UCSF Department of Orthopaedic Surgery

Digital Health Apps

Are they helping and worth the investment?

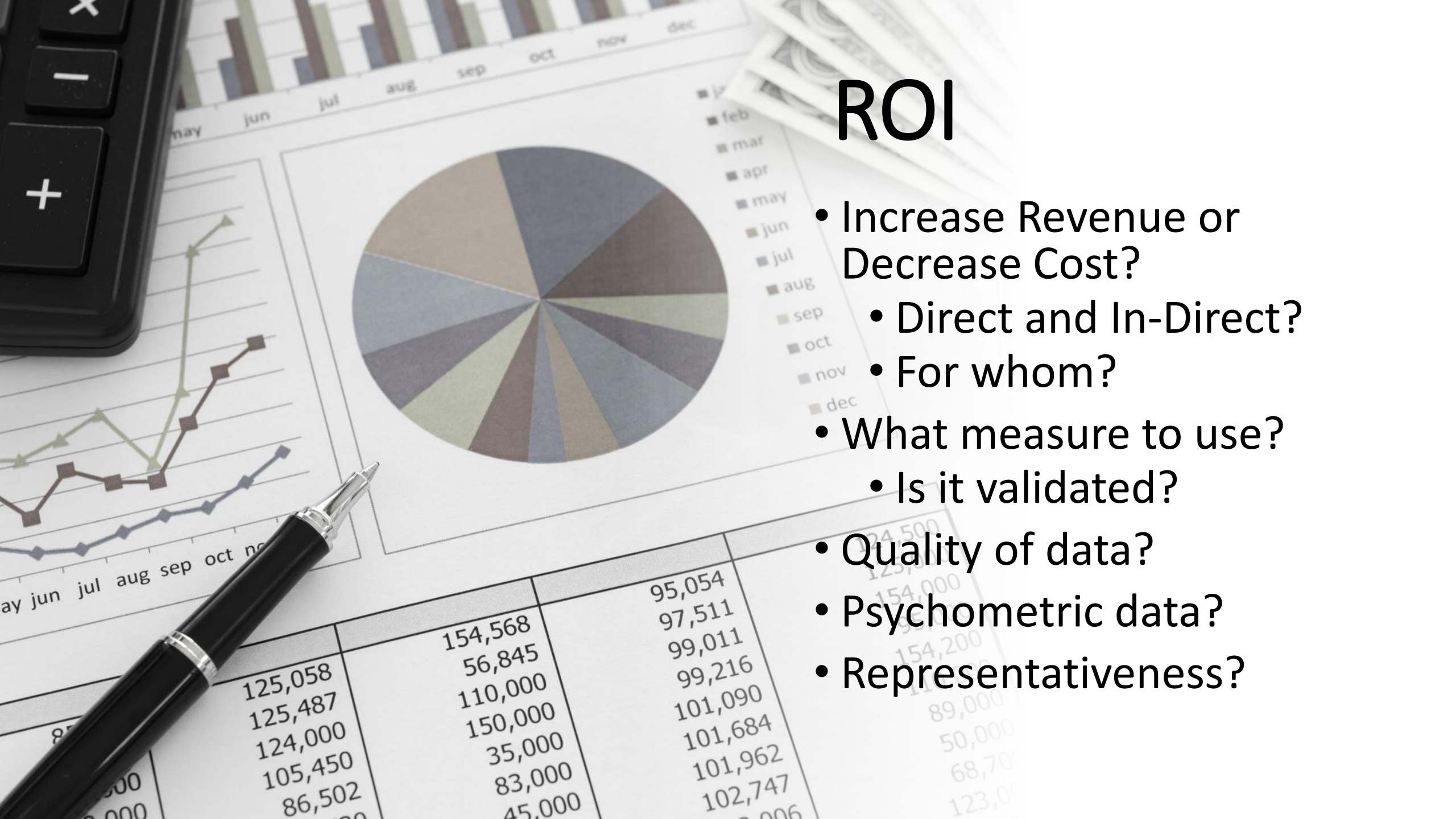
Stefano A. Bini MD Professor Orthopaedic Surgery UCSF

Conflicts of Interests

- Consultant for Stryker Corporation
- Advisor
  - Sira Health
- Formerly advised
  - CloudMedx
  - InSilico Trials
  - Capture Proof
- Grant from Google ATAP division
  - Sensors, AI and Predictive Analytics for Gait
- Journal of Arthroplasty
- Arthroplasty Today
- Journal of Orthopaedic Experience and Innovation
- Founder and VP of the Personalized Arthroplasty Society
- Founder and Chair Digital Orthopaedics Conference San Francisco

Disclaimer

- The naming of any company, entity, technology or invention during this presentation does not constitute any form of endorsement explicit or implicit by myself or my employer



ROI

- Increase Revenue or Decrease Cost?
  - Direct and In-Direct?
  - For whom?
- What measure to use?
  - Is it validated?
- Quality of data?
- Psychometric data?
- Representativeness?

RESOURCE ALLOCATION:

LeanTaaS
Better Healthcare Through Math

Products Customers Resources About Request a Demo

Transforming Healthcare Operations with **Data Science** and **Machine Learning**

iQueue
For Operating Rooms

80+ Leading Hospitals Rely on iQueue for Operating Rooms to Improve OR Utilization

- UCHealth increased OR utilization by 4%, adding over $10M in revenue
- MultiCare increased available OR **minutes by 300%.**
- OhioHealth repurposes 12 blocks per month using *Collect*.
- NewYork-Presbyterian Brooklyn Methodist Hospital increased their cases per day by 13%

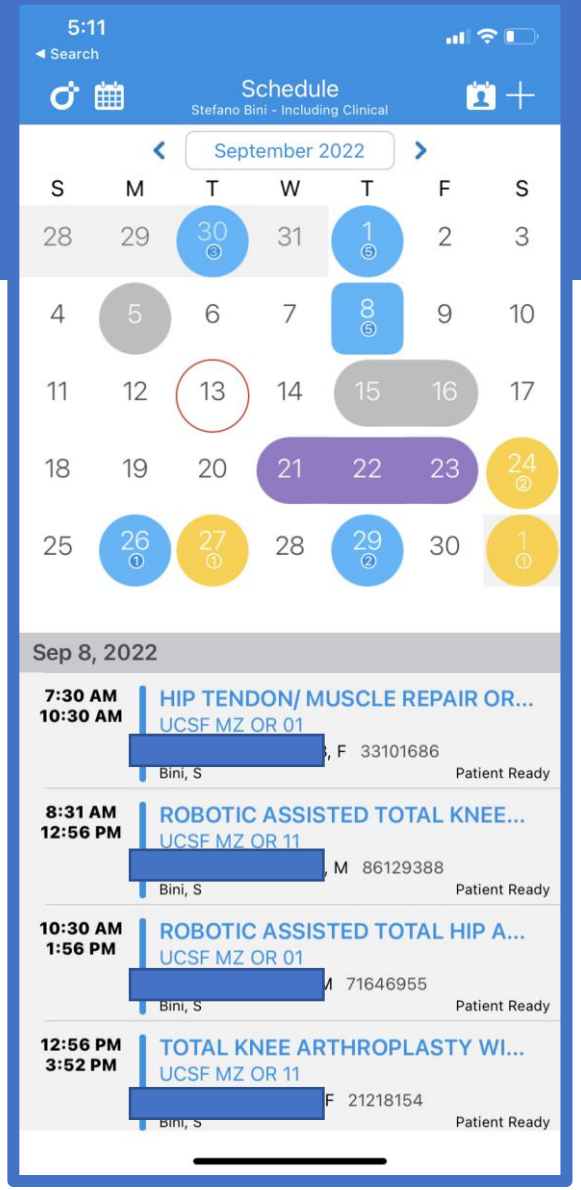
Learn More

iQueue
For Infusion Centers

140+ Cancer Centers Rely on iQueue for Infusion Centers to Improve Operations

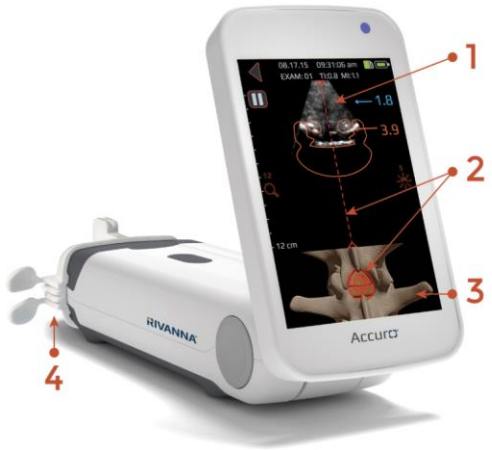
ROI direct revenue calculations

- DOCSPERA.COM
  - Surgical Scheduling App
- Goal filling 50% of available OR
  - for arthroplasty only
- IMPLEMENTATION COSTS
  - One time
    - 1
  - Recurring
    - 0.6
- REVENUE
  - Direct Contribution margin
    - 14.8
    - 15:1 ROI



Accuvein AR using IR technology

Rivanna Medical “Accuro”



Accuro’s world-first technology enables you to see what you’ve been missing.

1. SEE more than 5-10X* enhancement of bone-to-tissue contrast with **Multi-Frequency BoneEnhance® Image Reconstruction** technology.
2. FIND the ideal insertion point with **Midline** (red dashed line) and **Cross Hair** indicators.
3. AUTOMATICALLY IDENTIFY epidural location with success rates exceeding 94%* using **AI-Enabled SpineNav3D™ Image Recognition** technology.
4. MARK needle placement or perform real-time needle guidance with the **Accuro Locator** needle guide.

Virtual Rehab post TKA

- Bini et al
- RCT TKA virtual vs In person PT
- 26 patients
- 40% REDUCTION IN PT
- Equivalent outcomes and patient satisfaction

Journal of Telemedicine and Telecare

International Society for Telemedicine...

Impact Factor: **6.344**
5-Year Impact Factor: **6.338**

SUBMIT

Available access | Research article | First published online July 9, 2016

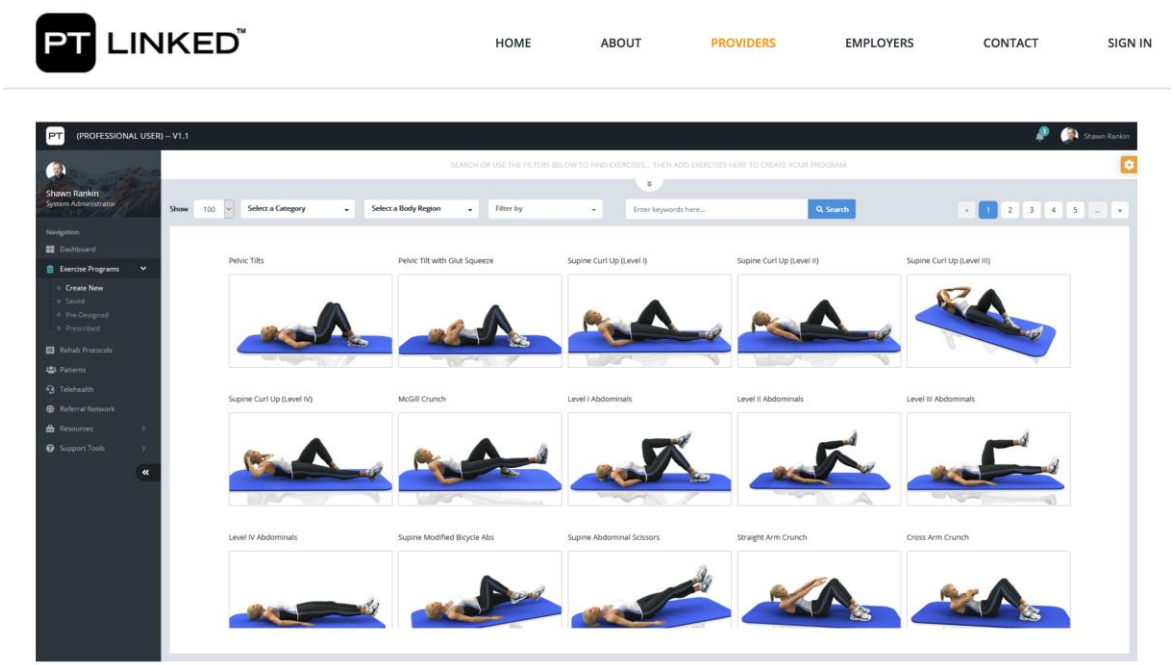
Clinical outcomes of remote asynchronous telerehabilitation are equivalent to traditional therapy following total knee arthroplasty: A randomized control study

