



Design and Status Update of the DIGITIZE Wearable Substudy in ALL ALS

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BACKGROUND

AIMS & OBJECTIVE

- ALS Clinical trials often rely on outcome measures that are typically measured in clinic, limiting the frequency at which they can be recorded during a trial.
 - This can lead to substantial missing data and decreased statistical power in clinical trials.
- There is a need for decentralized trials and remote options for study participation in ALS trials.
- Advances in digital health technologies (DHTs) have enabled remote monitoring and quantification of patient activity in natural, unsupervised environments where individuals go about their daily routines outside of clinical or laboratory settings.^{1,2,3}
- Accelerometers and gyroscopes embedded in inertial measurement unit (IMU) wearable sensors are some of the most common DHTs used to assess movement and activity levels.^{4,5,6}
- There have been several studies looking at the use of accelerometers and gyroscopes to quantify movement and activity in ALS, but none have been validated on large external datasets.^{7,8,9}
- This validation is necessary to understand the natural history of these measures in ALS for successful implementation into clinical trials.

- Collect digital data from wrist and ankle-worn IMU wearable sensors in people living with ALS, controls, and people who are healthy and carry a gene that can cause ALS.
- Identify and describe **reliable features** from the wearable sensors to quantify:
 - Gait
 - Upper extremity movement and function
 - Lower extremity movement and function
- Identify digital features from the wearable sensors that are **sensitive to change** in ALS disease progression.

METHODS

Observational optional add-on to the ASSESS ALL ALS and PREVENT ALL ALS studies.

Enrollment goal = 200 participants across 14 sites

Eligible participants will enroll for up to 12 months with study visits at baseline, months 4, 8, & 12

- Remote monitoring via the Empatica EmbracePlus worn at the wrist and Empatica EmbraceMini worn at the ankle (**Figure 1**)
 - First 2 weeks after baseline visit and then the first week of each month thereafter

Study Visits (either in-person or remote)

- Participants complete:
 - Surveys related to their strength and ambulation status and a fall questionnaire
 - Predicted compliance questions (baseline) and device usability questionnaires
 - Brief timed movements: elbow & knee flexions and extensions while wearing the devices.

Digital Data Collection: (Figure 2)

- Raw accelerometer and gyroscope data are being collected from the Empatica EmbracePlus worn at the wrist and Empatica EmbraceMini worn at the ankle.
- Data is transmitted via Bluetooth to the Care App and then to the Empatica Secure Cloud.
- Sites have access to the Care Portal where they monitor participant compliance during the recommended wear periods.



Figure 1. Empatica devices for DIGITIZE ALL ALS.

