

Study Title: A prospective investigation of the feasibility of smartphone-based self-monitoring to characterize cognitive and neurological impairment in patients with multiple sclerosis (FLOODLIGHT MS-MoreActive)

Participant Flow

Table 1 – Participant flow

Category	Primary progressive multiple sclerosis (PPMS)	Relapsing remitting multiple sclerosis (RRMS)	Secondary progressive multiple sclerosis (SPMS)
Started	12	242	25
Completed	0	0	0
Not Completed	12	242	25

Reasons for not Completed

Withdrawal by Participant	3	40	4
Other (Reason not Specified)	9	202	21

Baseline Characteristics

Treatment groups

Cohort 1: Participants with multiple sclerosis (PwMS) in Cohort 1 performed the Floodlight™ MS (FL MS) Cognitive Test once every week (QW) and all other FL MS tests every 2 weeks (Q2W), MSReactor tests, and Redenlab tests at least once a month and Audio Recorded Cognitive Screen (ARCS) test once a year up to Month 24.
Cohort 2: PwMS in Cohort 2 performed the FL MS Cognitive Test and all other FL MS tests Q2W, MSReactor tests, and Redenlab tests at least once a month, and ARCS test once a year up to Month 24.
Cohort 3: PwMS in Cohort 3 performed the FL MS Cognitive Test every 4 weeks (Q4W) and all other FL MS tests Q2W, MSReactor tests, and Redenlab tests at least once a month, and ARCS test once a year up to Month 24.

Table 2 - Baseline Characteristics (Full Analysis Set)

Demographic and Baseline Variable	Statistics	Cohort 1 (N=67)	Cohort 2 (N=128)	Cohort 3 (N=84)	All Participants (N=128)
Age (years)	Mean	49.5	52.5	51.2	51.4
	Standard Deviation [SD]	10.2	11.0	12.5	11.3
Sex (participants)					
Female	n (%)	54 (80.6%)	98 (76.6%)	63 (75.0%)	64 (22.9%)
Male	n (%)	13 (19.4%)	30 (23.4%)	21 (25%)	215 (77.1%)

Outcome Measures

Treatment groups

Cohort 1: Participants with multiple sclerosis (PwMS) in Cohort 1 performed the FL MS Cognitive TestQW and all other FL MS tests Q2W, MSReactor tests, and Redenlab tests at least once a month and ARCS test once a year up to Month 24.
Cohort 2: PwMS in Cohort 2 performed the FL MS Cognitive Test and all other FL MS tests Q2W, MSReactor tests, and Redenlab tests at least once a month, and ARCS test once a year up to Month 24.
Cohort 3: PwMS in Cohort 3 performed the FL MS Cognitive Test Q4W and all other FL MS tests Q2W, MSReactor tests, and Redenlab tests at least once a month, and ARCS test once a year up to Month 24.
All participants: PwMS in Cohorts 1, 2, and 3 performed the FL MS Cognitive Test QW, Q2W, and Q4W, respectively, and all other FL MS tests Q2W, MSReactor tests, and Redenlab tests at least once a month and ARCS test once a year up to Month 24

Primary Outcome Measures

1. Cross-sectional Correlation Between FL MS Cognitive Test vs. ARCS

Timeframe: Baseline, Month 12

Analysis Population Description: Full analysis set (FAS) included all participants who signed the informed consent form (ICF). MTS = Match Symbol; MTN = Match Number

Unit of Measurement: score

Table 3 – Cross-sectional Correlation Between FL MS Cognitive Test Scores vs. ARCS Total Score and Binned ARCS

		All participants	
	Number of Participants Analyzed:	222	
	Category	Point Estimate	Lower and Upper CI
Baseline: MTS vs ARCS	Number Analyzed:	222 Participants	
		0.25	0.12 to 0.38
Baseline: MTS vs Binned ARCS	Number Analyzed:	222 Participants	
		0.24	0.10 to 0.36
Baseline: MTN vs ARCS	Number Analyzed:	222 Participants	
		0.20	0.06 to 0.32

Baseline: MTN vs Binned ARCS	Number Analyzed:	222 Participants	
		0.17	0.03 to 0.30
Month 12: MTS vs ARCS	Number Analyzed:	51 Participants	
		0.27	−0.01 to 0.52
Month 12: MTS vs Binned ARCS	Number Analyzed:	51 Participants	
		0.23	−0.05 to 0.48
Month 12: MTN vs ARCS	Number Analyzed:	51 Participants	
		0.23	−0.06 to 0.48
Month 12: MTN vs Binned ARCS	Number Analyzed:	51 Participants	
		0.20	−0.09 to 0.46

