Agreement between accelerometer-derived and self-reported physical activity and sedentary time in patients with hepatocellular carcinoma

Nadia Kim[1,2,3,5] · David Barnes[2,3] · Misti V McCain[1,2,3] · Silvia Del Din[1,2] · Lisa Alcock[1,2] · Helen L Reeves[1,2,3,4] · Samuel T Orange[5,6,7]

[1]National Institute for Health and Care Research, Newcastle Biomedical Research Centre, Newcastle University, Newcastle upon Tyne, UK; [2]Translational and Clinical Research Institute, Faculty of Medical Sciences, Newcastle University, Newcastle upon Tyne, UK; [3]Newcastle University Centre for Cancer, Newcastle upon Tyne, UK; [4]Newcastle upon Tyne Hospitals NHS Foundation Trust Newcastle University, Newcastle upon Tyne, UK; [5] School of Biomedical, Nutritional and Sport Sciences, Newcastle University; [6] York St John University [7] Emles Bioventures, London

Background

Hepatocellular carcinoma (HCC) predominantly affects older adults with multiple comorbidities and functional limitations.

Accurate physical activity assessment is important for cancer research and supportive care.

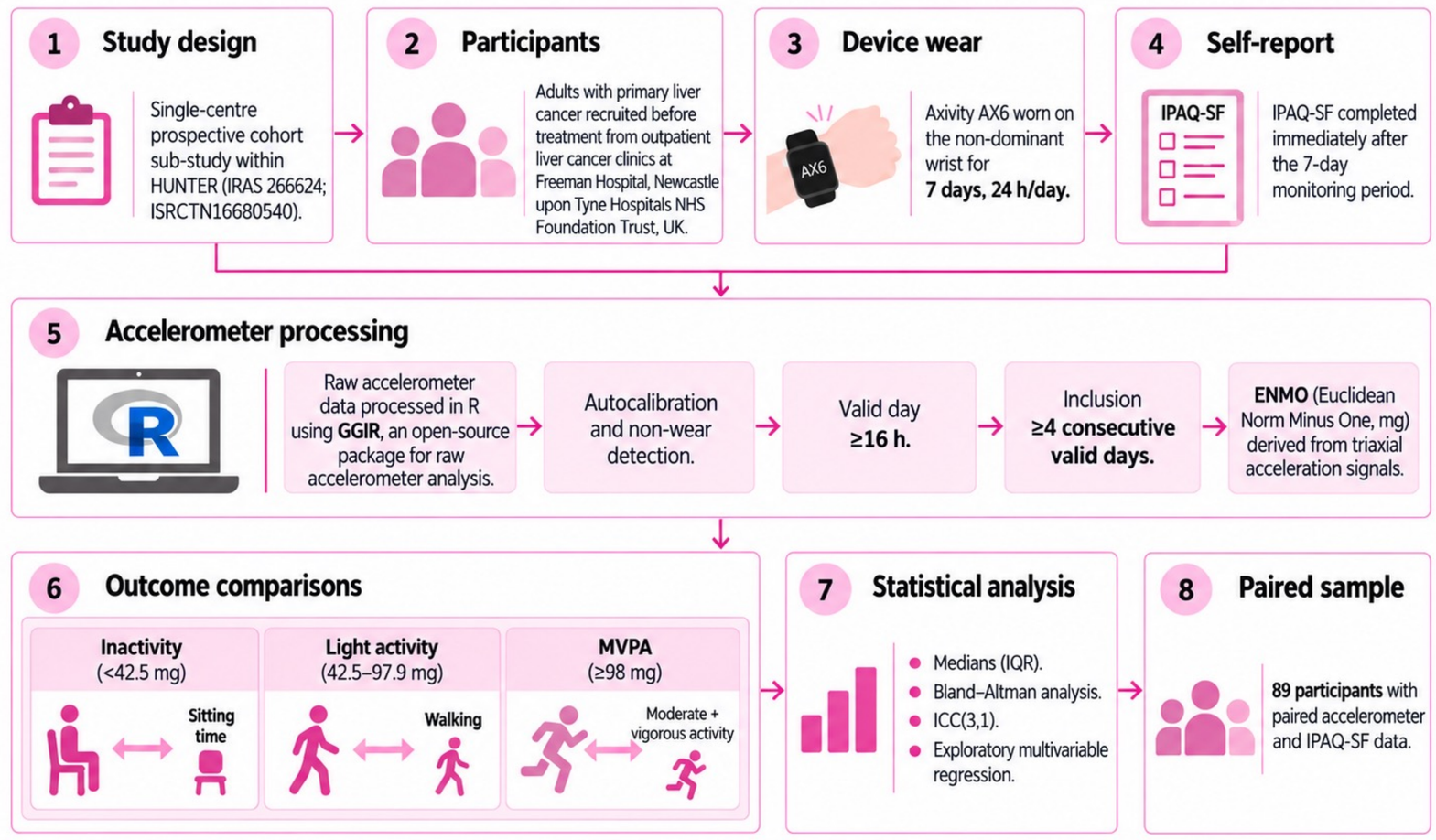
Previous studies have reported **limited agreement** between self-reported and device-derived physical activity measures.