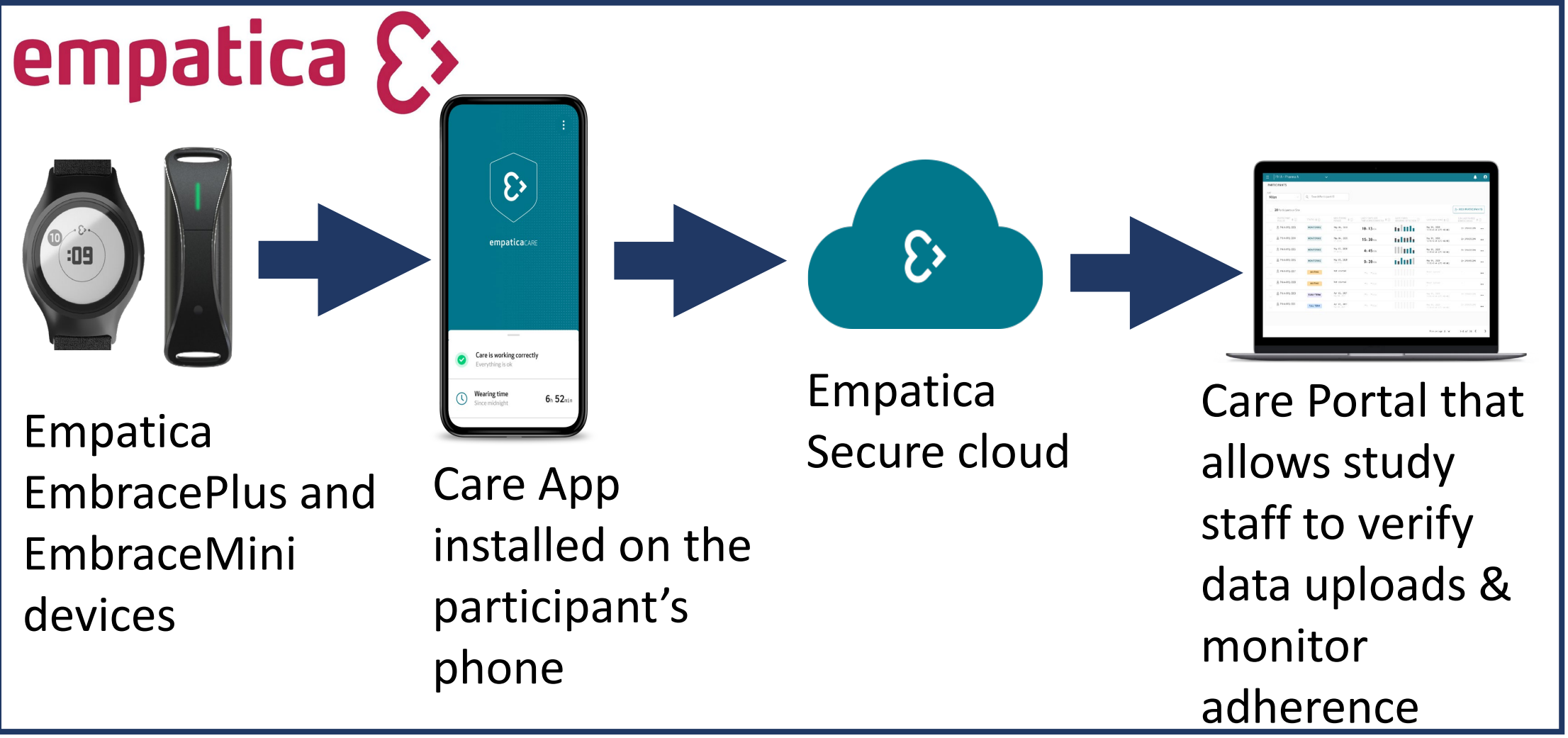


Figure 2. DIGITIZE ALL ALS Data Collection. Study staff monitor participant adherence through the Care Portal. Wear time for the wrist-worn device is captured at one-minute resolution, enabling detailed adherence monitoring. For the ankle-worn device, data collection can be verified, but wear time is not directly measured.

RESULTS TO DATE (data summarized through June 30, 2026)

Table 1. Demographics for participants who have started data collection in DIGITIZE ALL ALS.

	PREVENT Asymptomatic gene carriers	ASSESS Healthy controls	ASSESS Symptomatic Onsite	ASSESS Symptomatic Remote
Number enrolled*	26	48	21	16
Sex, Female (%)	17 (65.4%)	40 (83.3%)	5 (23.8%)	5 (31.2%)
Age, Mean (SD)	47.7 (13.8)	46.3 (16.1)	63.4 (9.2)	60.3 (12.5)
Race, n(%)				
White	25 (96%)	45 (93.8%)	20 (95.2%)	16 (100.0%)
Asian	3 (11.5%)	1 (2.1%)	1 (4.8%)	--
Black or African American	--	3 (6.2%)	--	--
Middle Eastern or North African	1 (3.8%)	--	--	--

*Number enrolled is the number of participants who started collecting wearable device data at the wrist on or before June 30, 2026.

**Age is the mean (SD) age for these participants at their time of enrollment into the main PREVENT/ASSESS studies.

Table 2. ALS history for participants in the ASSESS Symptomatic Onsite and Remote cohorts.

ASSESS ALS Symptomatic Cohort Participants	N	37
Time from symptom onset to monitoring start, months	Mean (SD)	70.4 (76.7)
Number of participants with time from onset <24months	Count (%)	12 (32.4%)
Family history of ALS		4 (11.1%)
Site of Symptom Onset		
Bulbar onset		9 (24.3%)
Limb onset		27 (73.0%)
General onset		1 (2.7%)

DISCUSSION

- Strong enrollment to date: asymptomatic gene carrier cohort fully enrolled (n=26), healthy controls nearly complete (48/50), and 37 participants with ALS have initiated remote data collection.
- Current recruitment is focused on the symptomatic ALS cohort.
- High adherence to the wrist-worn device, with participants consistently exceeding the recommended wear time through Month 6 (noting fewer participants reached later follow-up).
- Future analyses will compare adherence across participant cohorts and at different functional levels.
- Future work will leverage raw accelerometer and gyroscope data to develop novel digital measures of upper and lower extremity function, including gait.

