Wearable smartwatches are an effective tool to augment and characterize perioperative care in abdominal aortic surgery

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Disclosures

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Background

Aortic aneurysms are a common problem of the elderly:

- Estimated AAA prevalence of **2.98% in those aged 65-75 years**
- Approximately 25000 AAA repairs occur annually in the US
  - Mean age at repair is **76 years**

Background

So what's the problem?

1) We do a lot of AAA repairs (25,000)
2) We have a robust understanding of effectiveness (EVAR-1, OPEN)
   - Safe, effective and with advent of endovascular technology relatively well tolerated

….What are we missing?.....

The Problem

What We Traditionally Measure (Surgeon-Focused):

- Mortality, endoleak rates, technical success
- Lots of studies *(EVAR-1, OPEN)*

****What Patients Actually Care About****:

- Daily mobility, recovery, and quality of life
- Trade-offs between independence vs procedural risk
  - Patient centered outcomes (PCOs)
- Fewer studies investigating these topics

The Problem Cont.

Current Approach:

- PCOs (e.g., pain, recovery) assessed at post-operative visits

  -Relies on retrospective patient recall

The Problem:

- Recall-based measures may not accurately reflect true patient experience

The Problem Cont.

- Daniel Kahneman (Noble Prize Winner), *Pain*, 1996
  "Patients' memories of painful medical treatments"
  - Compared **real-time pain recordings vs retrospective recall**
  - Demonstrated these **are not equivalent**

So how can we accurately assess patient outcomes if we are collecting them all retrospectively?

Objectives

Aim 1) To prospectively measure changes in patient-centered outcomes after abdominal aortic surgery

Aim 2) To demonstrate the feasibility of using a smartwatch to longitudinally measure postoperative PCOs

Methods

Single-center prospective cohort study

University of Florida | March 2022 – June 2023

Patients provided an Apple Watch SE with ROAMM platform to track data

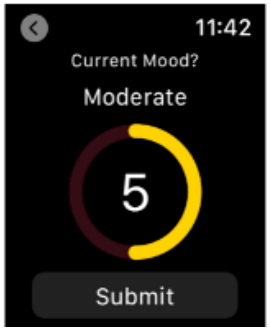
Inclusion:

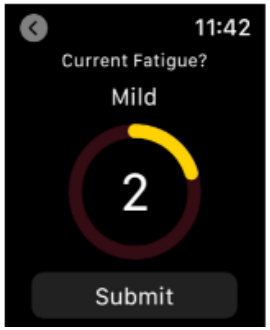
- Patients undergoing elective open or endovascular infrarenal AAA repair
- Non-emergent cases only

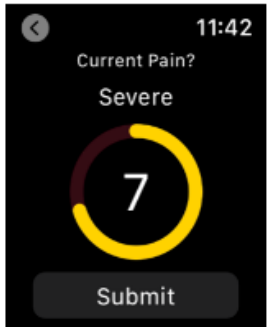
Methods

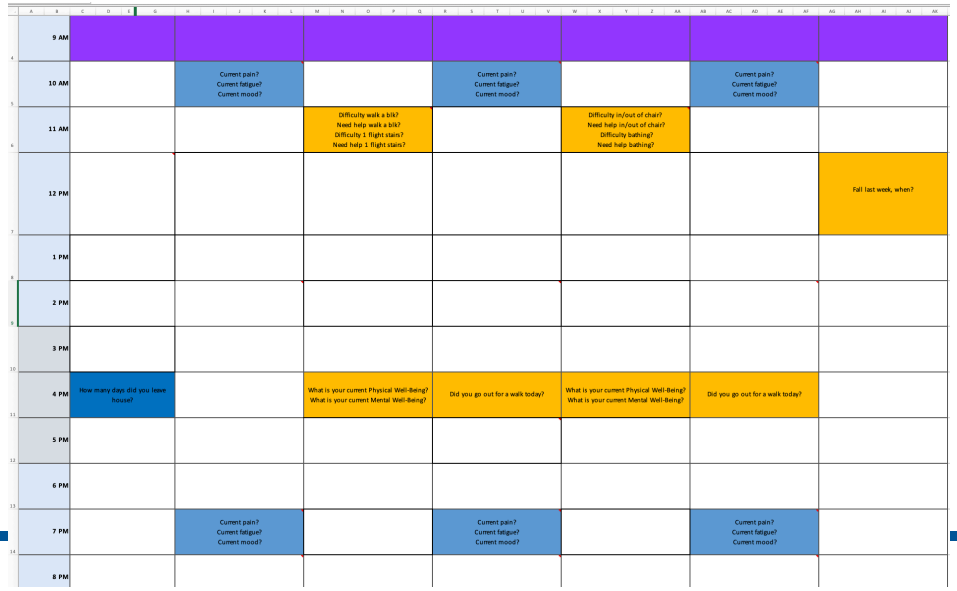
- Continuous smartwatch wear with daily prompted surveys:
  - **Pain, Fatigue, Mood, Physical activity, and Decision satisfaction**
- Data collection period:
  - Up to 2 weeks preoperatively (**Not all patients able to wear watch pre-op**)
  - Up to 4 weeks postoperatively
- Compliance: number of days questions were answered while watch was active and collecting data
- Variability: Assessed using within-patient standard deviation (SD)
- Decision satisfaction: Compared first vs last postoperative responses