However, agreement between **IPAQ-SF and accelerometry in patients with HCC** remains unexplored.

Study Aims

1. **Compare** IPAQ-SF and accelerometer-derived activity estimates.
2. **Assess agreement and bias** using ICCs and Bland–Altman analysis.
3. **Explore participant characteristics** associated with between-method disagreement.

Methods



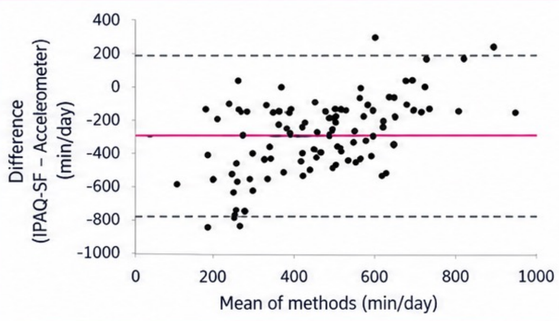
Results

89 participants with valid paired IPAQ-SF and accelerometer data

1 Age	Median **72 years**; IQR **66–78**
2 Sex	**80 male** (89.9%); **9 female** (10.1%)
3 Ethnicity	White ethnicity: **88 (98.9%)**
4 Body composition	Mean BMI **30.6 kg/m²** (SD 5.7); Obesity: **45 (50.6%)**
5 Comorbidity burden	≥1 comorbidity: **85 (95.5%)**; Hypertension 57.3%; Type 2 diabetes 55.1%
6 Liver disease	Cirrhosis present: **66 (74.2%)**; MASLD-associated liver disease: **34 (38.2%)**
7 Liver function	Child–Pugh class A: **81 (91.0%)**; MELD score median **8** (IQR 6–11)
8 Cancer stage	TNM stage I–II: **60 (67.4%)**; BCLC stage C: **49 (55.1%)**

Measurement pair	Accelerometer median (IQR), min/day	IPAQ-SF median (IQR), min/day	Mean bias (95% LoA), min/day	ICC (3,1)
Inactivity / sitting	**584** (489–676)	**305** (122–493)	**−257.3** (−741.1 to 226.6)	**0.051**
Light PA / walking	**234** (179–308)	**16** (1–68)	**−206.2** (−444.2 to 31.9)	**0.601**
MVPA	**80** (50–113)	**0** (0–25)	**−71.3** (−164.6 to 22.0)	**0.229**

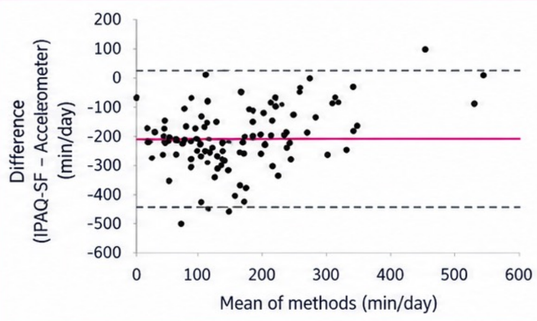
Inactivity / sitting time



Mean bias (95% LoA), min/day: **−257.3** (−741.1 to 226.6)