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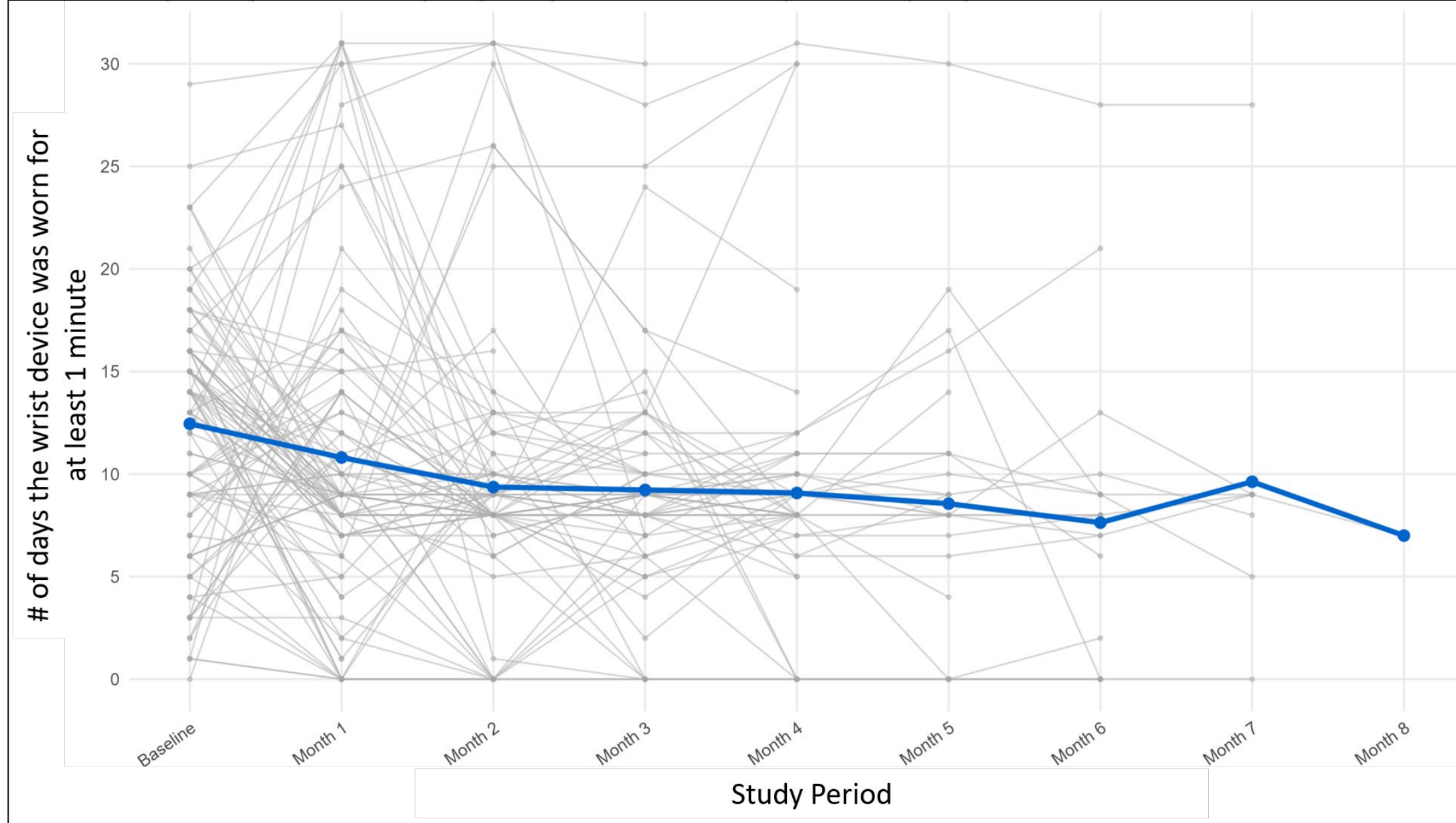


Figure 4. Number of days the wrist device was worn for at least 1 minute by each participant during the baseline period and each follow-up study month. Gray lines represent individual participant trajectories, and the **blue** line represents the mean number of days worn across participants for each study period. The baseline period extends from the first 2 weeks of wear through the end of that month. Follow-up periods correspond to complete calendar months.

Month	N	Mean Days (SD)	Mean hours/day when device was worn (SD)
Baseline	111	12.5 (5.9)	18.8 (4.3)
Month 1	102	10.8 (7.7)	19.2 (3.6)
Month 2	90	9.4 (6.9)	19.0 (2.6)
Month 3	71	9.2 (5.8)	18.8 (2.3)
Month 4	52	9.1 (6.5)	18.5 (2.8)
Month 5	27	8.6 (6.8)	18.7 (2.9)
Month 6	19	7.6 (7.3)	18.6 (3.4)
Month 7	8	9.6 (8.1)	20.2 (1.8)
Month 8	1	7.0 (-)	17.1 (-)

Table 3. Longitudinal wrist-worn device wear time across all participants. The baseline period includes the monitoring start date through the end of the enrollment month. Each follow-up month corresponds to the subsequent calendar month, during which participants were instructed to wear the devices for the first week. Any data from that month is included. N represents the number of participants who reached each month of follow-up.

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