Smart Watch Application









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Study Cohort

Total Patients (N)	26
Procedure Type	
EVAR	16 (62%)
Open	10 (38%)
Age (years)	
Mean	**71**
Oldest subject	**83**
Youngest subject	**54**
Female	4 (15%)
Wearable Data Collection	
Total responses	**1218**
Total days monitored	**581**
Mean days per patient	**22**

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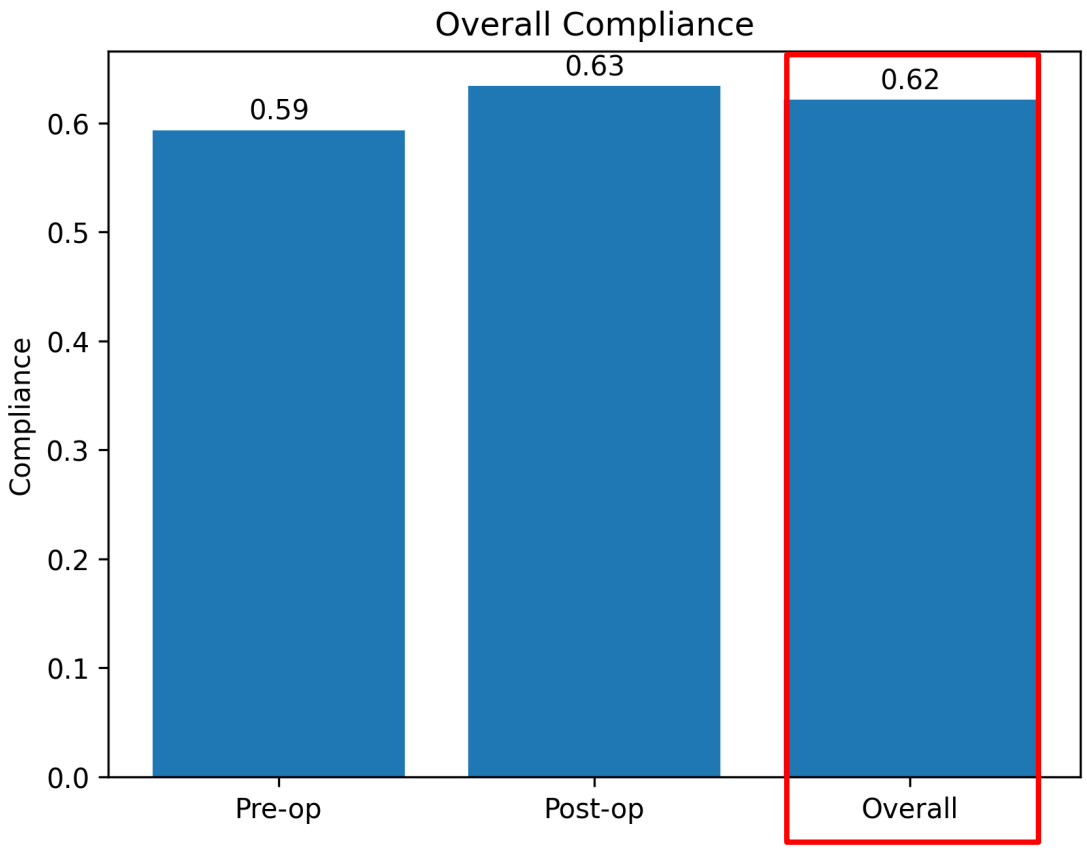
Overall Compliance