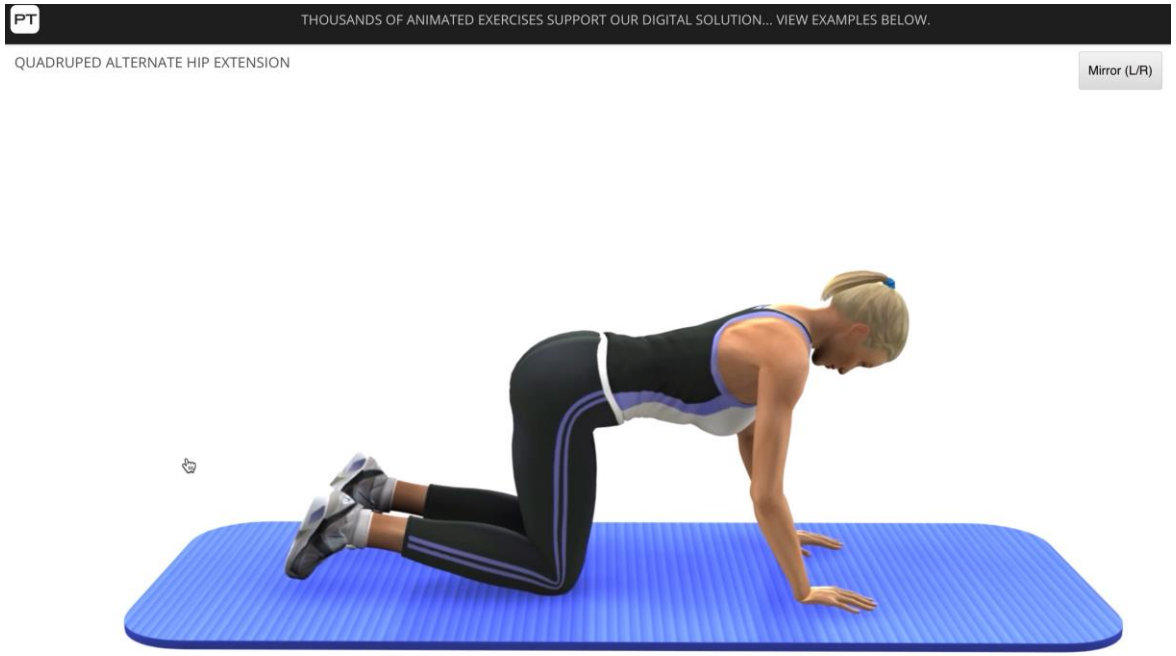
SA Bini, MD ✉ and J Mahajan, MD View all authors and affiliations

Volume 23, Issue 2 | https://doi.org/10.1177/1357633X16634518

REHAB and PREHAB

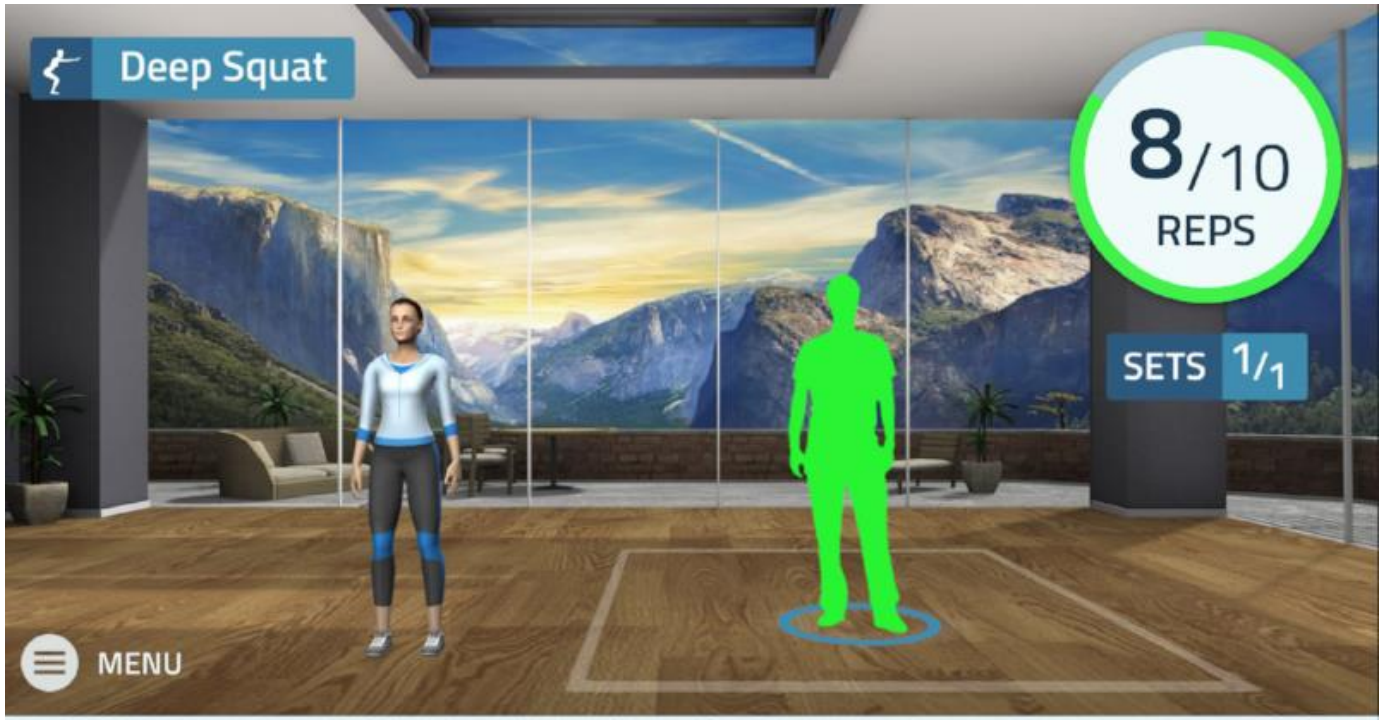
- Guided Physical Therapy and Rehabilitation Apps





Virtual PT with 3D tracking and feedback

- Prvu Bettger et al, JBJS 2020
- Virtual PT (3D, avatar, and feedback) vs. in home PT
- 306 patients
- 50% lower cost
- 60% fewer hospitalizations ($p<0.007$)
- Same fall risk and non-inferior PROMS



Squat down and then stand up

PT platforms

Moffet et al, Telemed J E Health 2017

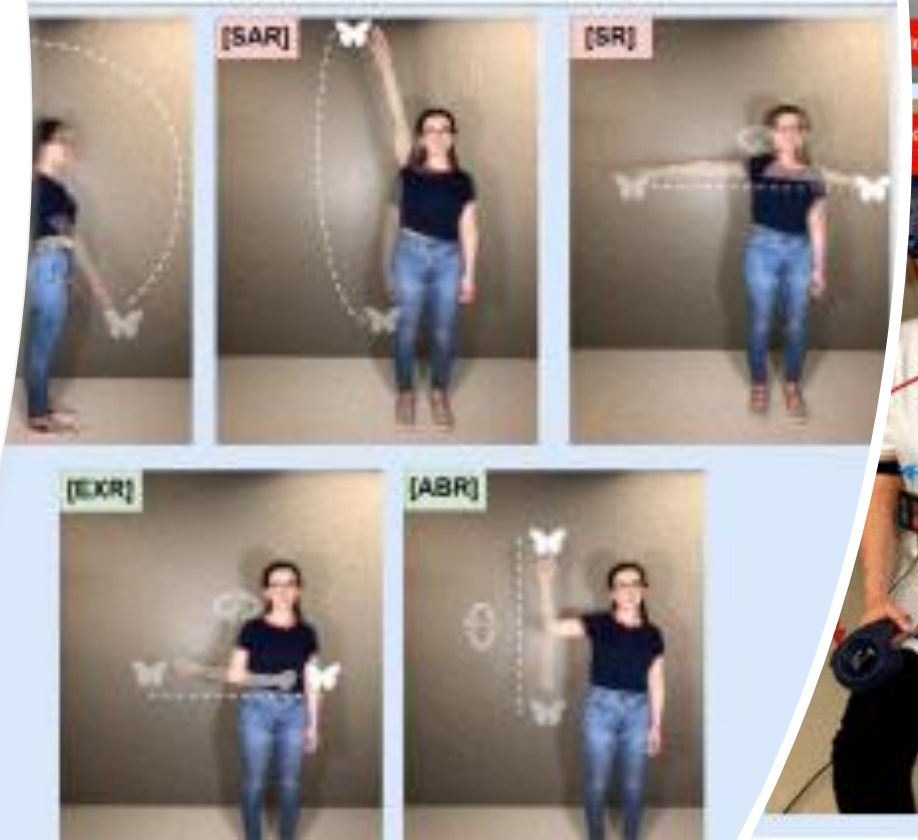
- RCT 198 patients : virtual TELE PT vs @home PT post TKA
- PROMs
- Difficult to compare and measure satisfaction
- Similar level of satisfaction

