Digital Orthopaedics

The ADJACENT POSSIBLE

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Conflicts of Interest

- Cloudmedx.com
- CaptureProof.com
- Stryker – consultant
- Johnson and Johnson – consultant
- Medacta – research support
- AAOS – Committee
- AAHKS – Digital Health Committee Chair
State of the Art in Medicine
Most cars have about 50 sensors and 5 Microprocessors and have a DASHBOARD.
Information overload
Reimbursement

Billing Services

- Reporting
- Eliminate Claim Denials
- Eligibility Verification
- Claim Submission
- Patient Billing
Payer Challenges

Projected Annual Cost of Health Care in the United States
Dollars in Billions

SOURCE: Centers for Medicare and Medicaid Services, 2015
Technology to the rescue
MCKINSEY Digital Advancement by Sector

HEALTH CARE LAGS WAY BEHIND

How Digitally Advanced Is Your Sector?
An analysis of digital assets, usage, and labor.

- Knowledge-intensive sectors that are highly digitized across most dimensions
- B2B sectors with the potential to digitally engage and interact with their customers
- Labor-intensive sectors with the potential to provide digital tools to their workforce
- Capital-intensive sectors with the potential to further digitize their physical assets
- Service sectors with potential to digitize customer transactions
- Quasi-public/highly localized sectors that lag across most dimensions

SOURCE: DATA ANALYSIS AND EXPERT INTERVIEWS CONDUCTED BY THE MCKINSEY GLOBAL INSTITUTE © HBR.ORG
DIGITAL HEALTH FUNDING SNAPSHOT: YEAR OVER YEAR

Over $8B have fueled new business models, increased demand, spurred a digital health revolution, and globalized what is now possible.

Momentum across pharma, provider, payor landscapes have culminated in a record year of funding and ushered in a new wave of entrants. In today’s climate of political change, and uncertain policy future, there is little doubt from investors that the health sector is in its moment of creative destruction.

“We're in the midst of a revolution. Every 50 years you see a massive revolution in healthcare and the next one is due for 2020.”

Kimberly Muller, Director of Technology Transfer, UC Innovations
StartUp Health NOW! Episode #101
DIGITIZING THE HEALTH CARE DELIVERY MODEL
Near future Vision for Orthopedics
Digital Orthopaedics: a definition

- The application of digital technology and data driven analytics to optimize the practice of orthopedics and the personalized management of musculoskeletal patients.
The Digital Health Buckets for MSK care

- 3D printing
- Robotics
- System Integration
- Big data and Analytics
- Tele-health
- Sensors
- Virtual reality
- Augmented reality
- Gaming and behavior change
- Natural Language Processing
- Sentiment Analysis
- Social Media
- Genomics
- Care Pathways
- IoT
- Halograms
- Security
- Exoskeletons
Health Care Experience in Orthopedics

- CLINIC
- SURGERY
- POST-OP
THE CLINIC EXPERIENCE
Mercy Virtual Medical Center

- Safewatch: manages 30 ICUs in 5 states
- Telestroke: EDs without access to a neurologist
- Virtual Hospitalists: can order tests, view results, do virtual rounds
- Home monitoring: monitor 3800 patients at home
MICROSOFT and HEALTH CHAT BOTS

- Text messaging based triage
- Direct patient to appropriate provider or resource
- Schedule appointments
Social media
Survey: 54 percent of millennials look online before choosing a doctor

By Jonah Comstock  |  August 31, 2015

Millennials are more likely than baby boomers to crowdsource their choice of physician, both online and in-person with friends, according to a new 3,000-person survey from Nuance.