ICC (3,1): **0.051**

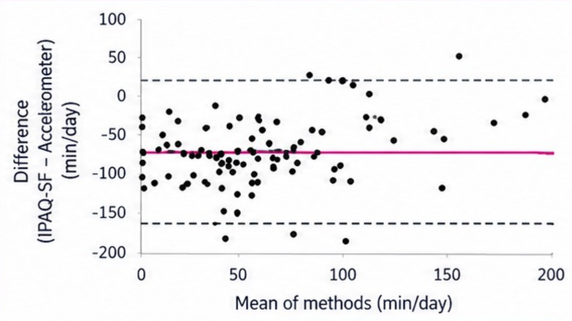
Light physical activity / walking



Mean bias (95% LoA), min/day: **−206.2** (−444.2 to 31.9)

ICC (3,1): **0.601**

Moderate-to-vigorous physical activity



Mean bias (95% LoA), min/day: **−71.3** (−164.6 to 22.0)

ICC (3,1): **0.229**

Mean bias = IPAQ-SF − accelerometer; negative values indicate lower self-reported values.
LoA = limits of agreement; ICC = intraclass correlation coefficient.

- IPAQ-SF group medians were **47.8% lower** for inactivity / sitting.
- IPAQ-SF group medians were **93.2% lower** for light PA / walking.
- IPAQ-SF group medians were **100% lower** for MVPA.
- Agreement was **poor** for inactivity / sitting and MVPA, and moderate for light PA / walking.

Mean bias Upper and lower 95% limits of agreement (LoA)

Discussion

- **Limited agreement** between IPAQ-SF and accelerometry indicates that the methods are not interchangeable.
- **Lower IPAQ-SF estimates** contrast with previous studies reporting higher self-reported activity in other cancer populations.
- **Measurement differences**, including ≥10-minute activity reporting for IPAQ-SF versus continuous accelerometer monitoring, may partly explain the discrepancies.
- **Higher BMI and older age** were associated with greater disagreement, suggesting that participant characteristics influence measurement comparability.
- **Clinical implications:** Accelerometry captures movement continuously, whereas IPAQ-SF provides complementary information on recalled activity type and context.

References

1. HUNTER: Hepatocellular Carcinoma Expediter Network — a collaborative research programme funded by Cancer Research UK and partner organisations to study tumour biology, biomarkers and therapeutic response in primary liver cancer (*HCC Expediter Network*). Newcastle University / Cancer Research UK. Available from: https://research.ncl.ac.uk/hunter/
2. Llovet JM, et al. Nat Rev Dis Primers. 2021;7:6.
3. Kim N, et al. J Gastrointest Cancer. 2026;57:60.
4. Prince SA, et al. Int J Behav Nutr Phys Act. 2008;5:56.
5. Lee PH, et al. Int J Behav Nutr Phys Act. 2011;8:115.
6. Boyle T, et al. Support Care Cancer. 2015;23:1121–1126.
7. Biskup M, et al. Diagnostics. 2023;13:3447.
8. van Hees VT, et al. PLoS ONE. 2013;8:e61691.
9. Bland JM, Altman DG. Lancet. 1986;327:307–310.

Newcastle University · Digital Health Innovation in Ageing & Neurodegeneration · Newcastle University Centre for Cancer · NIHR Biomedical Research Centre

This research was supported by the National Institute for Health Research (NIHR) Newcastle Biomedical Research Centre (BRC) based at The Newcastle upon Tyne Hospital NHS Foundation Trust, Newcastle University and the Cumbria, Northumberland and Tyne and Wear (CNTW) NHS Foundation Trust.
The views expressed are those of the author(s) and not necessarily those of the NIHR or the Department of Health and Social Care.

n.kim5@newcastle.ac.uk

Let's connect!