Overall calculated compliance: 62%

Active Days: 581, Response Days: 361

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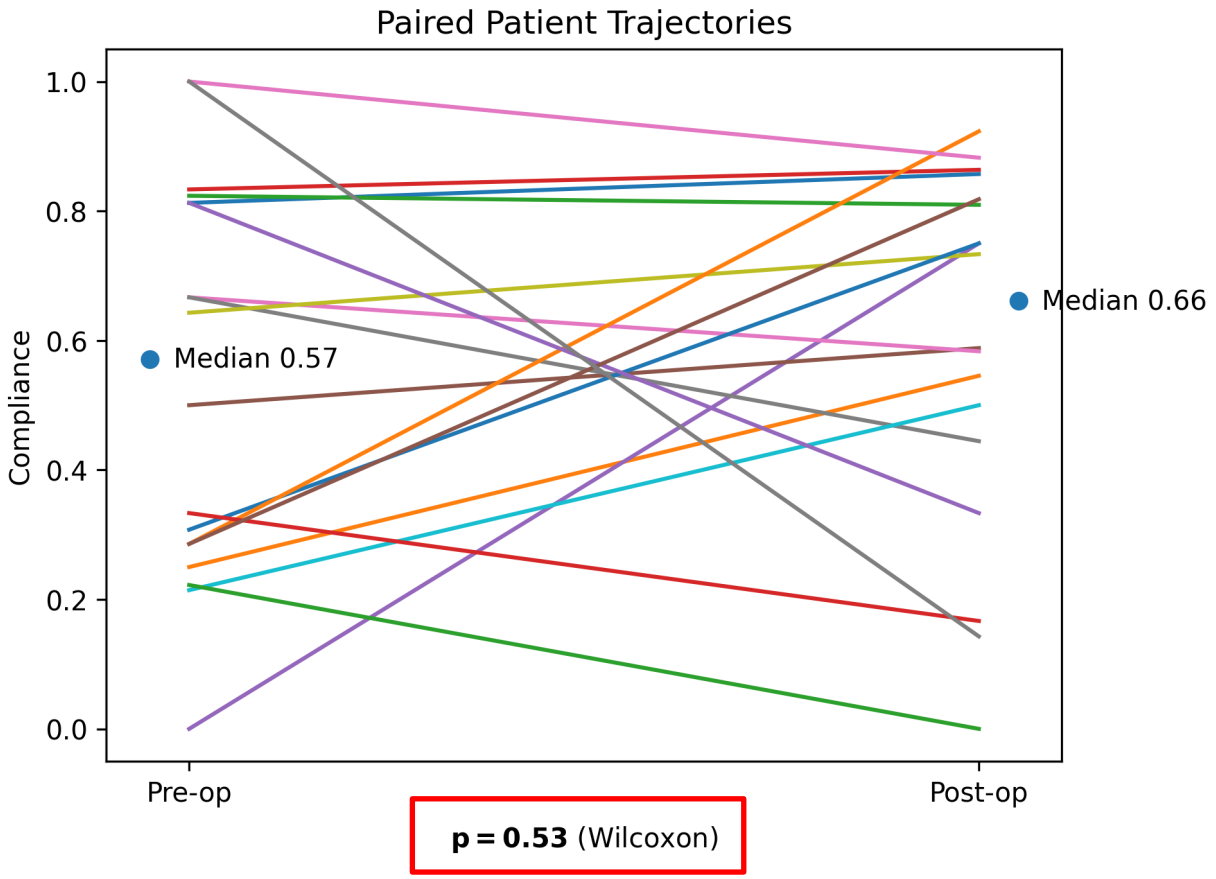
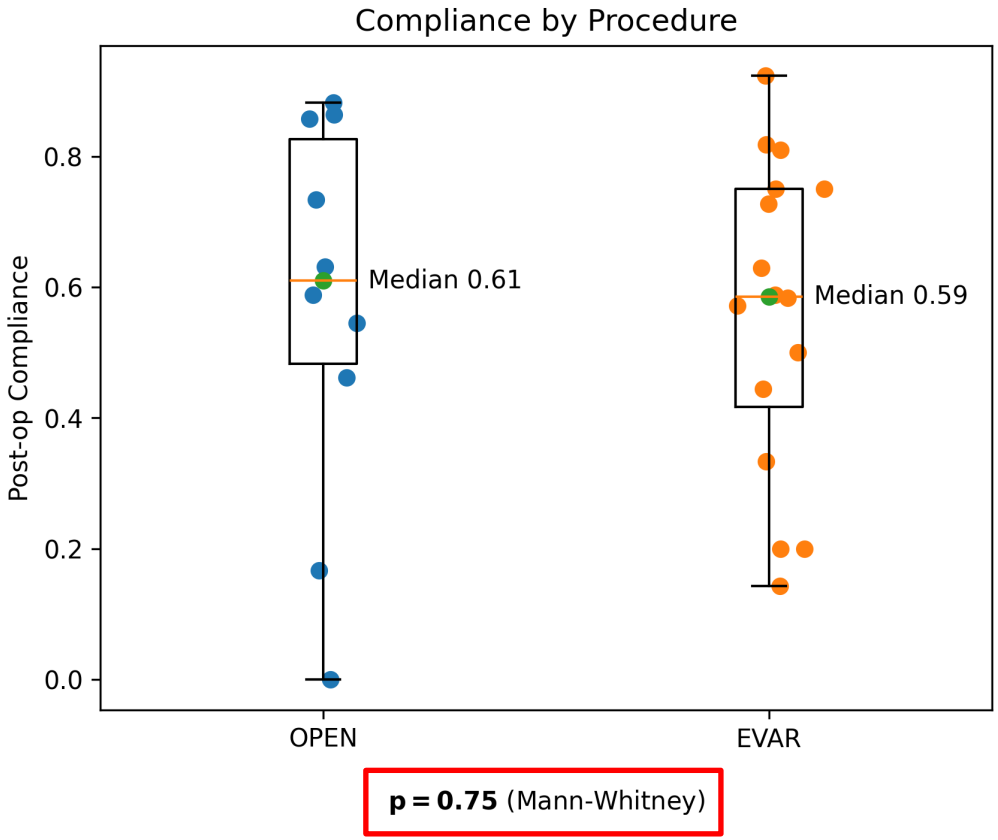
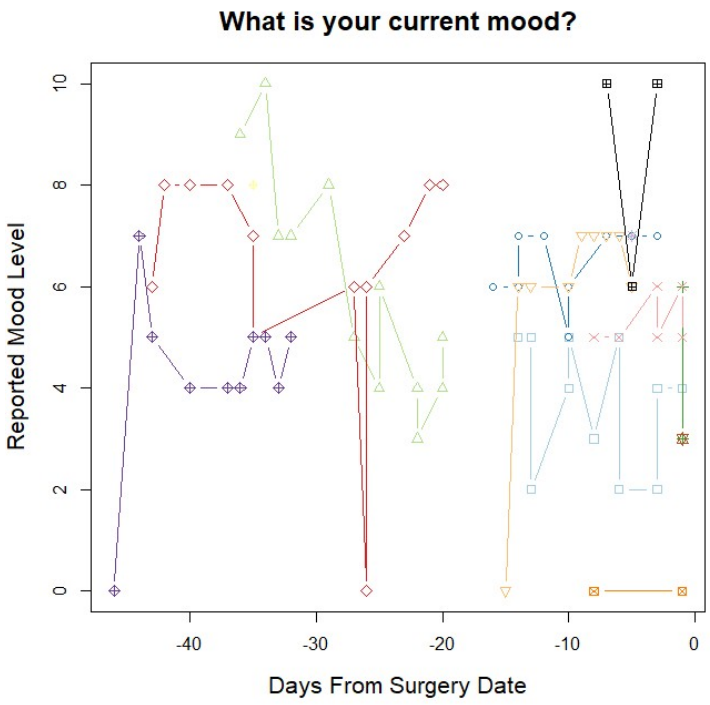
Pre vs. Post-op Compliance



