

Real-world physical behavior is associated with aerobic fitness, but not patient-reported outcomes, in cancer survivors



Shelby L. Bachman¹, Emma Gomes², Suvekshya Aryal¹, David Cella³, Ieuan Clay¹, Kate Lyden¹, Heather Leach²
¹VivoSense, Inc., ²Colorado State University, ³Northwestern University

BACKGROUND

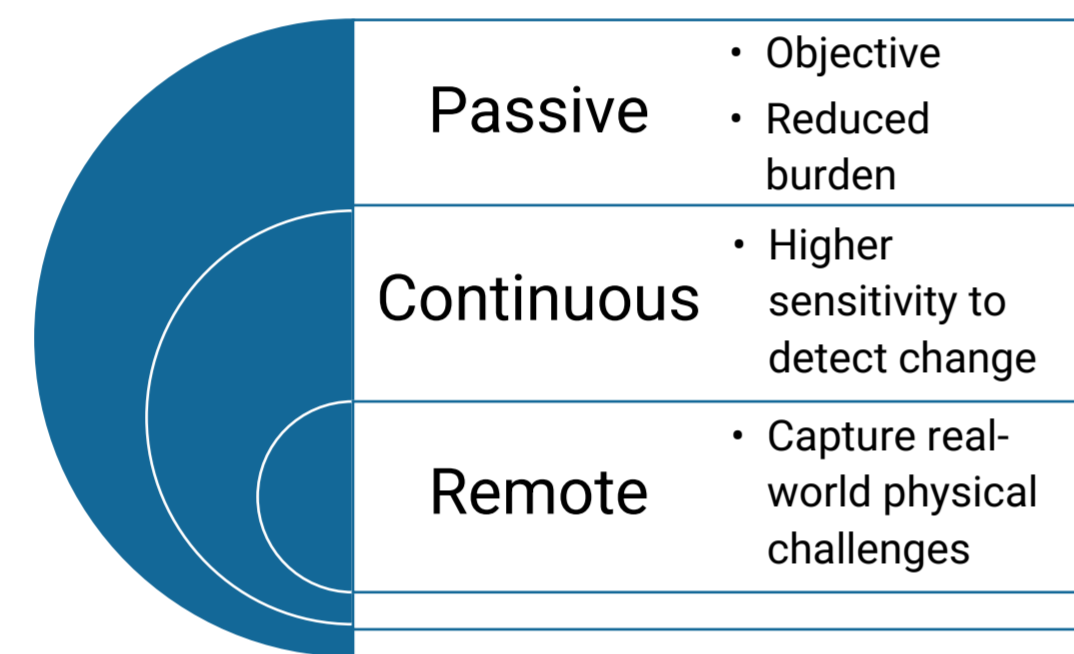
As cancer survival rates increase, maintaining health-related quality of life in cancer survivorship is a priority [1].

Physical function, one aspect of health-related quality of life, is heavily impacted by cancer and its treatments, even years after treatment completion [2].

Established assessments of well-being and physical function in oncology clinical research include patient-reported, clinician-reported, and performance outcome assessments.

These assessments can be burdensome, captured infrequently, prone to ceiling effects, and lacking in ecological validity.

Wearable sensors, such as accelerometers, can capture many aspects of real-world physical behavior [3] and may address some of these limitations.



OBJECTIVE

In cancer survivors, is real-world physical behavior associated with (1) aerobic fitness and (2) patient-reported well-being and physical function?

Comparing these associations, is real-world physical behavior more associated with aerobic fitness or patient-reported outcomes?

METHODS

Eighty-six disease-free cancer survivors who had completed treatment for breast, colon, or rectal cancer participated in the study.

Age range	21 – 85 years
% female	71%
BMI range	18 – 43
Average time since diagnosis	2.7 years
Average time since treatment	1.8 years

Perceived physical function and well-being were assessed with the FACT-G. FACT-G physical well-being scores were linked to scores on a custom subscale of the PROMIS-Physical Function (PF) [4].

