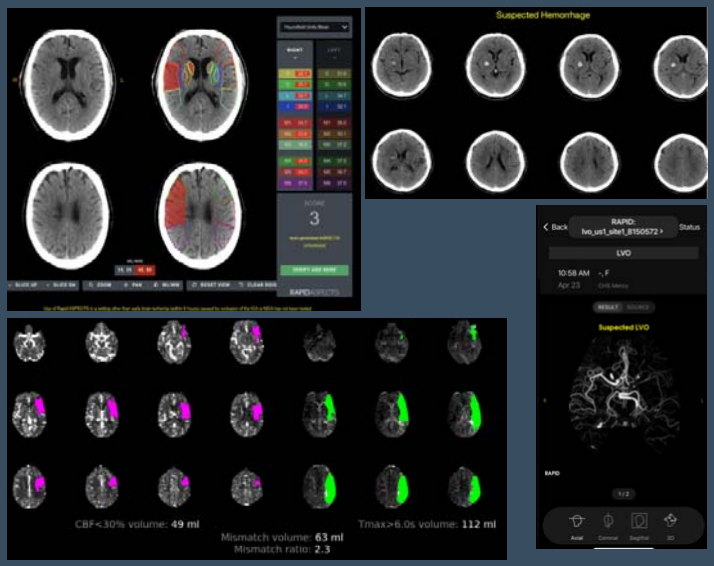
Imaging

- AI powered mobile application provides automated image analysis in minutes
- Imaging:
  - Rapid ASPECTS
  - CTA
  - CTP
  - ICH
  - LVO

- Communication
  - Forum messaging

- Web platform (coming soon)

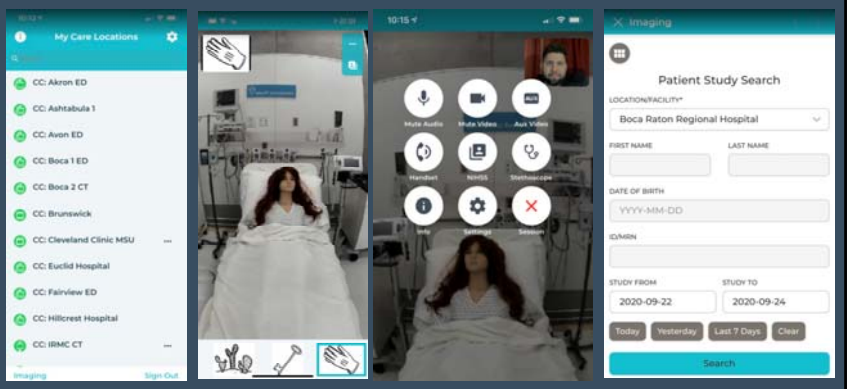
*Used in 4 major randomized EVT trials



https://www.rapidai.com/

Telestroke

- Telestroke one of the fasting growing telemedicine applications
  - Improves access to stroke specialists
  - 34% of Americans live >60min from nearest PSC
  - Increased IV thrombolysis and decreased incorrect treatment decisions
- InTouch/Teladoc provides a secure video connection
  - Mobile/Tablet
  - Desktop/laptop
- Imaging solution
  - SurePACS



Amorim E, Shih MM, Koehler SA, Massaro LL, Zaidi SF, Jumaa MA, Reddy VK, Hammer MD, Jovin TG, Wechsler LR. Impact of telemedicine implementation in thrombolytic use for acute ischemic stroke: the University of Pittsburgh Medical Center telestroke network experience.**J Stroke Cerebrovasc Dis**. 2013; 22:527–531. doi: 10.1016/j.jstrokecerebrovasdis.2013.02.0

https://intouchhealth.com/telehealth-solutions/stroke/

Telestroke

- Secure Video connection
  - Mobile App
  - Tablet
  - Laptop/desktop
- Imaging viewing
- EHR integration
- Amwell equipment in over 2000 hospitals
- Acquired Avizia in 2018 – Leader in acute care telemedicine including acute stroke

https://business.amwell.com/service-lines/telestroke/

Apps in Acute Stroke Research

- Acute stroke research also time sensitive
- Narrow windows for patient recruitment
- Mobile applications can enroll patients by facilitating:
  - Prescreening tools
  - Eligibility criteria
  - Enrollment
  - Randomization
- Used in ATACH II (Antihypertensive Treatment in Acute Cerebral Hemorrhage trial) and CLEAR-IVH (Clot Lysis Evaluating Accelerated Resolution of Intraventricular Hemorrhage

Qureshi A, Connelly B, Abbott E, Maland E, Kim J, Blake J. Mobile applications for handheld devices to screen and randomize acute stroke patients in clinical trials. *J Vasc Interv Neurol*. 2012;5(supp):26-29.

There's An App for That

- Apps can be a useful tool in the evaluation and treatment of acute stroke
- Combine several functions into 1 easy to use app
  - Communication
  - Image viewing
  - Image analysis
  - Videoconferencing
- Reduce bottlenecks
- Reduce redundancy
- Improve treatment times and outcomes
- Limited by cost

Cleveland Clinic
Every life deserves world class care.