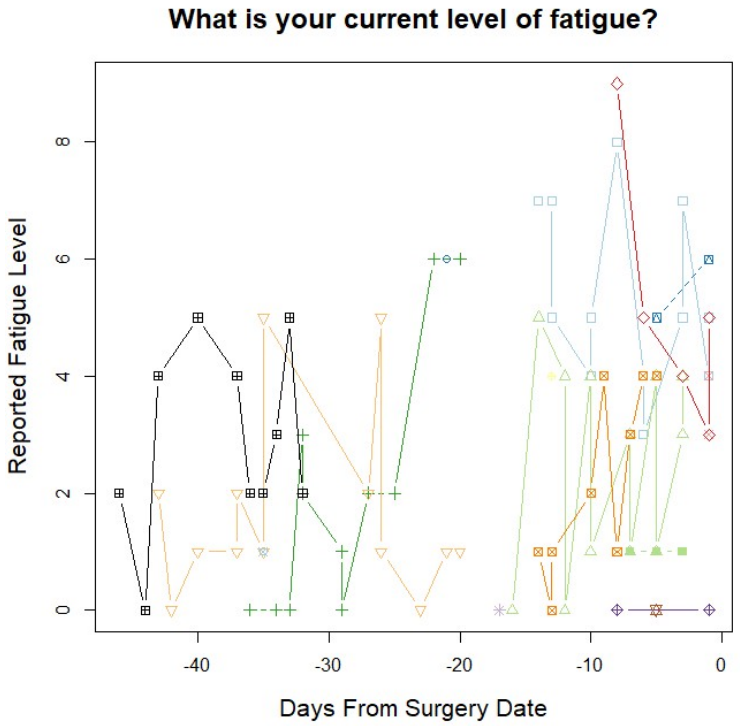
Open vs EVAR Post-Op Compliance



Variability (Pre-Op)



Mean SD: 0.75



Mean SD: 1.2

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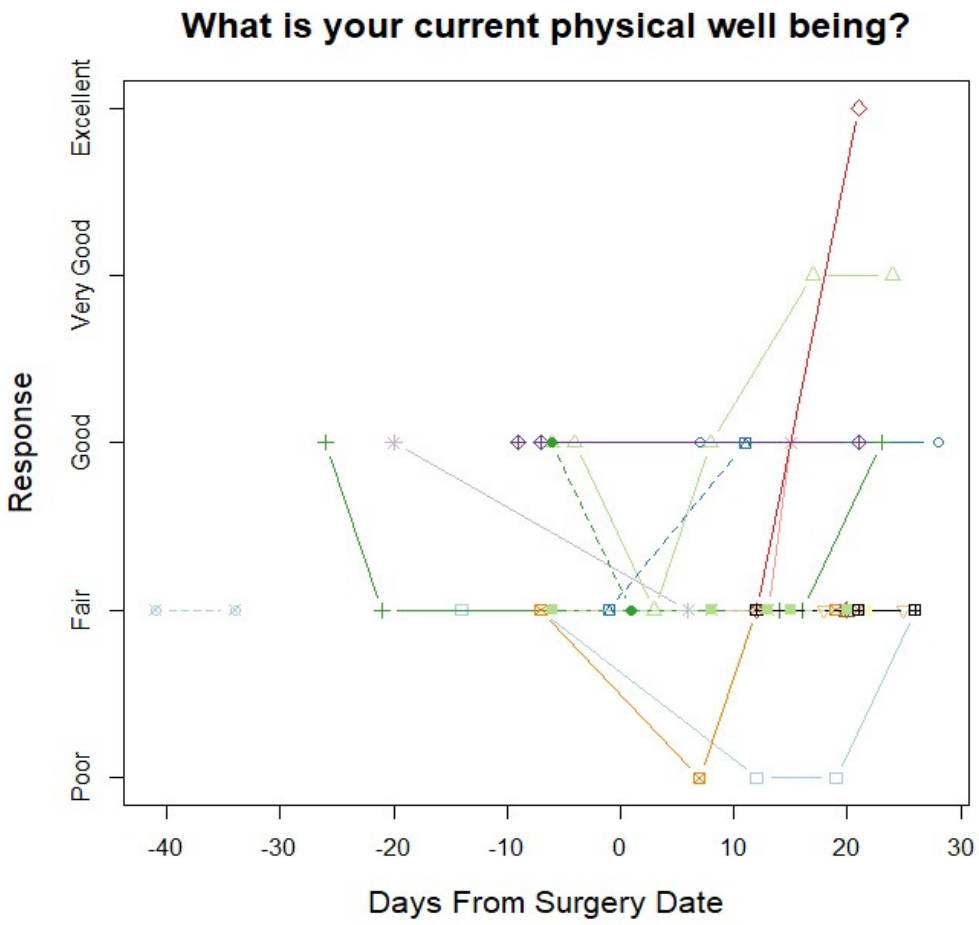
Variability (Pre vs. Post-Op)