Aerobic fitness was assessed as VO_2 during a submaximal exercise test conducted in the laboratory (n=49).

Participants wore an activPAL3 accelerometer on their thigh for 7 days. Accelerometry data were used to calculate measures of **real-world physical behavior**.

Spearman correlation analyses were used to test associations with real-world physical behavior. **Likelihood ratio tests** were used to compare associations.

RESULTS

Real-world physical behavior was associated with aerobic fitness, but not with patient-reported well-being or physical function

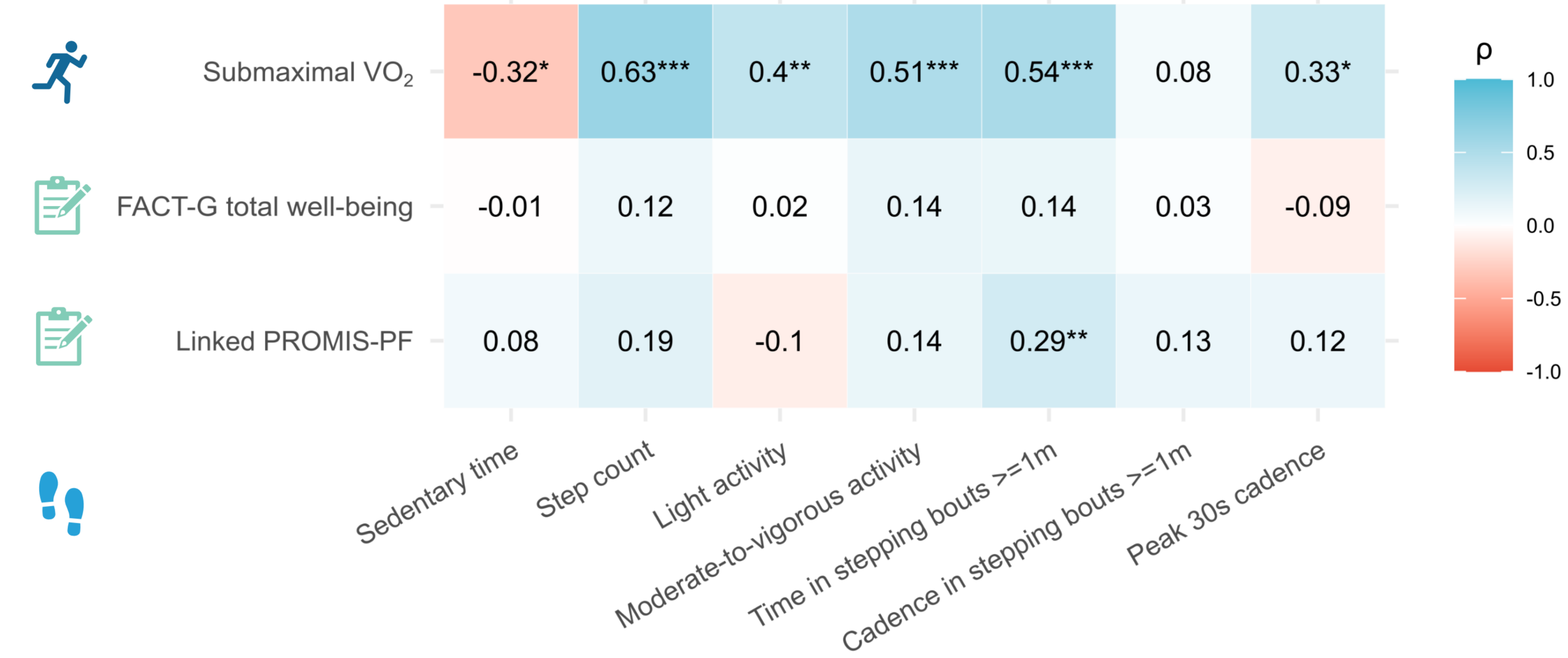


Figure 1. Spearman correlation analyses indicated that all but one of the accelerometry-derived measures of real-world physical behavior were associated with submaximal VO_2 . In contrast, FACT-G total well-being and linked PROMIS-PF T-scores were largely uncorrelated with the various measures of real-world physical behavior. * $p < .05$, ** $p < .01$, *** $p < .001$