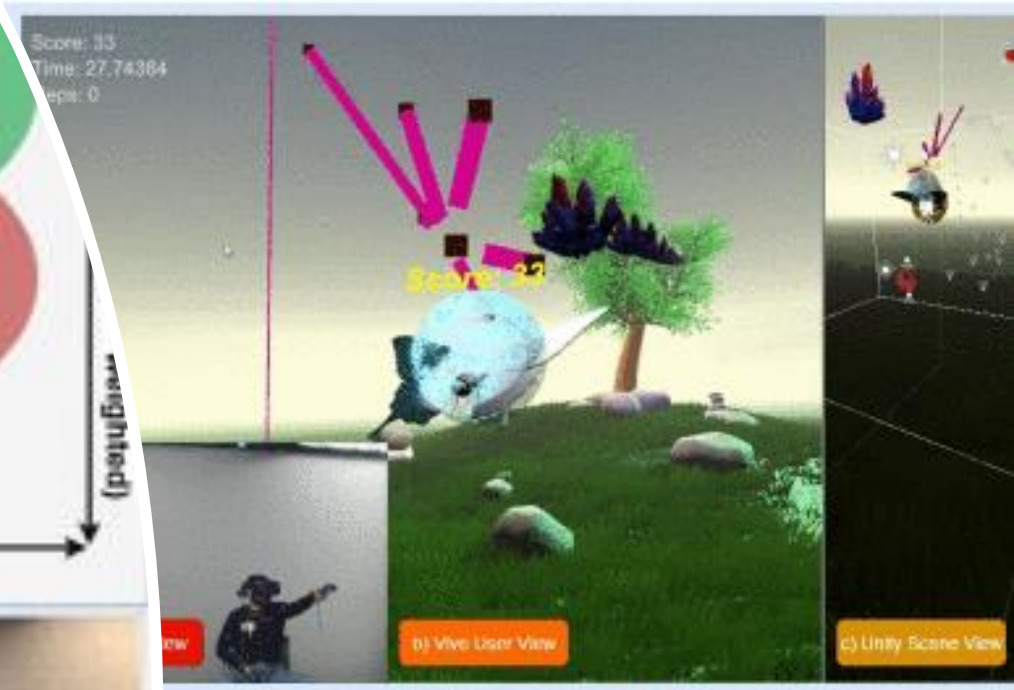
Seron et al PTJ 2021

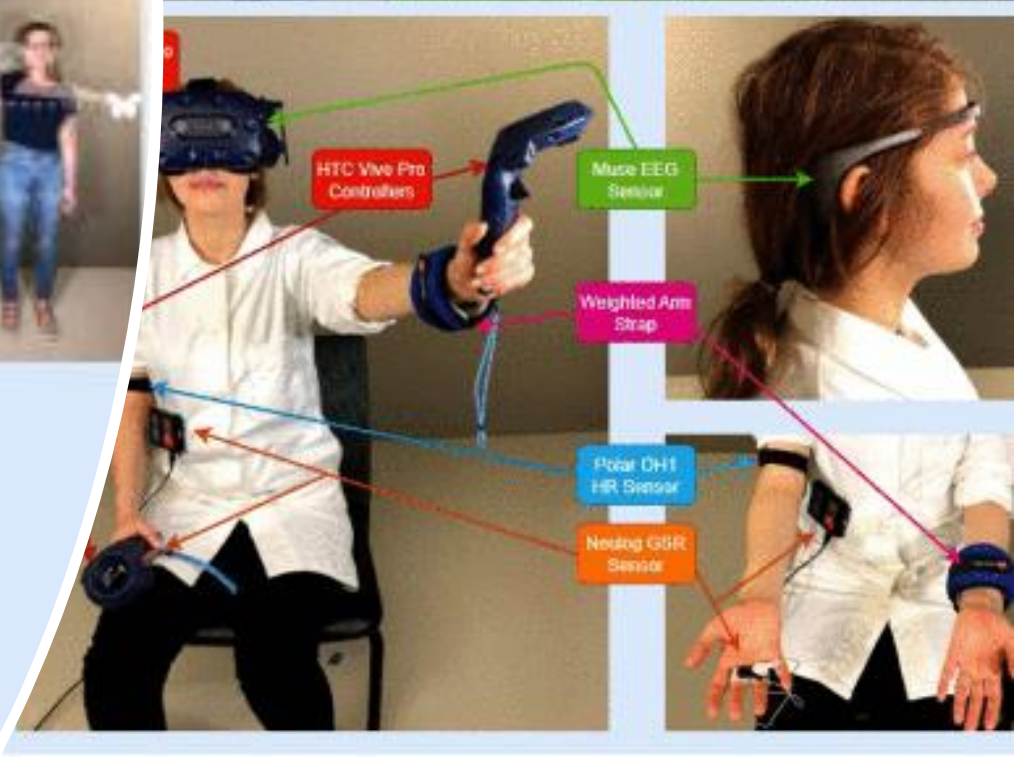
- Analysis of 53 Meta Analyses (17 included)
- Cardio, MSK, Neuro
- Similar results to in-person, better than no PT at all.

VR PT

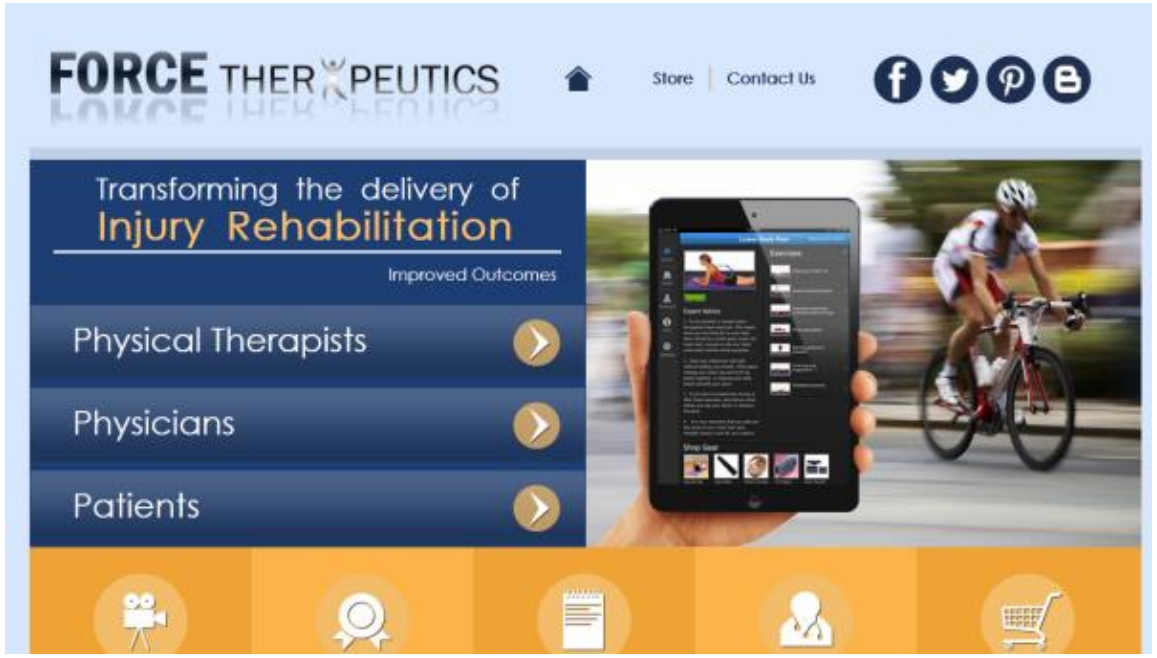
- Elor et al, IEEE 2021
- Next gen gamification of PT

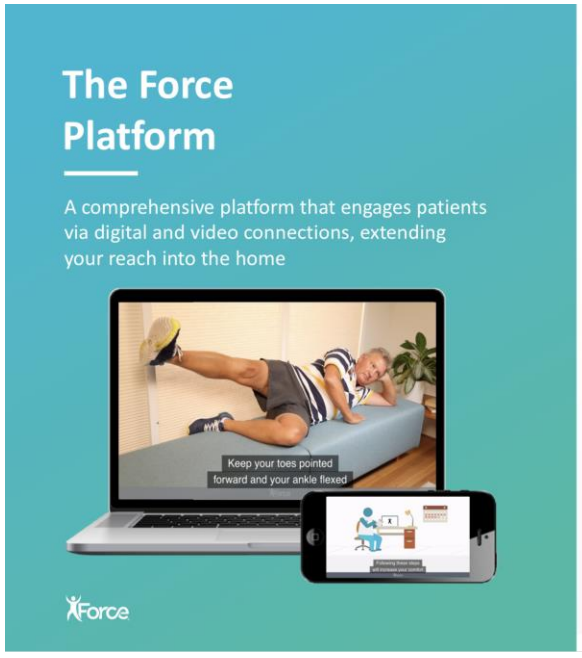


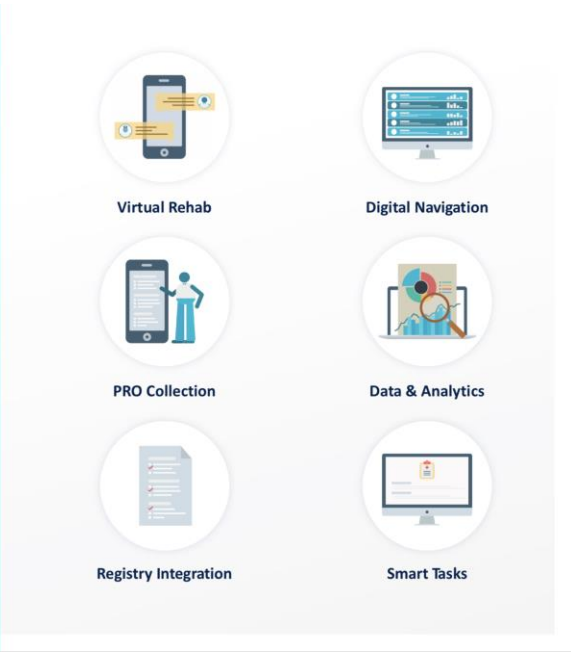




Physical Therapy
(P)Rehabilitation Platform







The Force ecosystem of care coordination

PROMs & Data Collection

Unparalleled PROMs collection & real-time data points to paint the full picture of your patient's journey.

Patient Education & Virtual PT

Deliver clinically validated, provider-prescribed education and video-based content to guide patients through every step.

Validated Personalized Care Plans

Force uses AI to personalize patient protocols & help target provider care.

Streamlined Workflows & Communication

Reduce call volume & improve operational efficiency while ensuring you Care Team is the single source of truth for recovery information.

HIPAA COMPLIANT · AICPA SOC · ECEN · The Joint Commission · AJRR American Joint Replacement Registry

Patient Engagement Platforms

Decrease touch points

Decrease readmissions

Increase patient compliance

Increased patient satisfaction

Costs not borne by the beneficiary

University of California
San Francisco

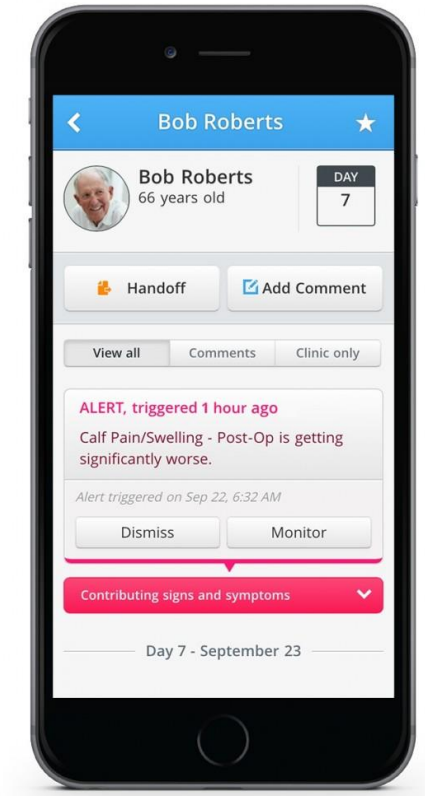
Mobile Patient Engagement Platforms May Help Reduce 30 Day Readmission Rates in Arthroplasty Patients

Stefano A. Bini, MD
Professor
Department of Orthopedic Surgery
UCSF

Founder and Chair, **The UCSF Digital Orthopaedics Conference** San Francisco (@THEDOCSF, #DOCSF18)
BRIDGING: TECHNOLOGY+ORTHOPAEDICS

