A WEARABLE TELEMEDICINE DEVICE FOR ACUTE STROKE ASSESSMENT: THE NEUROEGG STUDY

WILLIAM M. CLARK MS3

5th Annual Brody Medical Education Day
April 10, 2019

TELEMEDICINE

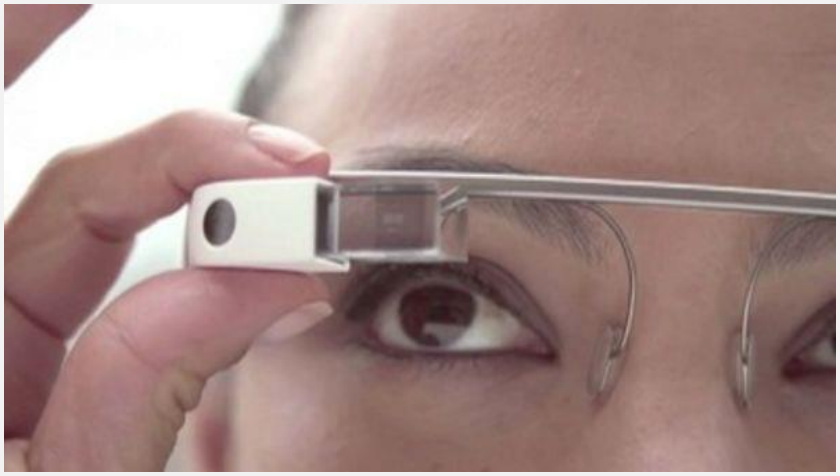
- Reduces healthcare costs
- Addresses physician shortages
- Allows for specialty care in remote and underserved areas

TELEMEDICINE IN MEDICAL EDUCATION

- AMA encourages core competencies in telemedicine for medical trainees[1]
- Advantages
  - Enhances medical trainee education and evaluation
  - Augments student preparedness and decision making[2]

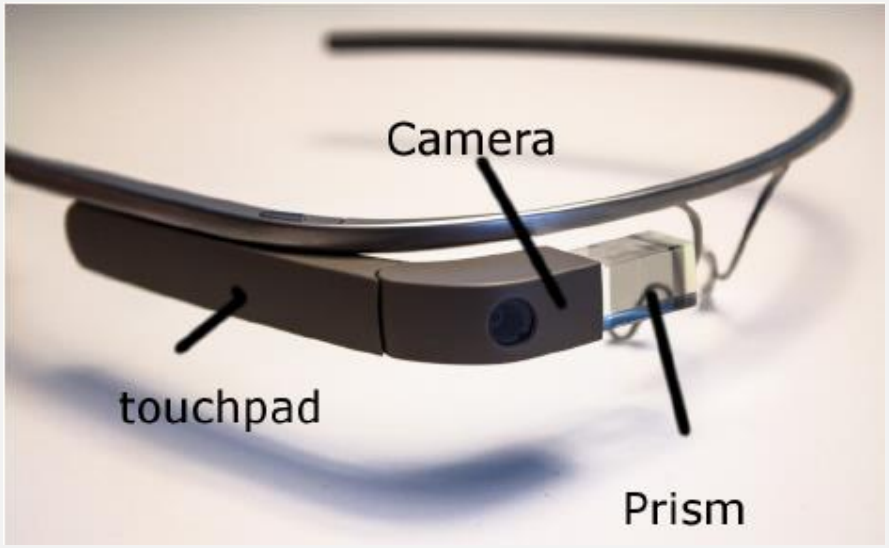
WEARABLE TELEMEDICINE

- Google Glass (GG) is a wearable device with telemedicine capability
- GG provides hands-free applicability for remote supervision and education at a much lower cost than traditional stationary telemedicine endpoints