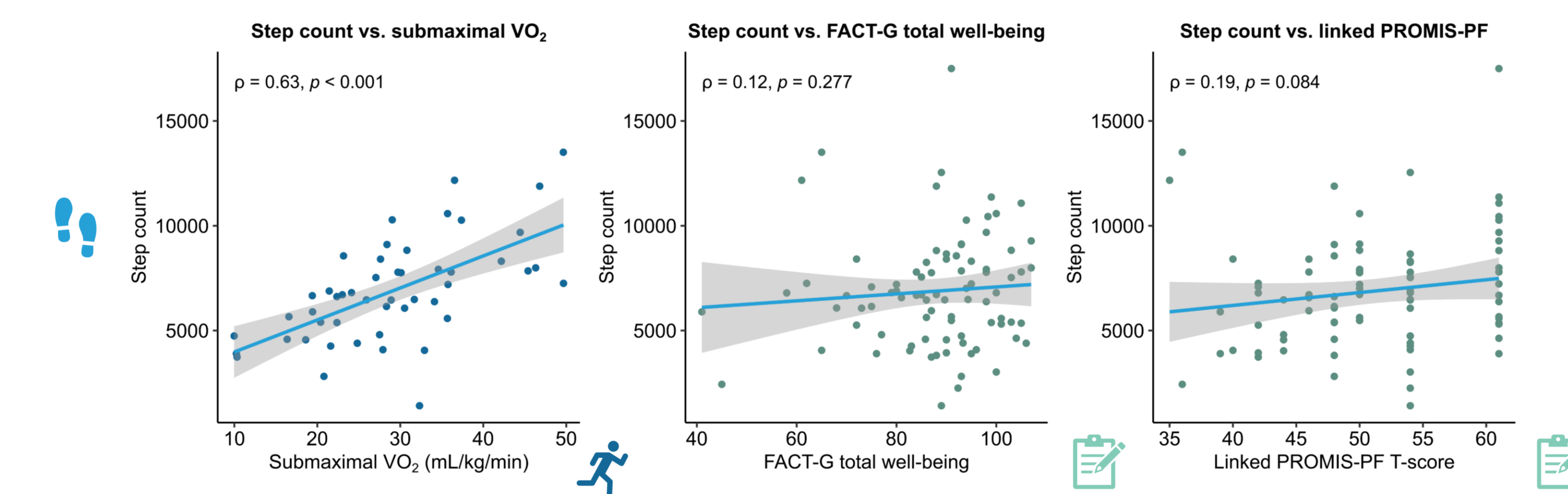


Figure 2. Focusing on associations with average daily step counts, submaximal VO_2 was significantly positively correlated with step counts. In contrast, neither FACT-G total well-being nor linked PROMIS-PF T-scores were significantly correlated with step counts.

Real-world physical behavior differed by aerobic fitness level, but not by patient-reported physical function