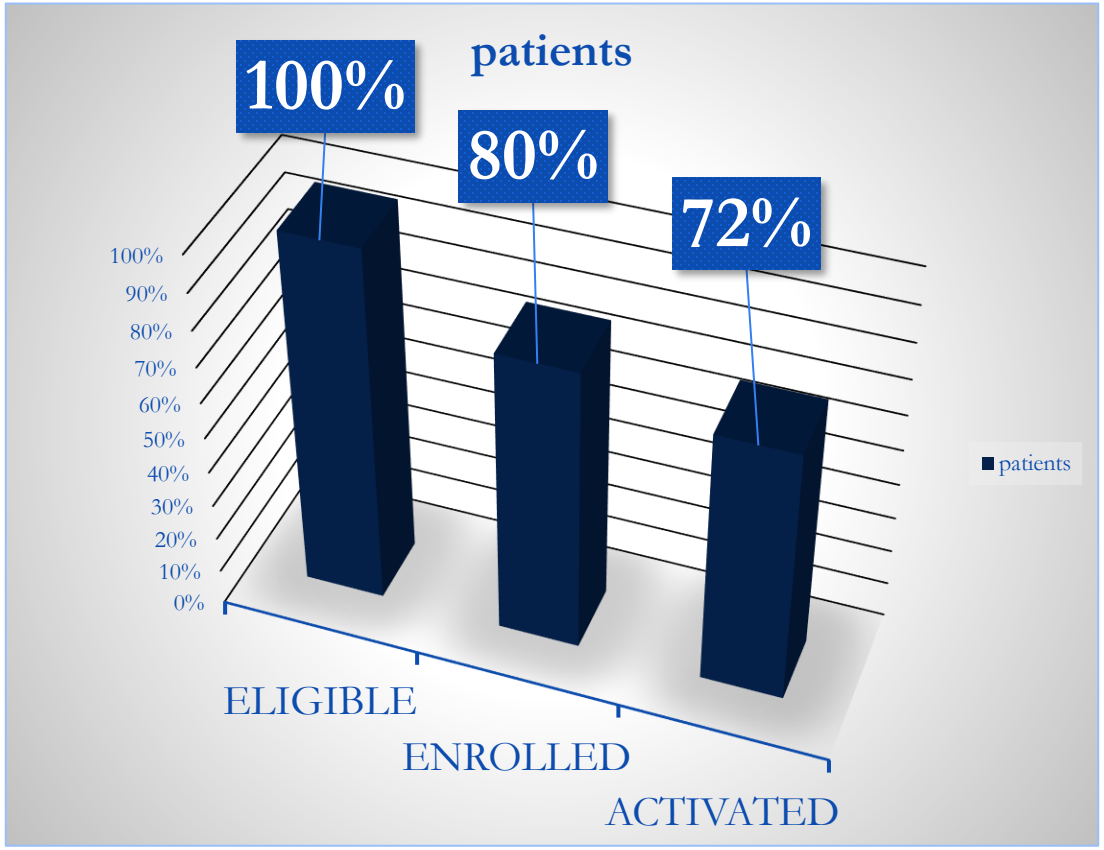
Aim

- Report the impact of PEP use at academic arthroplasty practice on:
  - Primary Outcome: non-elective 30 day readmission rates (NE30)
  - Secondary Outcome: resource Utilization
    - Messaging to care team
    - ED visits
    - Testing



Results

- Cohort
- 701 Eligible
- 561 Enrolled
- 502 Activated
- 92.4%
  - Satisfied with the PEP



Primary Outcome: readmission

- Non Elective Readmission 30 days for activated PEP patients
  - 7/502 (1.4%)
- NE30 for non-PEP patients
  - 9/199 (4.5%)
- P=0.01

Impact of a patient engagement platform on clinical practice workflow in an academic arthroplasty practice

[1]Stefano A. Bini, MD; [1,2]Richard D. Southgate, MD; [1]Aenor J. Sawyer, MD; [1,3]John Bonano, MD; [1]Erik N. Hansen, MD; [1]Thomas P. Vail, MD

[1] Department of Orthopaedic Surgery – University of California, San Francisco; [2] Department of Orthopedic Surgery – Northwest Permanente (Portland, OR);
[3] Department of Orthopaedic Surgery – Stanford University (Palo Alto, CA)

Background

- Higher levels of patient engagement lead to more efficient and effective healthcare[1]
- Patients with higher levels of engagement are more likely to report a positive care experience[2]
- Online patient engagement platforms **(PEP) provide asynchronous digital communication** between surgeons and patients using mobile applications
  - PEP are web-based mobile communication platforms
  - Can be accessed via computer or mobile device (phone or tablet)
- PEPs support care management and can collect patient-reported outcomes (PROs)
  - They have also been shown
    improve diabetes manageme
    reduce postoperative ED visi
- **Little is known about the impa**

- **Purpose: to describe the imp**
  academic arthroplasty practic

Methods

- Data prospectively collected
  patients at a single academ
  2016 through December 31,
- January 2016: UCSF divisio
  PEP called HealthLoop (Mo
  - HIPAA-compliant, secure
    via mobile and desktop d
  - **Guides patients throug**
    pathways with daily me
    communication
- PEP were also used to colle
  (PROs)
- Variables examined for the purpose of this study include:
  - Check-ins sent by PEP
  - Number of patient logins
  - Patient messages generated
  - Timing of patient messages
  - Mean staff response time
  - Number of staff and surgeon logins
  - Patient satisfaction

Results

- 561 patients: enrolled in the PEP (HealthLoop)
  - Average age: 62.4
  - Female: 329 (58%)
  - THA: 305 (54.4%)
- 502 patients (89.5%) activated their PEP account
  - Similar activation rates for THA (90.2%) and TKA (88.7%) (p = 0.56)
  - Similar activations rates based on gender (p = 0.91)
- 13,903 check-ins generated (throughout study period)
- 18,916 logins (time avg: 11 minutes)
- 5,319 messages generated
  - 1,343 (25.4%) generated in the first postoperative week

	Total	Average ± SD (per patient)
Check-ins	13093	26.1 ± 4.3
Patient logins	18916	38.8 ± 23.4
Messages generated	5319	14.2 ± 12.4
Team logins	4975	415 (per month)

Preoperative	
1 week postop	25%
1 week – 3 month postop	
3 month – 6 month postop	

Discussion

- **High patient participation rate using this PEP**
- Each patient averaged 39 PEP logins & 14 messages sent
  - >30% messaging rate than similar study on spine patients with a different app (Force)[5], suggesting that variations in how PEPs are designed or implemented may impact patient utilization rates.
- **Surgeons accounted for 6% of staff logins and there was variation in response rates between surgical teams.**
- Satisfaction rate were very high but had no relationship with
  ply because patients could
  channels.

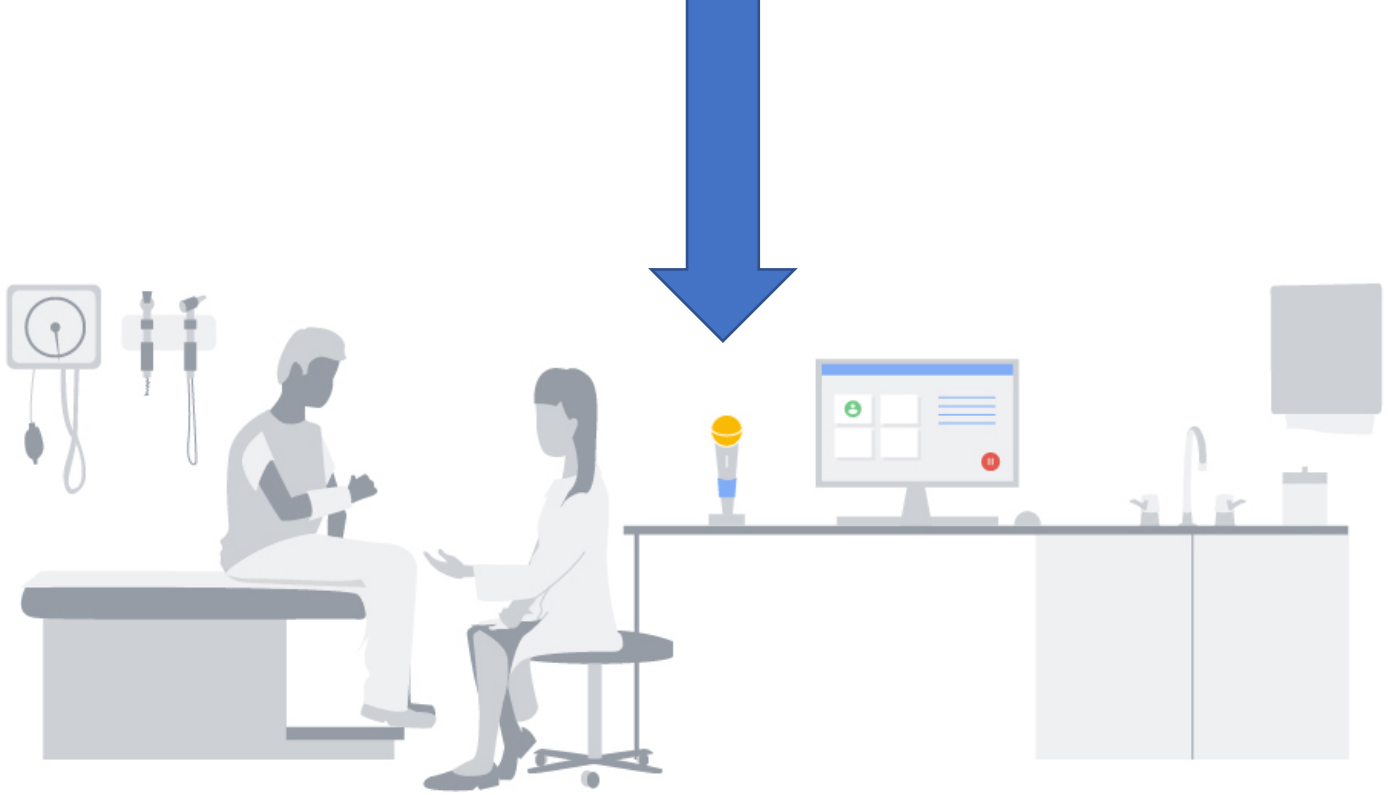
se to participate in the PEP
ghout postop period with a