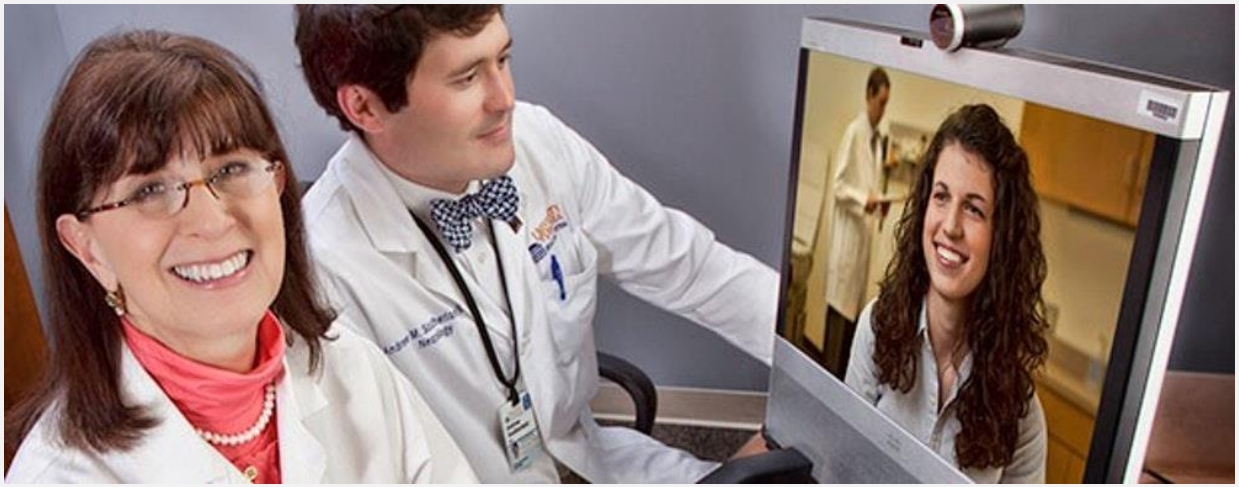
GOOGLE GLASSES

- $1, 500- 3,000/ unit[3]
- Capabilities: Live video teleconferencing (VTC), photo and video capture, and custom prism displays



NEUROEGG STUDY

- Neurology Resident Evaluation Using Google Glass (NeuRoEGG)
- PI: Dr. Andrew M. Southerland– Executive Vice Chair, Department of Neurology at the University of Virginia and Brody Scholar (2006)



RATIONALE FOR NEUROEGG

- Continuous in-person supervision of neurology residents is a challenge
- Acute stroke evaluations are time-sensitive
- Initial diagnosis and decision making depends on the examination

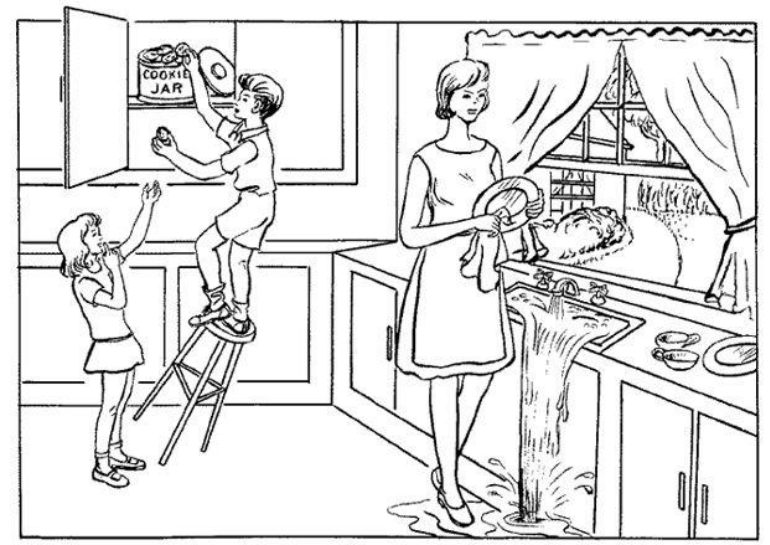
"Time is brain"

METHODS

- GG was paired with a HIPPA-compliant application for live video teleconferencing (VTC)
- During acute stroke evaluations, residents were simultaneously observed by an attending in-person and via live VTC
- Assessments were performed in the ED, Stroke unit, and Neurological ICU (Total=17)

METHODS

- Remote and in-person attending agreement was determined via the 11-item NIH Stroke Scale
- Total and individual components of the NIH stroke scale scores were compared using weighted Cohen's kappa statistics



NIH STROKE SCALE

Patient Identification. ___ ___-___ ___ ___-___ ___ ___

Pt. Date of Birth ___ ___/___ ___/___ ___

Hospital _____(___ ___-___ ___)

Date of Exam ___ ___/___ ___/___ ___

Interval: [ ] Baseline [ ] 2 hours post treatment [ ] 24 hours post onset of symptoms ±20 minutes [ ] 7-10 days [ ] 3 months [ ] Other _____(___ ___)

