Using Technology to Help with Quality, Staffing and Economics: Pre-Ops at Home

The Economic Reality: Disruption of the Healthcare Clinic by technology

- The costs of United States (US) healthcare continues to escalate despite recent healthcare reforms
- Administrative and overhead costs are a major reason for elevated healthcare costs in the US compared to other industrial nations [1]
- Brick and mortar clinic locations for patient care are expensive with respect to space, overhead and staffing costs.
- Medical systems need to scale in size and geography in the setting of lower overall reimbursements, which forces patients to access the healthcare system from increasingly larger distances [2]
- Technology has always been a market enabler for disruptive business models to deliver products and services for less overhead cost[3]
- Steep rise in mobile technology adoption provides a platform for disruptive healthcare models not only for medicine but particularly for anesthesiologists

The Business Case for Virtual Pre-Ops:

A new, highly connected, healthcare consumer

- The 30-49 year old demographic will be accessing the healthcare system with greater frequency in the next two decades
- Smartphone adoption in this demographic has increased to over 89%[4]
- This demographic expects "just-in-time" delivery of services as demonstrated by the market demand for "Uberized" services (i.e. rideshares, freelance work, haircuts, massages, grocery delivery, package delivery)
- Smartphone technology enables high-fidelity interactions across the mobile phone network and cloud including high-quality photos, video interaction, text-enabled chat devices
- Smartphones are easily connected to peripheral devices such as credit card readers, microphones, and even ECGs and stethoscopes that can integrate data into the mobile phone

Follow the Money: Larger investments into virtual clinics and telemedicine

- Large employers are looking to contract with health systems that offer alternative access to their customers[5]
- Over 71% of employers are offering services for telemedicine to their customers[5]
- Healthcare clinics that have first mover advantages in telemedicine technology (i.e. One Medical Group and Forward) have receive increasingly larger investments by venture capital companies[6]
- The healthcare system is investing more resources towards bundled care pathways – an important tenet into achieving value-based healthcare processes

The Pre-Operative Clinic: Anesthesia's opportunity to incorporate technology for disruption

- Almost half of inpatient stays are due to an operative procedure[7]
- Pre-operative assessments by anesthesiologists show promise for decreasing inpatient mortality for elective surgery[8]
- The pre-operative clinic is our major outpatient portal with patients (other than chronic pain clinics)
- The optimal business model for pre-operative clinics is still challenging to create, which necessitates technology use to decrease the administrative and staffing costs

Virtual Pre-Ops in Anesthesia: Past, Present and Future

The Past: Anesthesia's vast experience with telemedicine

- Anesthesiology has over a decade of experience with telemedicine
- First case series for virtual preoperative anesthesia consultation was in 2004 with 10 patients using a mobile viewing monitor with a mounted camera and operated by a nurse at a remote consulting site[9]
- In 2011, Galvez and Rehman reviewed the few existing pilot projects using telemedicine for pre-operative consultation [10]
- In 2013, Applegate and colleagues conducted a randomized controlled trial of using virtual pre-ops on 200 patients scheduled for head and neck surgery and demonstrated cost-savings with respect to decreased travel costs, lost work days, and childcare without cancellations or surgical delays [11]
- A case report exists for telemedicine-based airway assessment[12]
- In 2015, Roberts and colleagues demonstrated patient perceptions with virtual preoperative anesthesia clinics in the remote Northern Territory of Australia amongst 27 patients [13]

The Present: Virtual Pre-Ops at UCLA

- Patients can conduct virtual preoperative assessments via desktop, laptop, tablet, and mobile phone
- We have conducted over 250 virtual pre-ops with patients at home or from their work office in 2017-2018
- Virtual visits have become the default form of assessment for pre-operative evaluation
- Anesthesiology has the highest use rate for virtual clinics across the UCLA health system
- Evaluations are completed within 30 minutes (including documentation) using only an attending anesthesiologist and resident. Additional staff was unnecessary for the evaluations
- Airway assessments and image capture of the airway are integrated directly into the EHR chart and in the pre-operative documentation
- Virtual pre-ops were initially conducted using the HIPAA-compliant Zoom.com platform. UCLA now has integrated its virtual visits directly into the EPIC-based EHR.

- Case cancellation rate was 1.51% and the encounters significantly altered pre-operative management in 3.02% of cases.
- Patients saved over 10,000 one-way miles in driving to UCLA in 2018 which accounts for more than $5000 out-of-pocket patient dollars saved.

The Patient Experience: High Satisfaction Rates

- 97.5% describe being "satisfied" or "very satisfied" with their virtual pre-op evaluation
- 87.5% prefer a virtual visit over a traditional, in-person, anesthesia assessment
- 93.8% of patients could clearly hear and see the anesthesiologist during the evaluation
- The patient access of the virtual pre-op link to the video portal was the greatest impediment to full patient satisfaction with the service

High Mobile Integration: Patient Entered Flow Sheets

- At consultation, many patients have their mobile accessory devices activated to share data directly with the EHR using "patient entered flow sheets"
- Accessory devices include Bluetooth-enabled glucometers, weight scales, smartwatches, actigraphs, and pulse-oximetry monitors.

Case Examples: From Pre-habilitation to pain management to surgical follow-up

Case 1: Remotely monitoring diuresis in a patient with congestive heart failure scheduled for elective surgery.

Case 2: Anticipating chronic pain exacerbation using step counts

Case 3: Post-surgical quality of life assessment using patient-entered flowsheets in a patient with a complicated post-surgical course.