Secondary Outcome Measures

2. Longitudinal Correlation Between Change From Baseline to Month 12 on FL MS Cognitive Test vs. ARCS

Timeframe: Baseline up to Month 12

Analysis Population Description: FAS included all participants who signed the ICF.
Unit of Measurement: score

Table 4 – Correlation Between Change From Baseline to Month 12 in FL MS Cognitive Test Scores vs. ARCS Total Score and Binned ARCS

		All participants	
	Number of Participants Analyzed:	51	
	Category	Point Estimate	Lower and Upper CI
MTS vs ARCS	Number Analyzed:	51 Participants	
		-0.11	-0.38 to 0.18
MTS vs Binned ARCS	Number Analyzed:	51 Participants	
		-0.22	-0.47 to 0.07
MTN vs ARCS	Number Analyzed:	51 Participants	
		-0.05	-0.33 to 0.24

MTN vs Binned ARCS	Number Analyzed:	51 Participants	
		-0.15	-0.42 to 0.14

3. Cross-sectional Correlation Between Composite Digital Cognition Outcome vs. ARCS

Timeframe: Baseline, Month 12

Analysis Population Description: Composite-score test population included all participants in the all-time-evaluable (ATE) population who were not in the composite-score build population. ATE population included all participants who belonged to both the BE population and M12E population. Due to the extreme limitation of sample size at Month 12, summaries for Month 12 were excluded for this outcome measure.

Unit of Measurement: score

Table 5 – Cross-sectional Correlation Between Composite Digital Cognitive Score vs. ARCS Total Score and Binned ARCS

		All participants	
	Number of Participants Analyzed:	123	
	Category	Point Estimate	Lower and Upper CI
Baseline: Composite Cognitive Score vs ARCS	Number Analyzed:	123 Participants	
		-0.09	-0.27 to 0.09
	Number Analyzed:	123 Participants	
		-0.07	-0.25 to 0.11

Baseline: Composite Cognitive Score vs binned ARCS		
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4. Longitudinal Correlation Between Change From Baseline to Month 12 in Composite Digital Cognition Outcome vs. ARCS

Timeframe: Baseline up to Month 12

Analysis Population Description: Composite-score test population included all participants in the ATE population who were not in the composite-score build population. ATE population included all participants who belonged to both the BE population and M12E population.

Unit of Measurement: score

Table 6 –Correlation Between Change From Baseline to Month 12 in Composite Digital Cognitive Score vs. ARCS Total Score and Binned ARCS

		All participants	
	Number of Participants Analyzed:	14	
	Category	Point Estimate	Lower and Upper CI
Composite Cognitive Score vs ARCS	Number Analyzed:	14 Participants	
		–0.33	–0.74 to 0.26
Composite Cognitive Score vs binned ARCS	Number Analyzed:	14 Participants	
		–0.56	–0.85 to –0.03

5. FL MS Cognitive Feature Differences at Month 6, Month 12, and Month 18

Timeframe: Months 6, 12 and 18

Analysis Population Description: FAS included all participants who signed the ICF. Overall number analyzed is the number of participants with data available for analysis. Number analyzed is the number of participants with data available for analysis at the specified time point.

Unit of Measurement: score

Table 7 – Cognitive Feature Differences at Month 6, Month 12, and Month 18

		Cohort 1		Cohort 2		Cohort 3	
	Number of Participants Analyzed:	35		65		35	
	Category	Median	Interquartile Range	Median	Interquartile Range	Median	Interquartile Range
Month 6: MTN	Number Analyzed:	35 Participants		65 Participants		35 Participants	
		0.50	0.00 to 1.00	1.00	0.00 to 1.00	0.00	–1.00 to 1.00
Month 12: MTN	Number Analyzed	14 Participants		33 Participants		18 Participants	
		1.00	0.00 to 2.00	1.00	0.00 to 1.50	0.75	0.00 to 1.00

Month 18: MTN	Number Analyzed:	4 Participants		7 Participants		7 Participants	
		2.25	0.75 to 3.25	1.00	−0.50 to 3.00	0.50	−0.50 to 1.50
Month 6: MTS	Number Analyzed:	35 Participants		65 Participants		35 Participants	
		4.00	2.00 to 6.00	3.00	0.50 to 5.00	2.00	0.50 to 3.00
Month 12: MTS	Number Analyzed:	14 Participants		33 Participants		18 Participants	
		5.00	3.00 to 7.50	4.00	2.50 to 5.50	3.50	2.00 to 5.50
Month 18: MTS	Number Analyzed:	4 Participants		7 Participants		7 Participants	
		9.75	6.25 to 12.75	9.00	5.50 to 10.50	3.00	2.00 to 8.00