11. Extinction and Inattention (formerly Neglect): Sufficient information to identify neglect may be obtained during the prior testing. If the patient has a severe visual loss preventing visual double simultaneous stimulation, and the cutaneous stimuli are normal, the score is normal. If the patient has aphasia but does appear to attend to both sides, the score is normal. The presence of visual spatial neglect or anosagnosia may also be taken as evidence of abnormality. Since the abnormality is scored only if present, the item is never untestable.	0 = **No abnormality.** 1 = **Visual, tactile, auditory, spatial, or personal inattention** or extinction to bilateral simultaneous stimulation in one of the sensory modalities. 2 = **Profound hemi-inattention or extinction to more than one modality;** does not recognize own hand or orients to only one side of space.	____

RESULTS

- In-person and remote attendings' total NIHSS scores demonstrated almost perfect agreement [Cohen's kappa=0.84; CI (0.73-0.96)]
- Weighted kappa statistics for individual NIHSS items varied:
  - Strongest agreement: Best gaze and motor leg

RESULTS

Kappa statistic	Strength of Agreement
<0.00	Poor
0.00-0.20	Slight
0.21-0.40	Fair
0.41-0.60	Moderate
0.61-0.80	Substantial
0.81-1.00	Almost Perfect

Table I. Weighted Kappa Interpretation Scale

NIHSS Item	κ	95% CI
LOC	0.57	(0.1-1.0)
Gaze	1.00	(1.0-1.0)
Visual	0.54	(0.08-1.0)
Facial Palsy	0.27	(-0.13- 0.67)
Motor Arm	0.71	(0.51-0.9)
Motor Leg	0.81	(0.7-0.9)
Ataxia	0.47	(0.12-0.81)
Sensory	0.76	(0.44-1.0)
Language	0.68	(0.3-1.0)
Dysarthria	0.24	(-0.17-0.66)
Extinction	*	*
Overall	0.84	(0.73-0.96)

Table II. In-person vs. Remote Attending NIHSS Agreement

CHALLENGES ENCOUNTERED

- Logistical and time constraints resulted in slower than anticipated enrollment (N=17)
- Aligning attending and resident call schedules required substantial administrative support
- Altering stroke code protocols necessitated resident buy-in

LESSONS LEARNED

- GG allowed remote supervising physicians to provide accurate hands-free teleconsultation to residents in the acute stroke setting
- Inheriting the learner's visual perspective introduced a novel approach to assess examination skills

NEXT STEPS

- Feasibility testing in the outpatient setting
  - Is GG more effective with increased schedule flexibility?
- Resident and patient satisfaction surveys
  - Is GG distracting to the user or patient?

ACKNOWLEDGEMENTS

- PI and Mentor: [1, 2]Andrew M. Southerland MD, MSc
- NeuRoEGG Team: [1]Joseph Carrera, MD; [1]Connor Wang, BA; [1]Haydon Pitchford, BA; [1]Nichole Chiota-McCollum, MD; [1,2]Bradford B. Worrall MD, MSc
- [1]Departments of Neurology and [2]Public Health Sciences- University of Virginia Health System
- Study was supported by educational grants from the American Academy of Neurology, American Brain Foundation, and American Board of Psychiatry and Neurology. Additional hardware support was provided by Pristine Inc. (Austin, Tx)

RESOURCES

- Images:
- https://www.healthleadersmedia.com/innovation/4-ways-telemedicine-changing-healthcare (Slide 1)
- https://innovatemedtec.com/digital-health/telehealth-telemedicine-connected-health%20 (Slide 2)
- https://medtechboston.medstro.com/blog/2014/04/21/bwh-google-glass-the-radically-reinvented-wearable-ehr/ (Slide 3)
- https://www.business2community.com/tech-gadgets/5-reasons-google-glass-miserable-failure-01462398 (4)
- https://news.virginia.edu/content/uva-health-system-swinfen-charitable-trust-verizon-foundation-join-accelerate-and-expand (7)
- http://www.nihstrokescale.org/ (8)
- https://www.bizjournals.com/cincinnati/news/2016/04/25/trihealth-invests-in-groundbreaking-google-glass.html
- Content:
- 1. https://www.ama-assn.org/press-center/press-releases/ama-encourages-telemedicine-training-medical-students-residents
- 2. Jagolino AL, Jia J, Gildersleeve K, Ankrom C, Cai C, Rahbar M, Savitz SI, Wu TC. A call for formal telemedicine training during stroke fellowship. Neurology [Internet]. 2016 May 10;86(19):1827-33.
- 3. Knight HM, Gajendragadkar PR, Bokhari A. Wearable technology: Using google glass as a teaching tool. BMJ Case Rep [Internet]. 2015 May 12;2015:10.1136/bcr-2014.

CONTACT INFORMATION

- William M. Clark
- MS3 Brody School of Medicine
- clarkwi17@students.ecu.edu

THANK YOU