"We know a huge number of patients today are looking up symptoms and health information online, so it's just a matter of time until they shop for physicians and communicate grievances that way, too," Dr. Tony Oliva, national medical director at Nuance, said in a statement. "These are informed healthcare consumers who, if they feel rushed, are likely to share criticism online. Healthcare organizations need to find ways to help physicians optimize time spent with their patients and to protect their reputations."
Our platform was built to make collecting outcomes possible

Reporting PROs

**Hands Off for You**
We connect directly with your patients, on your behalf, 100% out of office.

**85%+ Capture Rate**
Across ALL intervals. No other patient-reported outcomes vendor achieves a higher capture rate.

**Robust Reporting**
Our fully customizable patient-reported outcome reports are designed with your goals in mind.

**Dedicated Support**
CODE is your dedicated outcomes team, ensuring you collect the most robust data possible.
Data Entry
Digital Scribes
EHR and FHIR standards: a common language
AI, Big data and Machine Learning

- Agfa, Siemens and IBM Watson

- Chest X-ray:
  - Review all prior films and read reports
  - Dx: small-cell lung cancer 95%

- EMR:
  - Summarize clinical history
CONFLUENCE

- ML
- AVATARS
- NLP
- Sentiment Analysis

- EMOTIONALLY RESPONSIVE AI powered BOTS...
Surgery/Hospital
Artificial Intelligence in the Hospital

- Resource allocation
- Process Optimization
AI in the operating room
LeenTaas.com

• UC Health Colorado
• AI based scheduling tool
• Revenue increased 4% ($15M) per year
VR education
Augmented Reality in Orthopaedics
MR and Holograms (MS Hololens)
Smart Implants
ROBOTICS
Humanoid Robots: Meet Pepper
Value-based payments are forcing a massive transfer of risk onto providers

**Payers**
- Humana
- Walmart
- CMS

Risk transfer
- $500B+ (2015)

**Providers**
- BPCI-A / CJR / Commercial Bundles
- Accountable Care Orgs (ACOs)
- Medicare Advantage (MA)
- Integrated Delivery Networks (IDNs)
- $2T+ (2025)

Dollars linked to value and/or quality
STRATIFY PATIENT RISK DYNAMICALLY (CLARIFYHEALTH)

Patient profiles with 200+ risk factors, including social determinants

Stratify and track member risk in real-time for cost, quality, and outcomes

Comprehensive personal member profiles comprise 200+ risk factors—clinical, social, and demographic
WHICH SPECIALISTS ADD THE MOST VALUE?

Identify variations in care, episode cost, case-mix, etc.
Post op
Telepresence Robots: Meet VGo
Telerehabilitation: CaptureProof.com
Patient Engagement Platforms: HealthLoop
Wearable Activity Sensors: Pt. doing great...
Patient who is not doing so great
Machine Learning: grouping patients into clusters that predict PRO results
PAI (measure of overall metabolic output)
Why now?
The adjacent possible:

*Where good ideas come from.*
Steven Johnson 2011

Innovation usually happens in the realm of the adjacent possible
(The realm of possibilities available at any given moment)
The Adjacent Possible

Great ideas beyond the adjacent possible are doomed to be short term failures
April 3, 1968
Logarithmic pace of change in computing
Moore’s Law in practice

Moore’s Law – The number of transistors on integrated circuit chips (1971-2016)

Moore’s law describes the empirical regularity that the number of transistors on integrated circuits doubles approximately every two years. This advancement is important as other aspects of technological progress – such as processing speed or the price of electronic products – are strongly linked to Moore’s law.
Cost of computing power = iPad2

Note: The iPad2 has computing power equal to 1600 million instructions per second (MIPS). Each data point represents the cost of 1600 MIPS of computing power based on the power and price of a specific computing device released that year.

Source: Moreavee n.d.
% of U.S. adults who own the following devices

Source: Surveys conducted 2002-2018.
PEW RESEARCH CENTER
The *Possible* changes daily

- 60x data transmission speeds
- 60x computational power
- -90% energy use
- Memistors (Transistors that act like neurons)
- Voice recognition that does not require voice
- Brain to Machine interfaces that allows you to access the web by thinking about it
- Biologics, 3D printing, etc
The Digital Orthopedic Revolution: Adjacent...
Possible.
ATM
Data Access
Interoperability
Cyborgs