not insignificant
response time and high

pport staff and needs to be
ent access to other
Phone, email) may mitigate

change, health outcomes and costs change,

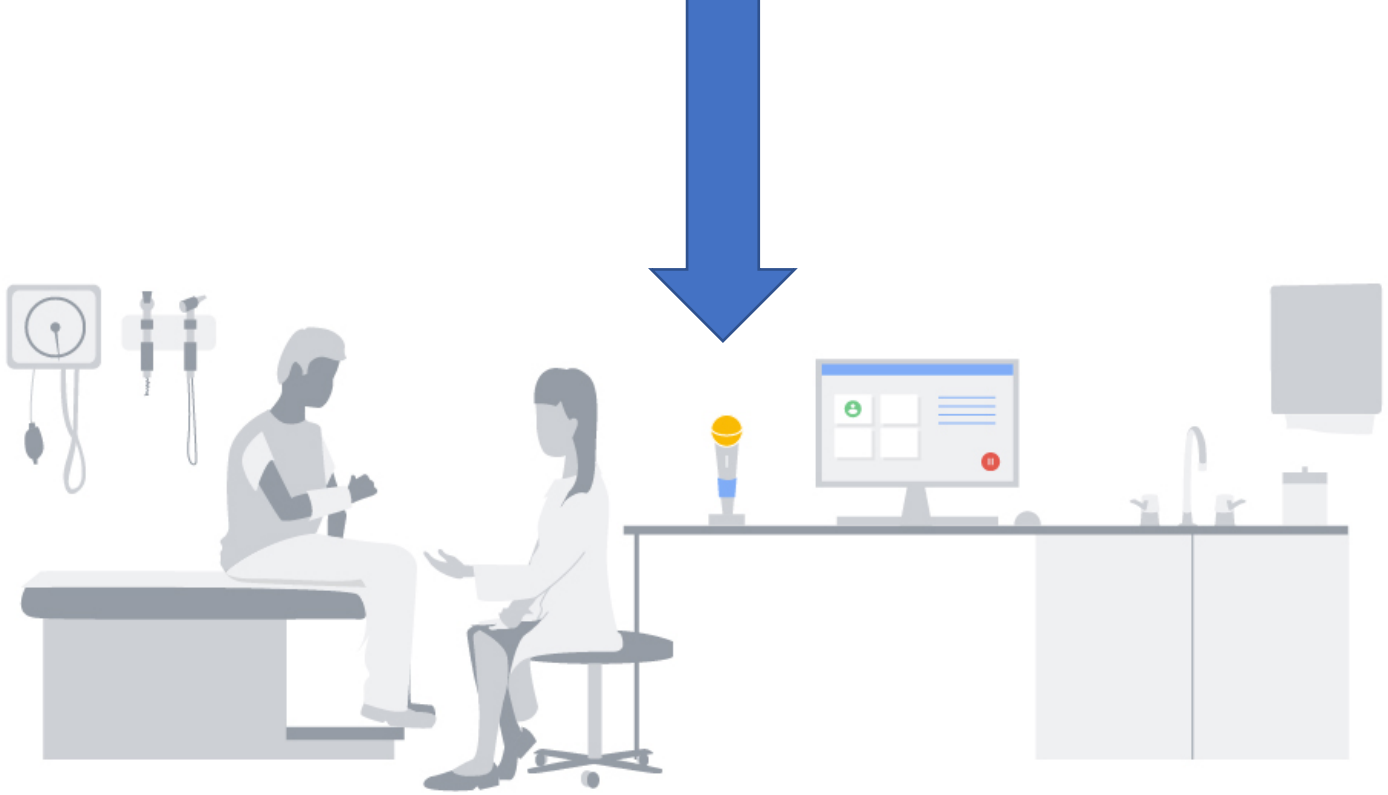
2. Mosen, D. M. et al. Is patient activation associated with outcomes of care for adults with chronic conditions? J. Ambul. *Care Manage* 30, 21–29 (2007).
3. Perez, F. et al. Evaluation of a mobile health system for supporting postoperative patients following day surgery. *J Telemed Telecare* 12 Suppl 1, 41–43 (2006).
4. Davidovitch, R. et al. Home health services are not required following total hip arthroplasty. *J Arthroplasty*. In press.
5. Bell, K., et al. "Patient Adoption and Utilization of a Web-Based and Mobile-Based Portal for Collecting Outcomes After Elective Orthopedic Surgery." *American journal of medical quality: the official journal of the American College of Medical Quality* (2018)



Here come the Digital Scribes

- Voice recognition and Machine learning
  - 65% automated transcription
- Decrease clinical documentation load

- < documentation time by 90’



Here come the Digital Scribes

In Person: $31,000-55,000 / yr
Virtual: $14,400/ yr

No recurrent training
No schedule issues
Physical constraints
Remote Locations

Decrease burnout
Work Life Balance
Increase Revenue

Is $14K worth it?

Virtual Clinics

Telehealth

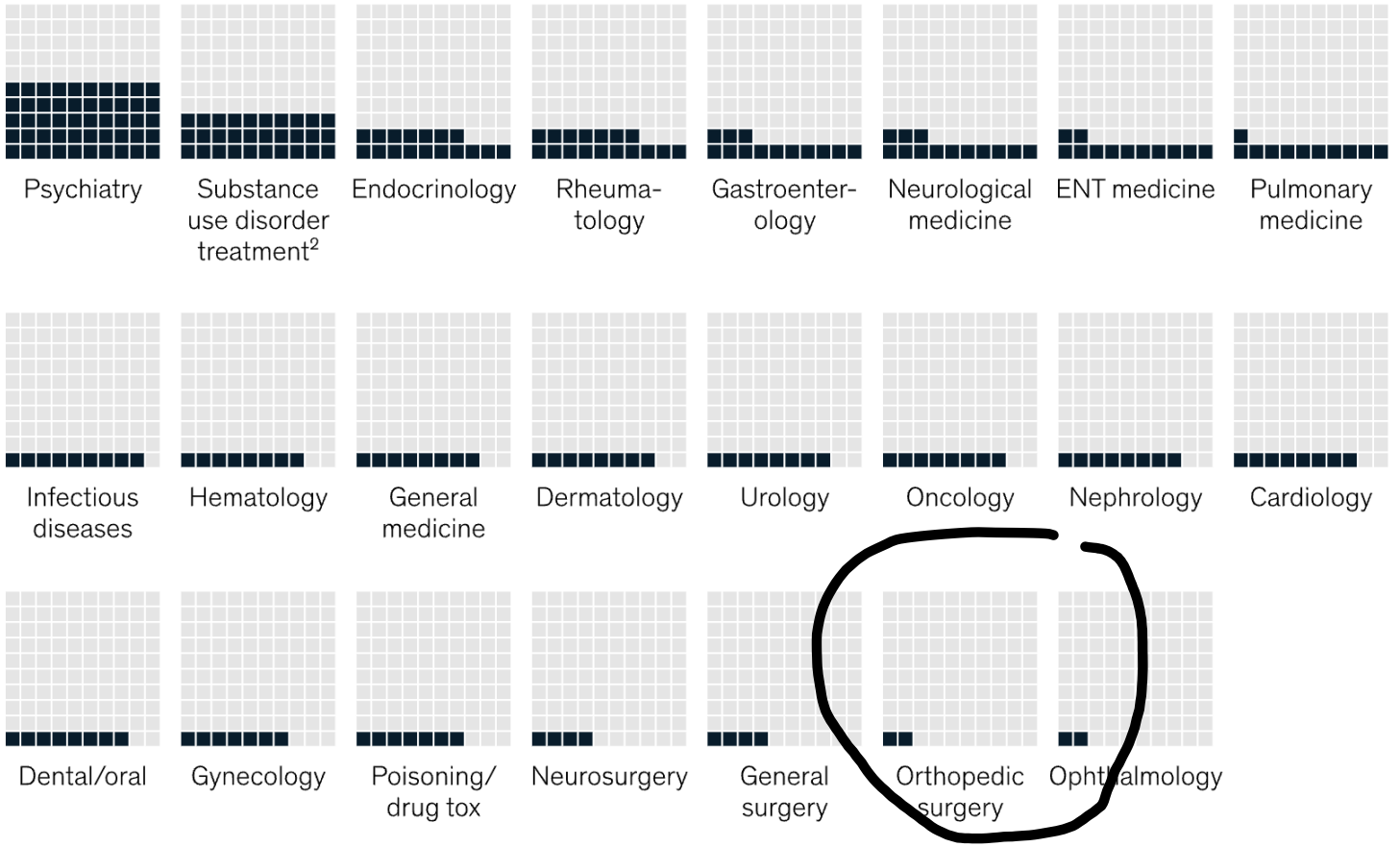
- Increased access
- Decreased costs
- Equal outcomes

Not an “across the board” phenomenon.

example: Low adoption in Orthopedics

Substantial variation exists in share of telehealth claims across specialities.

Share of telehealth of outpatient and office visit claims by specialty (February 2021[1]), %



[1] Includes only evaluation and management claims; excludes emergency department, hospital inpatient, and physiatry inpatient claims; excludes certain low-volume specialties.
[2] Also includes addiction medicine and addiction treatment.
Source: Compile database; “Telehealth: A quarter-trillion-dollar post-COVID-19 reality?” May 2020, McKinsey.com; McKinsey analysis

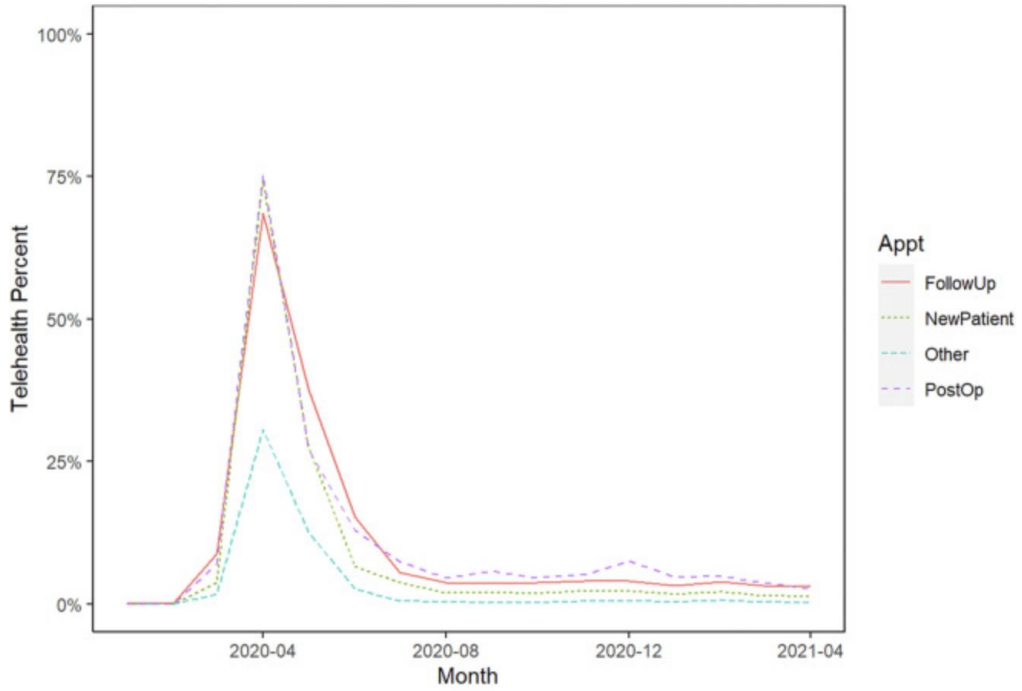
McKinsey & Company

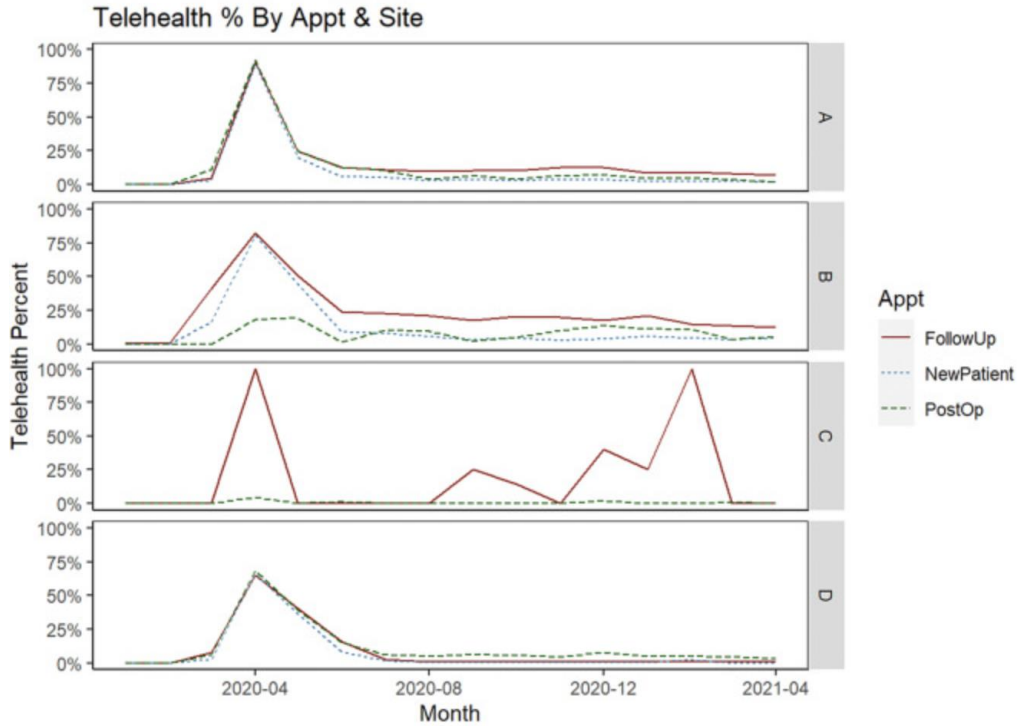
Original research

Multi-center evaluation of telehealth utilization in hip and knee arthroplasty from prior to and for one-year during the COVID-19 pandemic