6. Cross-sectional Hand/Gait vs Expanded Disability Status Scale (EDSS) Assessed Using Spearman Rank-order Correlation

Timeframe: Baseline, Months 6, 12 and 18

Analysis Population Description: FAS included all participants who signed the ICF. Overall number analyzed is the number of participants with data available for analysis. Number analyzed is the number of participants with data available for analysis at the specified time point.

Unit of Measurement: score

Table 8 – Cross-sectional Hand/Gait vs EDSS

		All participants	
	Number of Participants Analyzed:	224	
	Category	Point Estimate	Lower and Upper CI
Baseline: Step Frequency vs EDSS	Number Analyzed:	179 Participants	
		-0.27	-0.40 to -0.12
Baseline: Step power vs EDSS	Number Analyzed:	179 Participants	
		-0.34	-0.47 to -0.20
Baseline: Step Intensity vs EDSS	Number Analyzed:	179 Participants	
		-0.33	-0.46 to -0.19
Baseline: Median Turning Angular Velocity vs EDSS	Number Analyzed:	181 Participants	
		-0.37	-0.49 to -0.23

Baseline: Number of Successful Pinches vs EDSS	Number Analyzed:	223 Participants	
		-0.39	-0.50 to -0.27
Baseline: Average Celerity vs EDSS	Number Analyzed:	224 Participants	
		-0.26	-0.38 to -0.13
Month 6: Step Frequency vs EDSS	Number Analyzed:	44 Participants	
		-0.17	-0.45 to 0.15
Month 6: Step power vs EDSS	Number Analyzed:	44 Participants	
		-0.36	-0.60 to -0.07
Month 6: Step Intensity vs EDSS	Number Analyzed:	44 Participants	
		-0.37	-0.61 to -0.08
Month 6: Median Turning Angular Velocity vs EDSS	Number Analyzed:	41 Participants	
		-0.32	-0.58 to -0.00

Month 6: Number of Successful Pinches vs EDSS	Number Analyzed:	64 Participants	
		-0.26	-0.48 to -0.00
Month 6: Average Celerity vs EDSS	Number Analyzed:	65 Participants	
		-0.22	-0.45 to 0.03
Month 12: Step Frequency vs EDSS	Number Analyzed:	23 Participants	
		-0.14	-0.53 to 0.30
Month 12: Step power vs EDSS	Number Analyzed:	23 Participants	
		-0.37	-0.69 to 0.06
Month 12: Step Intensity vs EDSS	Number Analyzed:	23 Participants	
		-0.40	-0.70 to 0.03
Month 12: Median Turning Angular Velocity vs EDSS	Number Analyzed:	22 Participants	
		-0.36	-0.69 to 0.08
	Number Analyzed:	30 Participants	

Month 12: Number of Successful Pinches vs EDSS		-0.29	-0.60 to 0.09
Month 12: Average Celerity vs EDSS	Number Analyzed:	31 Participants	
		0.04	-0.33 to 0.40
Month 18: Step Frequency vs EDSS	Number Analyzed:	4 Participants	
		0.00	-0.97 to 0.97
Month 18: Step power vs EDSS	Number Analyzed:	4 Participants	
		0.40	-0.92 to 0.98
Month 18: Step Intensity vs EDSS	Number Analyzed:	4 Participants	
		-0.40	-0.98 to 0.92
Month 18: Median Turning Angular Velocity vs EDSS	Number Analyzed:	3 Participants	
		1.00	NA to 1.00
		The lower limit of 90% confidence interval (CI) could not be estimated due to an insufficient number of participants.	

Month 18: Number of Successful Pinches vs EDSS	Number Analyzed:	5 Participants	
		-0.05	-0.90 to 0.88
Month 18: Average Celerity vs EDSS	Number Analyzed:	6 Participants	
		0.06	-0.80 to 0.84

7. Correlation Between FL MS Digital Outcomes (Calculated from Baseline to Month 12) and Subsequent Changes in EDSS

This outcome measure could not be assessed due to data insufficiency.