Pre-op Mean SD: 0.14

Post-op Mean SD: 0.48

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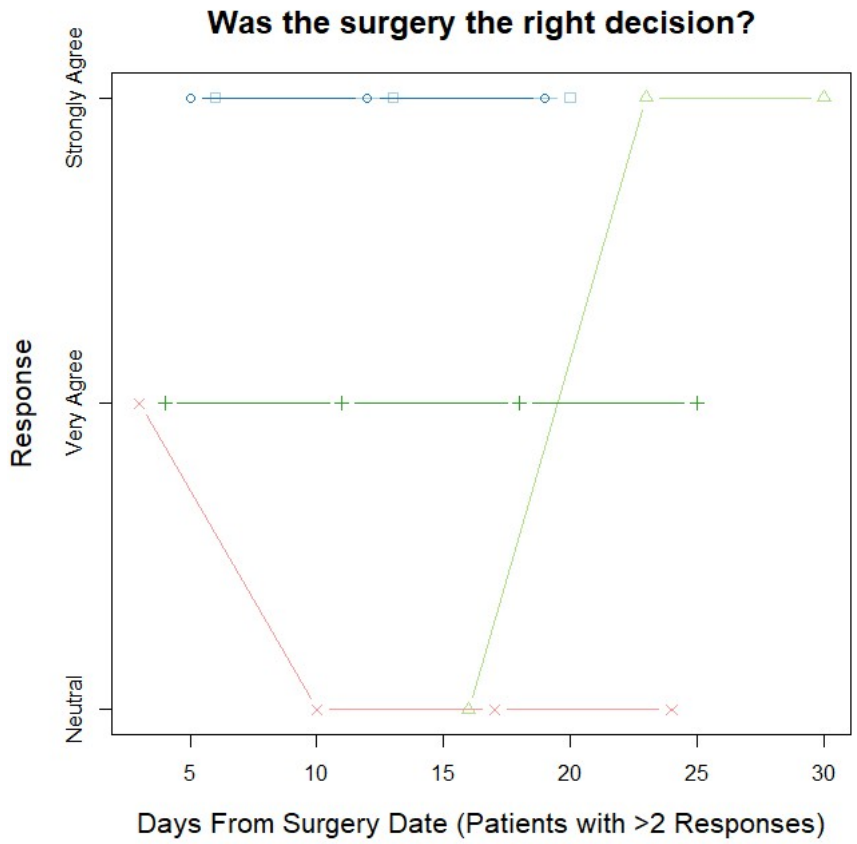
Decision Satisfaction



Last response – first response classification (N=12)

More negative: 3 (25.0%)

Stayed the same: 7 (58.3%)

More positive: 2 (16.7%)

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Limitations

- Small sample size (N=26) limits statistical power and generalizability
- Single-center study may not reflect broader patient populations
- Potential selection bias:
  - Patients willing/able to use wearable technology
- Patient reported outcomes (PROs) are subjective and self-reported, introducing response bias
- Limited follow-up may not capture long-term recovery

Future Directions

- Correlate PROs with:

  -Readmissions and recovery milestones
- Develop predictive models to identify patients at risk for poor recovery—Improve preoperative counseling
- Remote monitoring systems
  - Currently enrolling patients with CLTI at UF, capturing real-time data that is entered into EMR and used by providers
- We are starting enrollment for this same project enrolling patients w/ AAA (including complex)
  - 1 year f/u

Conclusions

- Smartwatch-based PCO collection is feasible in **elderly** AAA patients
- High patient engagement enabled dense, longitudinal data capture
- Recovery is dynamic, with meaningful day-to-day variability
- Traditional clinic visits fail to capture this variability
- Wearables provide a novel window into patient-centered recovery

Thank you

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