Stefano Bini MD [1], Yu-Fen Chiu MS [2], Michael Ast MD [2], Chad Krueger MD [3], Joseph Maratt MD [4], Ilya Bendich MD/MBA [2]

- 296,540 to hip arthroplasty surgeons
- Jan 2020 to April 2021
- Peak April at 55% average
- Dropped back to 5%
- Preference for post op visits
- No difference by age group
- No difference by geography





Telemedicine Efficacy Data

Chaundry et all CORR 2021	Hwa, Wren JAMA 2013
• Meta Analysis: Equivalence for patient and surgeon satisfaction to in person visits	• No difference in post op complications

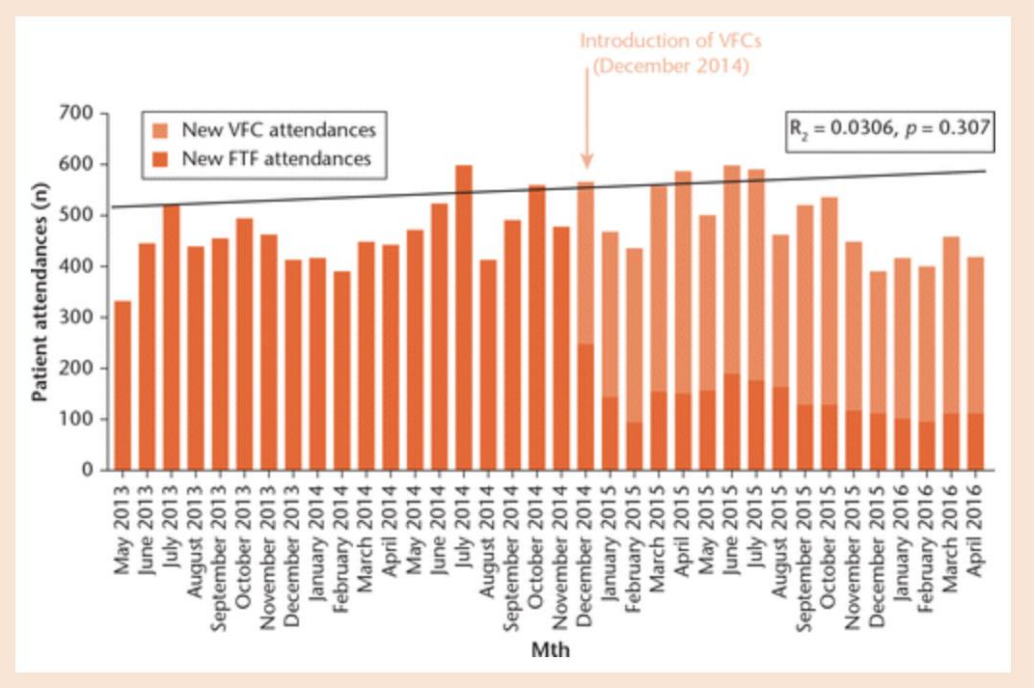
Bone & Joint Research, Vol. 6, No. 5 | Research

The clinical and cost effectiveness of a virtual fracture clinic service

An interrupted time series analysis and before-and-after comparison

A. McKirdy, A. M. Imbuldeniya

- Mc Kirdy et al BJJ 2017
- Retrospective before and after implantation
- 17,671 patients
- Virtual Fracture care
  - 70% reduction in-person clinic visits
  - 50% reduction in wait time for first visit
  - 70% reduction in no-show rates
  - No increase in consultation time
  - £130,000 annual savings

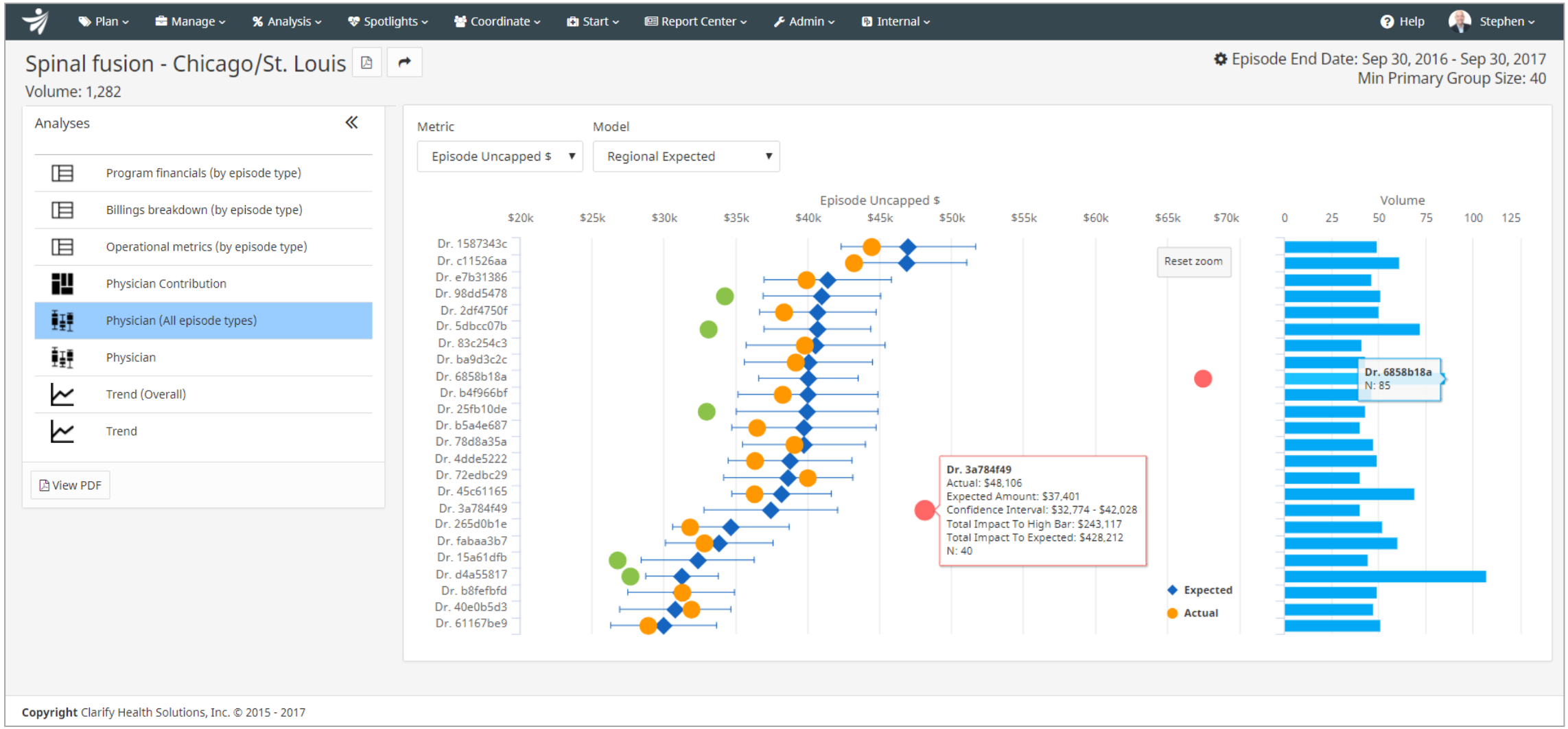


Clinical Decision Support Systems

- Knowledge Based (rules driven) and Knowledge Free (machine learning) to analyze clinical data
- Currently mostly leverage EHRs
- Philips, Allscripts, AthenaHealth, GE Healthcare, McKesson etc
  - Medication Errors
  - Image Analysis
- Currently over $2B

VARIATION IN COST OF CARE FOR SAME PROCEDURE?

Identify variations in care, episode cost, case-mix, etc.

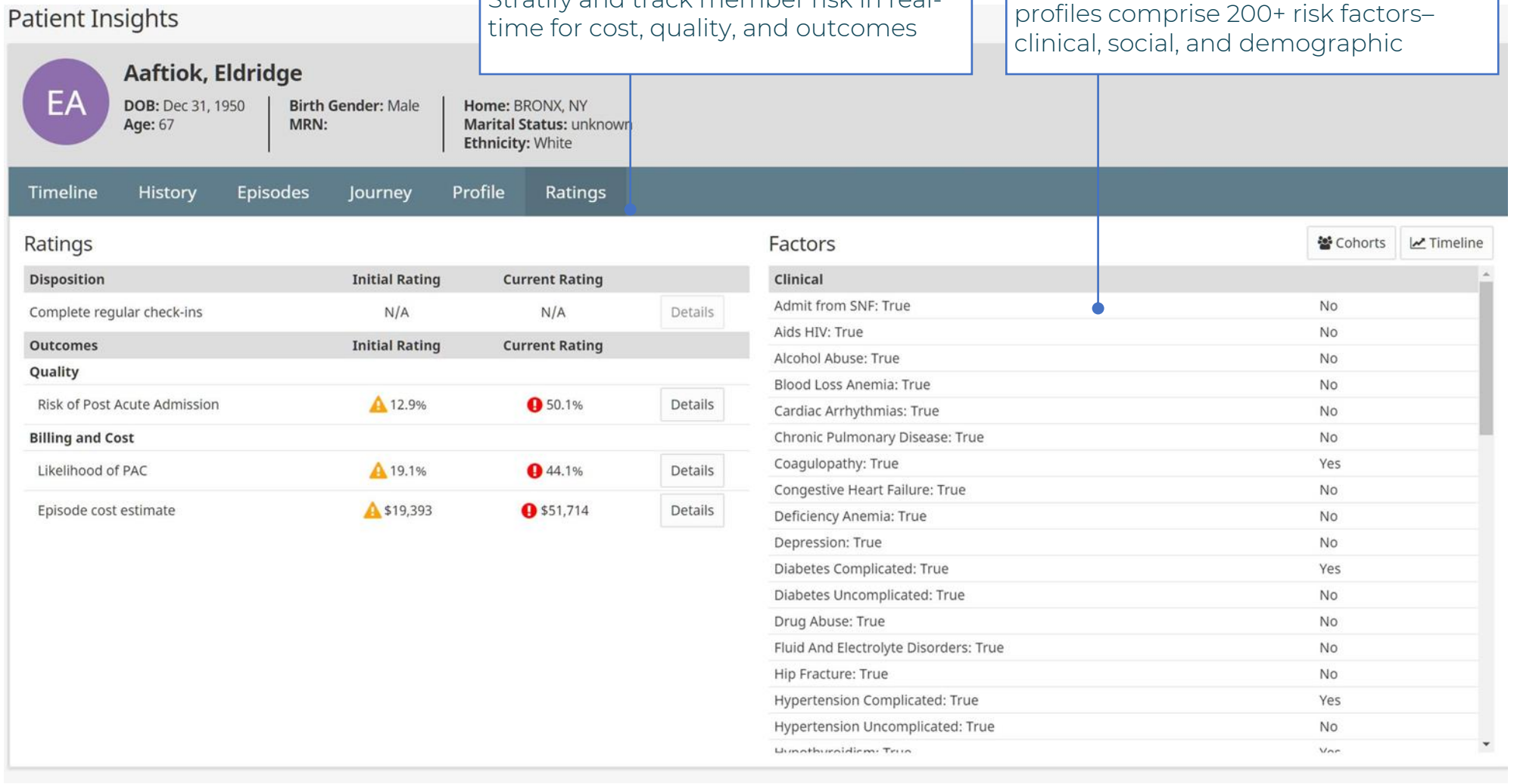


STRATIFY PATIENT RISK DYNAMICALLY

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



Overall Referral Distribution

30%	McCormick Health Care Corporation Northwest New York
20%	Ascendency Health Northwest Regional
10%	First Medical Northern Plains Care Group