Financing Virtual Visits: The Reimbursement Paradox

- Medicare, largely, does not support or reimburse "store and forward" telemedicine activities by telemedicine programs except for Alaska and Hawaii.
- Medicare does reimburse live, virtual patient interactions as well as 30-minute or more remote monitoring of patients at select, rural, care locations (Codes GVCI1 and GRAS1).
- Medicaid program reimbursement varies on a state-by-state basis
- CMS recently signaled proposals for remote physiologic monitoring and internet consultations [14]
- Controversy still exists for E&M billing that distinguishes itself from surgical DRG codes

The Future: Remote Patient Monitoring

- Large growth and investments into wearable technology
- Information technology and finance sectors are making large investments into healthcare including Apple, Google, Amazon, JP Morgan, and Berkshire Hathaway.
- Khosla Ventures and other investment firms taking risks with companies that use mobile technologies to monitor patients with chronic conditions

- Market is being flooded with mobile-integrated devices such as glucometers, smartwatches, movement analysis, sensor-enabled clothing, voice analysis, and ECG sensors.

Deep Learning: Artificial Intelligence and Beyond

- Much interest in Deep Learning by both academic institutes and industry[15] [16]
- Google Brain and Google AI teams claim that deep learning has the potential to transform and revolutionize healthcare[15]
- Immediate applications to anesthesiology include improved and novel risk stratification strategies for patients scheduled for surgery and difficult airway prediction using image analysis and machine learning.
- Deep learning techniques can apply computational methods such as back propagation[17] to find more subtle predictors for anesthesia risk such as MACE or difficult airway using large, multivariable, datasets and high-fidelity image and video analysis.
- Deep learning and AI may pave roads towards a AI—physician care team model for perioperative medicine and management

Citations:

1. Papanicolas I, Woskie LR, Jha AK. Health Care Spending in the United States and Other High-Income Countries. JAMA 2018;319(10):1024–39.

2. Regev A, Mahajan A. Integrating Academic and Private Practices: Challenges and Opportunities. Anesthesiology Clinics 2018;36(2):321–32.

3. Christensen C, Grossman J, Hwang J. The Innovator's Prescription: A Disruptive Solution for Health Care. 1st Edition. New York, N.Y., United States, New York, N.Y.: McGraw-Hill Education; 2009.

4. Mobile Fact Sheet [Internet]. Pew Research Center: Internet, Science & Tech. 2018 NW 1615 L. St, Washington S 800, Inquiries D 20036 U-419-4300 | M-419-4349 | F-419-4372 | [cited 2018 Jun 19]; Available from: http://www.pewinternet.org/fact-sheet/mobile/

5. Mercer | National Survey of Employer-Sponsored Health Plans 2017 [Internet]. [cited 2018 Sep 25]; Available from: https://www.mercer.us/what-we-do/health-and-benefits/strategy-and-transformation/mercer-national-survey-benefit-trends.html

6. One Medical Group: The Potential Uber of Healthcare – Digital Innovation and Transformation, Harvard Business School. [cited 2018 Sep 25]; Available from: https://digit.hbs.org/submission/one-medical-group-the-potential-uber-of-healthcare/

7. McDermott KW, Elixhauser A. Overview of Operating Room Procedures During Inpatient Stays in U.S. Hospitals, 2017. HCUP Statistical Brief #233, 2017

8. Blitz JD, Kendale SM, Jain SK, Cuff GE, Kim JT, Rosenberg AD. Preoperative Evaluation Clinic Visit Is Associated with Decreased Risk of In-hospital Postoperative Mortality. Anesthes 2016;125(2):280–94.

9. Wong DT, Kamming D, Salenieks ME, Go K, Kohm C, Chung F. Preadmission Anesthesia Consultation Using Telemedicine Technology: A Pilot Study. Anesthes 2004;100(6):1605–7.

10. Galvez JA, Rehman MA. Telemedicine in anesthesia: an update. Current Opinion in Anaesthesiology 2011;24(4):459–62.

11. Applegate RL, Gildea B, Patchin R, et al. Telemedicine Pre-anesthesia Evaluation: A Randomized Pilot Trial. Telemedicine and e-Health 2013;19(3):211–6.

12. Dilisio RP, Dilisio AJ, Weiner MM. Preoperative virtual screening examination of the airway. Journal of Clinical Anesthesia 2014;26(4):315–7.

13. Roberts S, Spain B, Hicks C, London J, Tay S. Telemedicine in the Northern Territory: An assessment of patient perceptions in the preoperative anaesthetic clinic. Australian Journal of Rural Health 23(3):136–41.

14. Proposed Policy, Payment, and Quality Provisions Changes to the Medicare Physician Fee Schedule for Calendar Year 2019 [Internet]. Centers for Medicare & Medicaid Services; 2018. Available from: https://www.cms.gov/Newsroom/MediaReleaseDatabase/Fact-sheets/2018-Fact-sheets-items/2018-07-12-2.html

15. Hinton G. Deep Learning—A Technology With the Potential to Transform Health Care. JAMA 2018;320(11):1101–2.

16. Stead WW. Clinical Implications and Challenges of Artificial Intelligence and Deep Learning. JAMA 2018;320(11):1107–8.

17. Rumelhart DE, Hinton GE, Williams RJ. Learning representations by back-propagating errors. Nature 1986;323(6088):533–6.