8. In-app FL MS Post-appointment Questionnaire Assessed During Study Period

Timeframe: Baseline, Months 6 and 12

Description: Participants were asked to answer the following 5 questions: Question (Q) 1: Have you discussed your Floodlight MS data with your provider? Q2: From your point of view, do you find that using Floodlight MS helps your provider to better understand your disease status? Q3: Do you find that using Floodlight MS helps you to be better informed about your disease status? Q4: From your point of view, do you find that using Floodlight MS helps you to have a better conversation with your provider about your care? Q5: Would you recommend Floodlight MS to another person living with MS? Q1-Q4 were answered with Yes or No. Q5 was answered with one of the following options: “Definitely”, “Possibly”, “Probably” or “Probably not”. Proportion of participants who answered the questions mentioned above has been reported.

Analysis Population Description: FAS included all participants who signed the ICF. Overall number analyzed is the number of participants with data available for analysis. Number analyzed is the number of participants with data available for analysis at the specified time point. No participants were analyzed at Month 18 and Month 24.

Unit of Measurement: proportion of participants

Table 9 – Post-appointment Questionnaire: Answer Distributions

		All participants
	Number of Participants Analyzed:	15
	Category	Proportion of participants
Q1 - Baseline: No	Number Analyzed:	3 Participants
		1.00
Q1 - Baseline: Yes	Number Analyzed:	3 Participants
		0.00
Q1 - Baseline: Missing	Number Analyzed:	3 Participants
		0.00
Q1 - Month 6: No	Number Analyzed:	15 Participants
		0.67
Q1 - Month 6: Yes	Number Analyzed:	15 Participants
		0.33
Q1 - Month 6: Missing	Number Analyzed:	15 Participants
		0.00
Q1 - Month 12: No	Number Analyzed:	12 Participants
		0.58
Q1 - Month 12: Yes	Number Analyzed:	12 Participants

		0.42
Q1 - Month 12: Missing	Number Analyzed:	12 Participants
		0.00
Q2 - Baseline: No	Number Analyzed:	3 Participants
		0.00
Q2 - Baseline: Yes	Number Analyzed:	3 Participants
		0.00
Q2 – Baseline: Missing	Number Analyzed:	3 Participants
		1.00
Q2 - Month 6: No	Number Analyzed:	15 Participants
		0.07
Q2 - Month 6: Yes	Number Analyzed:	15 Participants
		0.33
Q2 – Month 6: Missing	Number Analyzed:	15 Participants
		0.60
Q2 - Month 12: No	Number Analyzed:	12 Participants
		0.00
Q2 - Month 12: Yes	Number Analyzed:	12 Participants
		0.42

Q2 – Month 12: Missing	Number Analyzed:	12 Participants
		0.58
Q3 - Baseline: No	Number Analyzed:	3 Participants
		0.00
Q3 - Baseline: Yes	Number Analyzed:	3 Participants
		0.00
Q3 – Baseline: Missing	Number Analyzed:	3 Participants
		1.00
Q3 - Month 6: No	Number Analyzed:	15 Participants
		0.20
Q3 - Month 6: Yes	Number Analyzed:	15 Participants
		0.20
Q3 – Month 6: Missing	Number Analyzed:	15 Participants
		0.60
Q3 - Month 12: No	Number Analyzed:	12 Participants
		0.00
Q3 - Month 12: Yes	Number Analyzed:	12 Participants
		0.42
Q3 – Month 12: Missing	Number Analyzed:	12 Participants

		0.58
Q4 - Baseline: No	Number Analyzed:	3 Participants
		0.00
Q4 - Baseline: Yes	Number Analyzed:	3 Participants
		0.00
Q4 – Baseline: Missing	Number Analyzed:	3 Participants
		1.00
Q4 - Month 6: No	Number Analyzed:	15 Participants
		0.07
Q4 - Month 6: Yes	Number Analyzed:	15 Participants
		0.33
Q4 – Month 6: Missing	Number Analyzed:	15 Participants
		0.60
Q4 - Month 12: No	Number Analyzed:	12 Participants
		0.08
Q4 - Month 12: Yes	Number Analyzed:	12 Participants
		0.33
Q4 – Month 12: Missing	Number Analyzed:	12 Participants
		0.58