Keepage: Top Provider Groups

	Keepage
Sodus Point Medical Center	61.6%
Western New York Medical Center	60.2%
Healthcare	59.7%
Rochester Care Medical Center	58.4%
Plattsburgh Medical Center	57.4%
Essex Falls Medical Center	56.3%
Sentinel Range Healthcare	55.2%

Keepage: Bottom Provider Groups

	Keepage
Jamestown Bluff Medical Center	5.2%
North Buffalo Health	6.3%
Auburn Hills Medical Center	7.4%
Five Ponds Medical Center	8.4%
Burlington Health	9.7%
Queensbury Healthcare	10.2%
West Albany University	11.6%

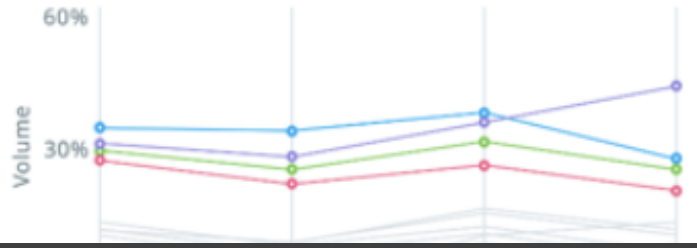
Keepage: Key Specialties

	Keepage
Orthopedics	61.6%
Cardiology	60.2%
General Surgery	59.7%

Referral Distribution by Specialty

	Inbound Vol	Distribution
Cardiology	11,345	
Orthopedics	10,372	
Critical Care	9,362	

Keepage Trends by Highest Vol



Robust Clinical Decision Support Solutions for Better Outcomes

An integrated suite of clinical decision support solutions purpose-built to improve the quality, safety, and efficiency of patient care.

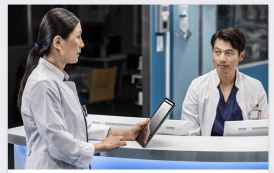
GE Health

Carestation Insights platform is designed to support:

Anesthesia Department

+ Drive best clinical practices
+ Measure protocol standardization
+ Optimize processes and their adoption

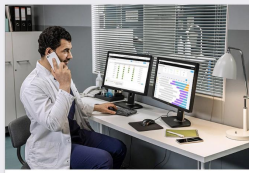
Make smart decisions to optimize patient care.



OR Manager

+ May help improve operational efficiency
+ Helps OR start times stay on schedule
+ Support quality objectives with visibility to machine checkout status before use

Review and respond to workflow issues.



Administration

+ Meet financial goals
+ Review and optimize resource use
+ Encourage best practices

Make meaningful use of your budget.

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Administration

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+ Review and optimize resource use
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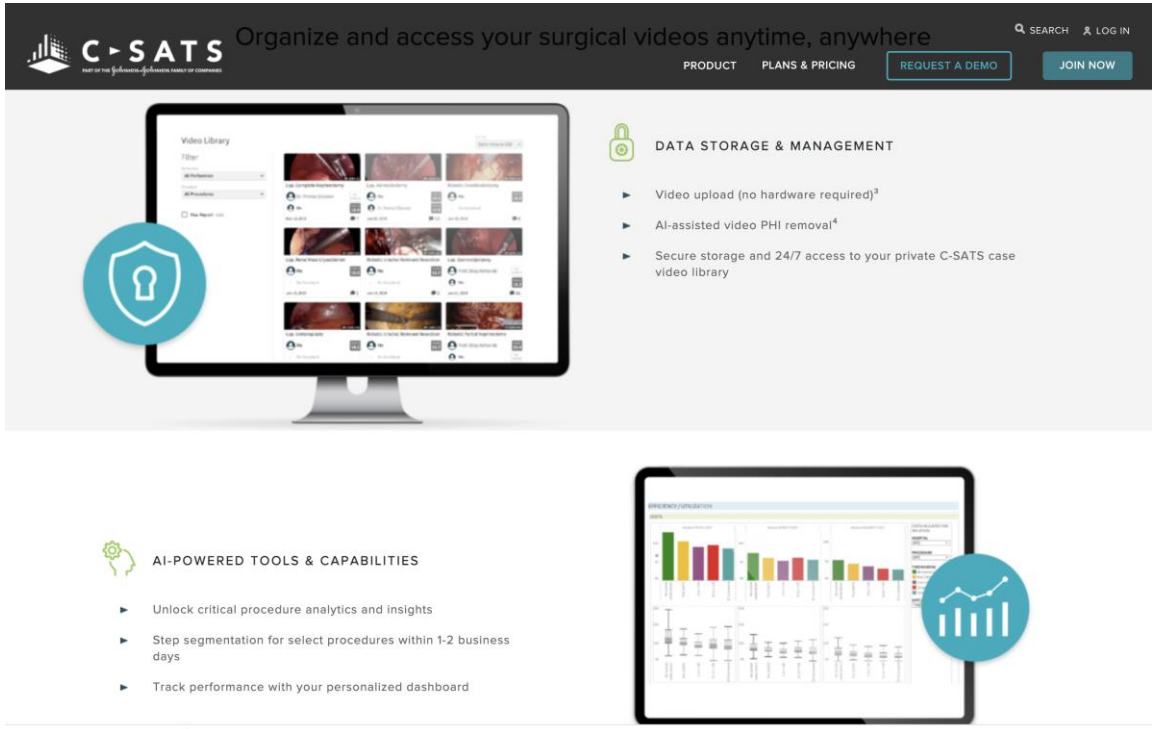
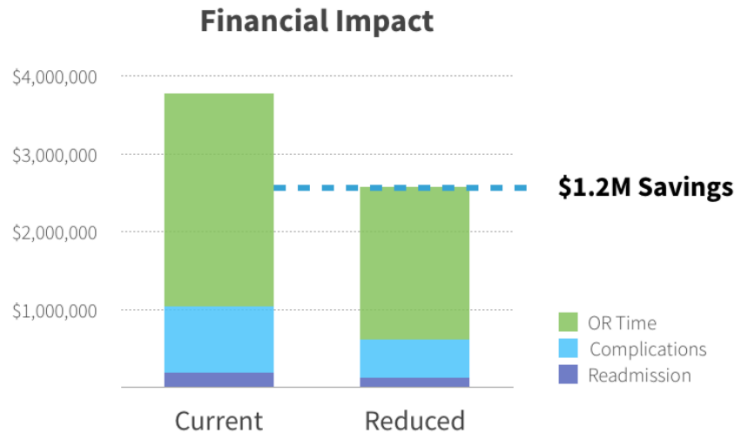
Make meaningful use of your budget.

The value of Protocol Adherence



Healthcare systems realize significant cost savings when their practitioners use proper technique, procedure and protocol. Failures of care delivery, which include “poor execution or lack of widespread adoption of best practices,” account for $154 billion in wasteful healthcare spending. (JAMA, April 2012)



Digital Health Apps

Are they helping and worth the investment?

Stefano A. Bini MD Professor Orthopaedic Surgery UCSF

Is this a scalable model?

Scarce resources are expensive

Projected Health Workforce Shortages USA 2025

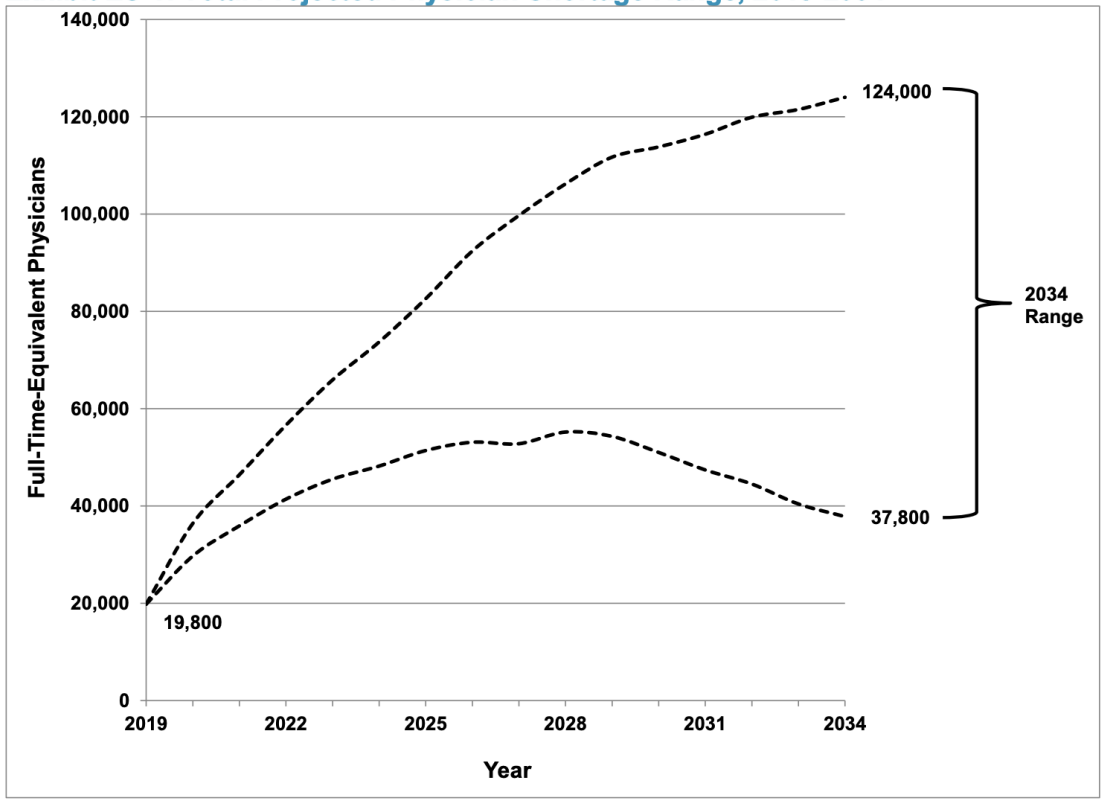
- Becker's Hospital Review 2018
  - 400, 000 Home Health Aids
  - 95,000 Nursing Assistants
  - 59,000 Medical and Clinical Lab Technologists
  - 30,000 Nurse Practitioners
  - 11,000 Physicians and Surgeons