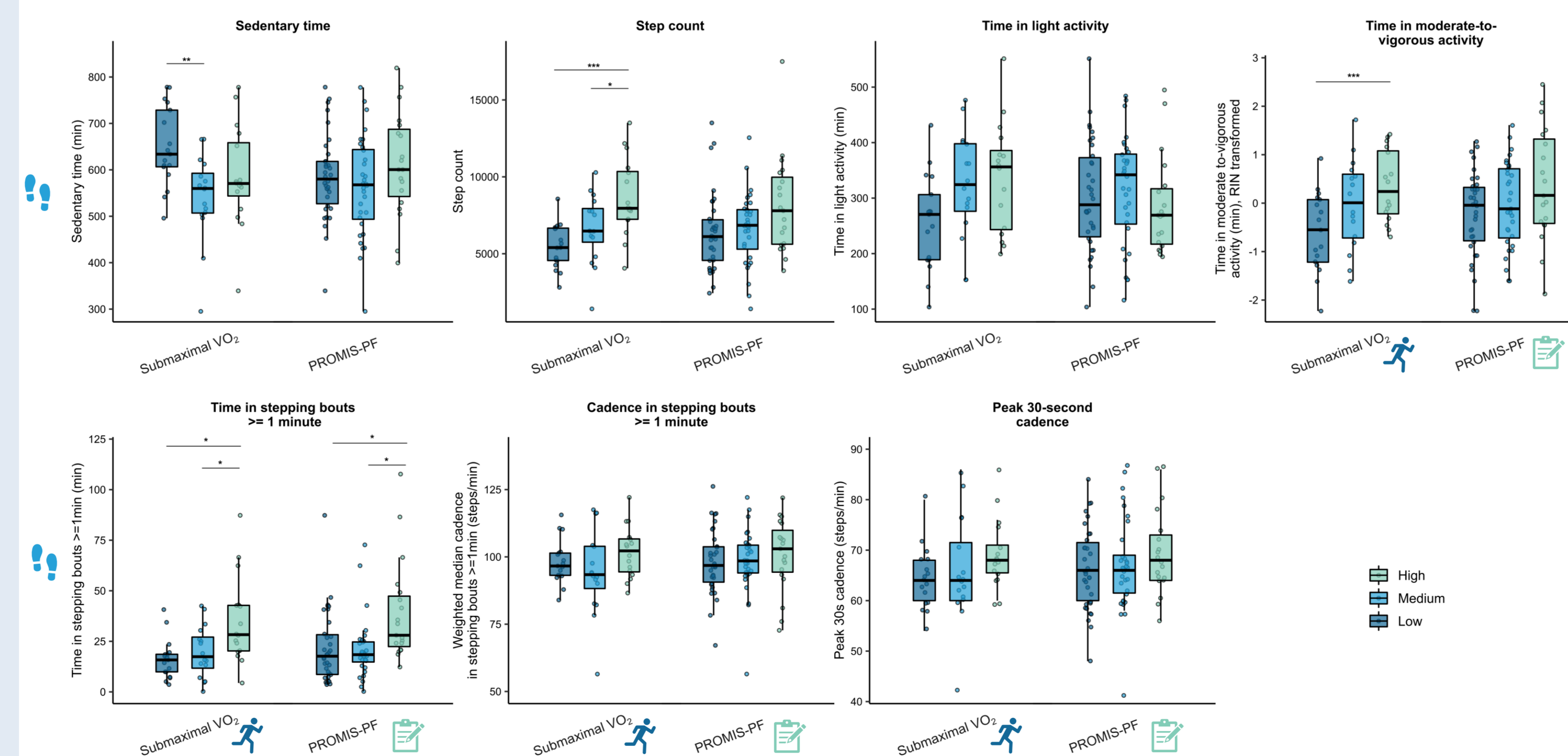


Figure 3. Mann-Whitney-U and Welch's t-tests indicated that individuals with high submaximal VO_2 took more steps, spent more time in moderate-to-vigorous activity, spent more time in stepping bouts over 1 minute compared to those with lower submaximal VO_2 . By and large, individuals with high vs. low levels of linked PROMIS-PF T-scores did not differ in terms of real-world physical behavior. * $p < .05$, ** $p < .01$, *** $p < .001$

Real-world physical behavior was more associated with aerobic fitness than with patient-reported physical function