Q5 – Baseline: Definitely	Number Analyzed:	3 Participants
		0.00
Q5 – Baseline: Possibly	Number Analyzed:	3 Participants
		0.67
Q5 – Baseline: Probably	Number Analyzed:	3 Participants
		0.00
Q5 – Baseline: Probably not	Number Analyzed:	3 Participants
		0.33
Q5 – Month 6: Definitely	Number Analyzed:	15 Participants
		0.40
Q5 – Month 6: Possibly	Number Analyzed:	15 Participants
		0.27
Q5 – Month 6: Probably	Number Analyzed:	15 Participants
		0.27
Q5 – Month 6: Probably not	Number Analyzed:	15 Participants
		0.07
Q5 – Month 12: Definitely	Number Analyzed:	12 Participants
		0.50
Q5 – Month 12: Possibly	Number Analyzed:	12 Participants

		0.33
Q5 – Month 12: Probably	Number Analyzed:	12 Participants
		0.08
Q5 – Month 12: Probably not	Number Analyzed:	12 Participants
		0.08

9. FL MS Usability Score From mHealth Usability Questionnaire Assessed During Study Period

Timeframe: Baseline, Months 6, 12, 18 and 24

Analysis Population Description: FAS included all participants who signed the ICF. Proportion of participants who answered the question “The app was easy to use” have been reported here. Overall number analyzed is the number of participants with data available for analysis. Number analyzed is the number of participants with data available for analysis at the specified time point.

Unit of Measurement: proportion of participants

Table 10 – mHealth Usability Questionnaire

		All participants
	Number of Participants Analyzed:	95
	Category	Proportion of participants
Baseline: Strongly Disagree	Number Analyzed:	6 Participants
		0.00
Baseline: Disagree	Number Analyzed:	6 Participants

		0.00
Baseline: Somewhat Disagree	Number Analyzed:	6 Participants
		0.00
Baseline: Neither Agree nor Disagree	Number Analyzed:	6 Participants
		0.00
Baseline: Somewhat Agree	Number Analyzed:	6 Participants
		0.00
Baseline: Agree	Number Analyzed:	6 Participants
		0.33
Baseline: Strongly Agree	Number Analyzed:	6 Participants
		0.67
Month 6: Strongly Disagree	Number Analyzed:	40 Participants
		0.00
Month 6: Disagree	Number Analyzed:	40 Participants
		0.00
Month 6: Somewhat Disagree	Number Analyzed:	40 Participants
		0.10
Month 6: Neither Agree nor Disagree	Number Analyzed:	40 Participants
		0.07

Month 6: Somewhat Agree	Number Analyzed:	40 Participants
		0.07
Month 6: Agree	Number Analyzed:	40 Participants
		0.17
Month 6: Strongly Agree	Number Analyzed:	40 Participants
		0.58
Month 12: Strongly Disagree	Number Analyzed:	95 Participants
		0.01
Month 12: Disagree	Number Analyzed:	95 Participants
		0.01
Month 12: Somewhat Disagree	Number Analyzed:	95 Participants
		0.03
Month 12: Neither Agree nor Disagree	Number Analyzed:	95 Participants
		0.01
Month 12: Somewhat Agree	Number Analyzed:	95 Participants
		0.08
Month 12: Agree	Number Analyzed:	95 Participants
		0.23
Month 12: Strongly Agree	Number Analyzed:	95 Participants

		0.62
Month 18: Strongly Disagree	Number Analyzed:	32 Participants
		0.00
Month 18: Disagree	Number Analyzed:	32 Participants
		0.00
Month 18: Somewhat Disagree	Number Analyzed:	32 Participants
		0.03
Month 18: Neither Agree nor Disagree	Number Analyzed:	32 Participants
		0.03
Month 18: Somewhat Agree	Number Analyzed:	32 Participants
		0.19
Month 18: Agree	Number Analyzed:	32 Participants
		0.38
Month 18: Strongly Agree	Number Analyzed:	32 Participants
		0.38
Month 24: Strongly Disagree	Number Analyzed:	11 Participants
		0.00
Month 24: Disagree	Number Analyzed:	11 Participants
		0.00

Month 24: Somewhat Disagree	Number Analyzed:	11 Participants
		0.00
Month 24: Neither Agree nor Disagree	Number Analyzed:	11 Participants
		0.00
Month 24: Somewhat Agree	Number Analyzed:	11 Participants
		0.00
Month 24: Agree	Number Analyzed:	11 Participants
		0.36
Month 24: Strongly Agree	Number Analyzed:	11 Participants
		0.64

10. Association Between FL MS Digital Outcome and Clinical Relapses

This outcome measure could not be assessed due to data insufficiency.

Adverse Events

No adverse event data related to any of the assessments presented in the analyses were collected.