AAMC 2021 Report on MD Supply and Demand

- Estimated Physician Shortage 2034: 37,000-124,000

The Complexities of Physician Supply and Demand: Projections From 2019 to 2034

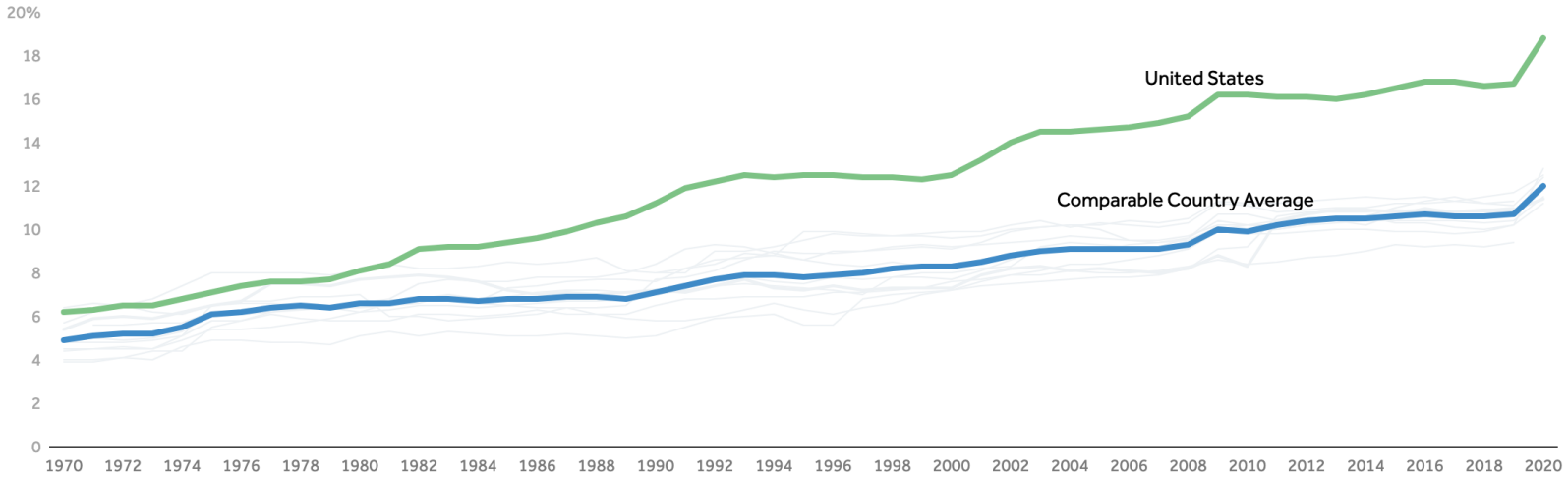
Exhibit ES-1: Total Projected Physician Shortage Range, 2019-2034



Note: Because complex systems have internal checks and balances to avoid extremes, the upper and lower bounds of the shortage projections reflect the range of most likely outcomes. The divergence over time represents increasing uncertainty.

Health Care Cost as a % of GDP

Health consumption expenditures as percent of GDP, 1970-2020

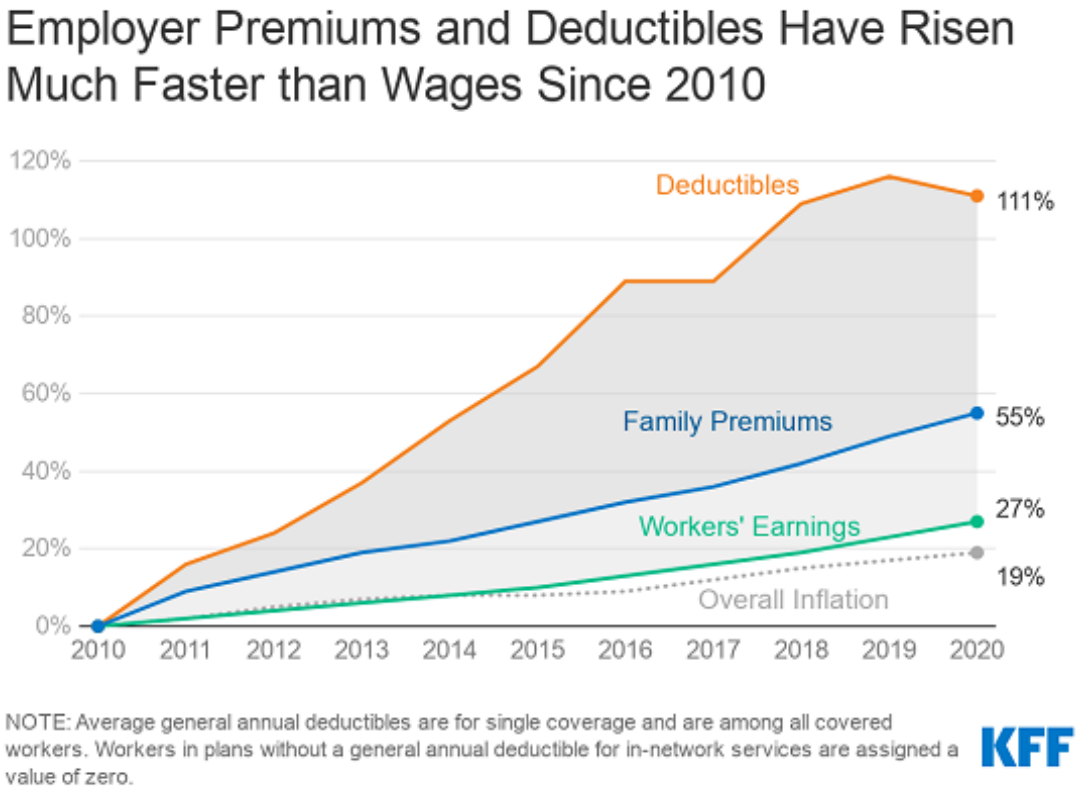


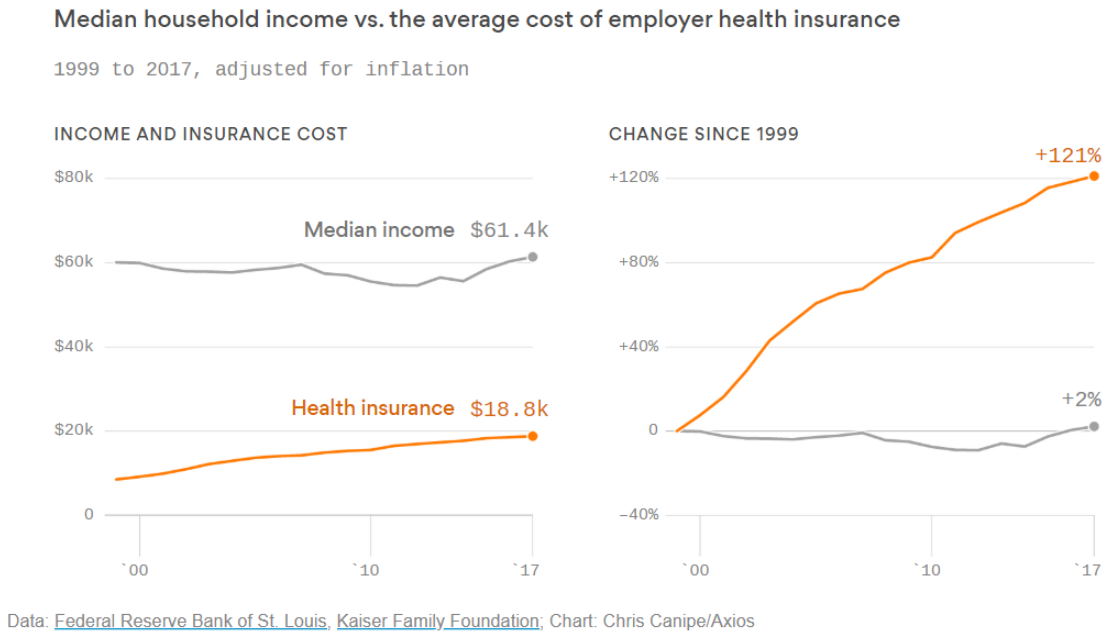
Notes: U.S. values obtained from National Health Expenditure data. Health consumption does not include investments in structures, equipment, or research. 2020 data not yet available for Australia, Belgium, Canada, Japan or Switzerland. Provisional 2020 data for Austria, Germany, Netherlands, Sweden and the United Kingdom. Provisional 2019 data for Canada. Data for Australia and Japan in 2019 and France in 2020 is estimated. France data before 1990 is not shown.

Source: KFF analysis of OECD and National Health Expenditure (NHE) data • Get the data • PNG

Peterson-KFF Health System Tracker

Healthcare affordability : 30% of income

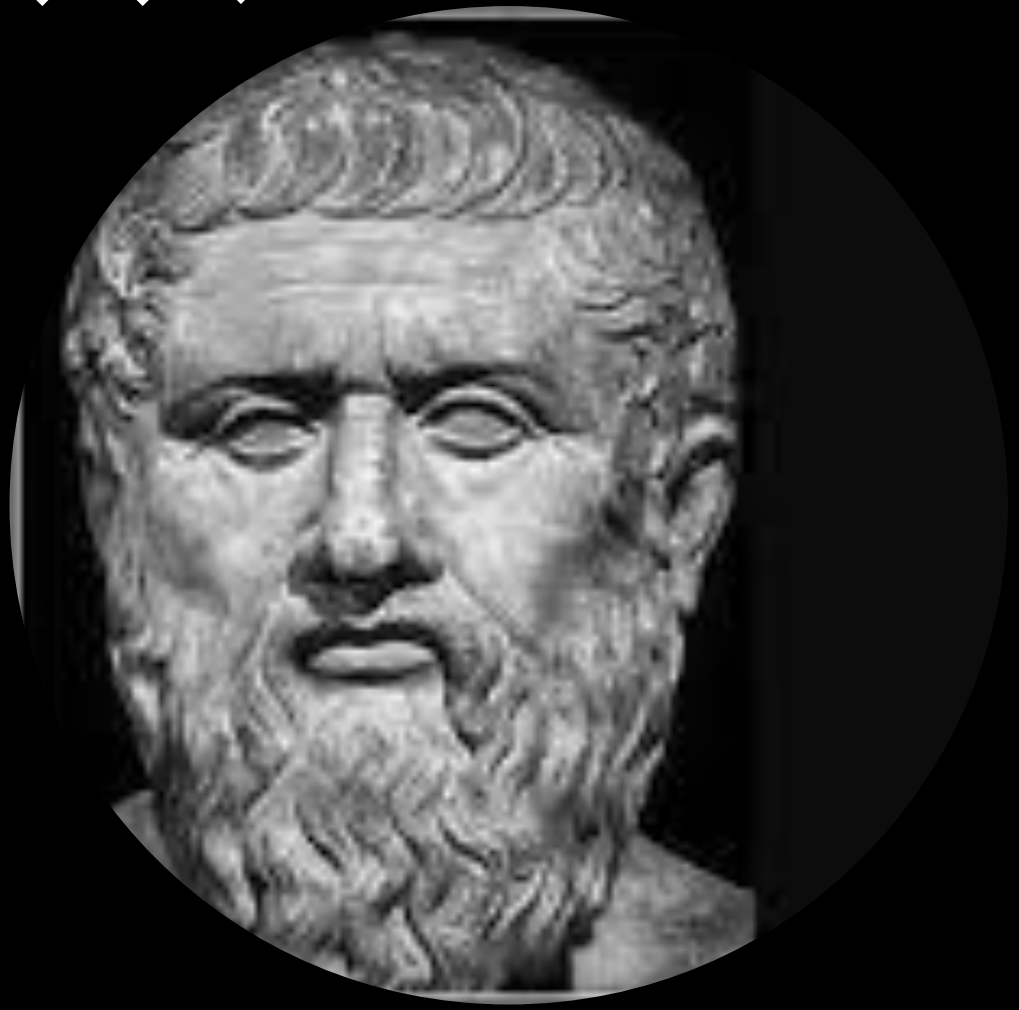




The real question is not who's going to pay for tomorrow's care model. It is: who is going to pay for today's care model tomorrow?

Stefano Bini on LinkedIn

February 17, 2017



~~Beauty~~ Value is in the eye of the beholder

- Diverse measures of quality
- Disconnect between payer and beneficiary
- Change management costs seldom taken into account
  - (30% of total cost of implementation)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THANK YOU

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