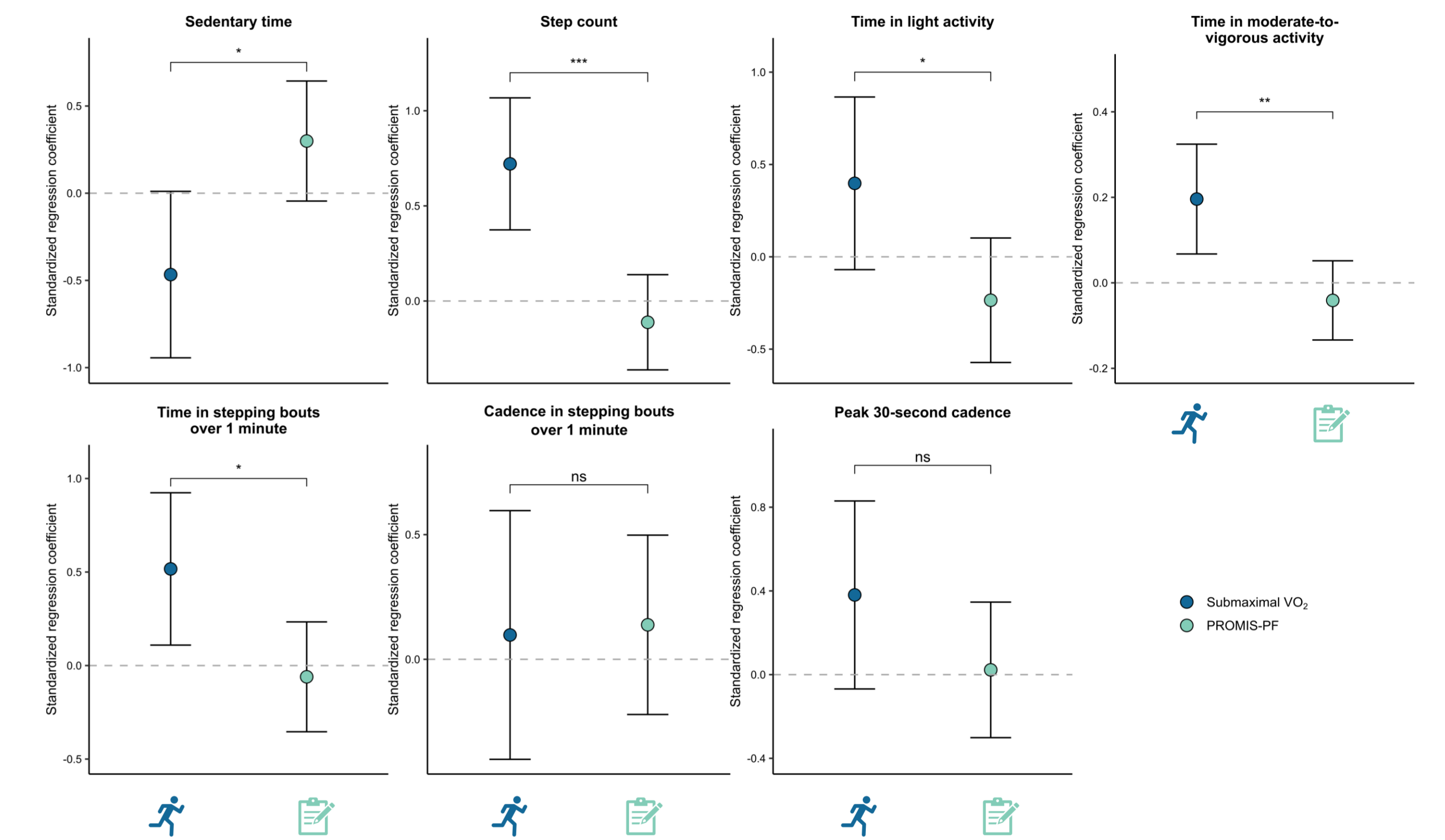


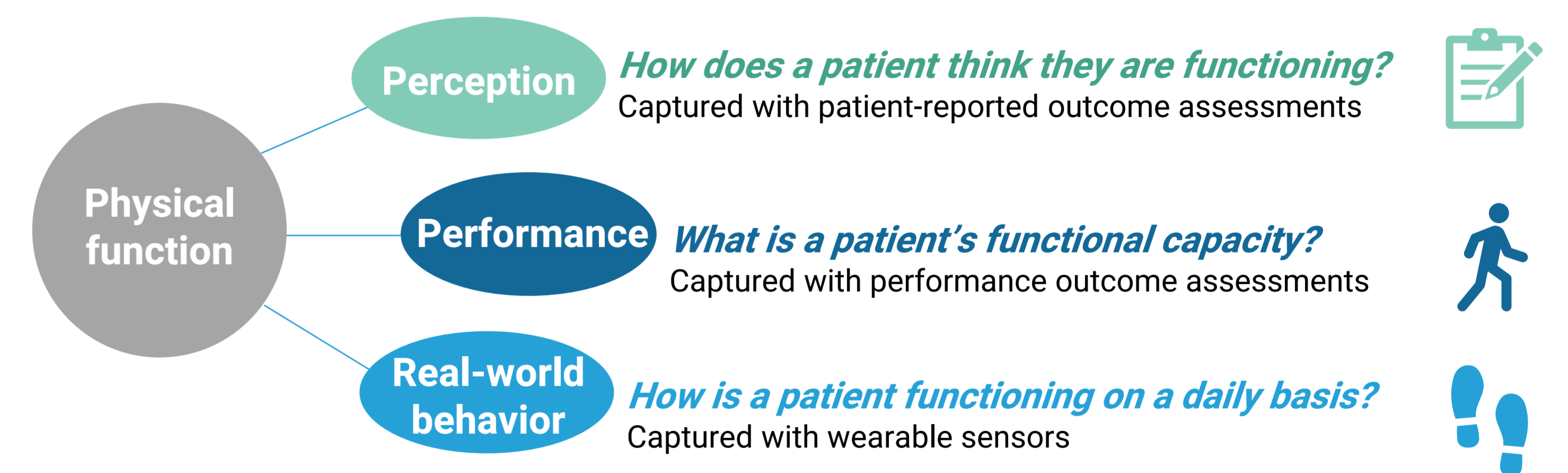
Figure 4. Likelihood ratio tests indicated that time spent sedentary, time in light and moderate-to-vigorous activity, time in stepping bouts over 1 minute, and step counts were more associated with submaximal VO_2 than with linked PROMIS-PF T-scores. * $p < .05$, ** $p < .01$, *** $p < .001$

CONCLUSIONS

In individuals who had completed cancer treatment, accelerometry-derived measures of real-world physical behavior were more related to aerobic fitness than to patient-reported well-being and physical function.

These findings may be explained by ceiling effects in patient-reported well-being and physical function.

Combining patient-reported outcome, performance outcome, and real-world assessments may be useful to more holistically capture physical function in cancer survivors.



REFERENCES

- [1] Jefford M, Howell D, Li Q, Lisy K, Maher J, Alfano CM, Rynderman M, Emery J. Improved models of care for cancer survivors. *The Lancet* 2022;399(10334):1551–1560
- [2] Wu H-S, Harden JK. Symptom burden and quality of life in survivorship: a review of the literature. *Cancer Nurs* 2015;38(1):E29-54.
- [3] Low CA. Harnessing consumer smartphone and wearable sensors for clinical cancer research. *NPJ Digit Med* 2020;3:140.
- [4] Kaat AJ, Schalet BD, Rutsohn J, Jensen RE, Cella D. Physical function metric over measure: An illustration with the Patient-Reported Outcomes Measurement Information System (PROMIS) and the Functional Assessment of Cancer Therapy (FACT). *Cancer* 2018;124(1):153–160.

FUNDING

American Cancer Society Grant #131629-MRSG-18-021-01-CPPB