

Sensor-Video Assessment of Functional Movement Disorders (FMD) in a Home-Like Setting

REALMove-FMD

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BACKGROUND

- FMD — common neuropsychiatric condition: abnormal motor control without structural pathology
- Core feature: internal inconsistency of motor performance — symptoms vary across tasks and with attentional focus^{1 2}
- Everyday variability poorly understood — clinical snapshots miss the full picture; self-reports are biased

Can continuous video-sensor monitoring provide ecologically valid markers of FMD symptom dynamics?

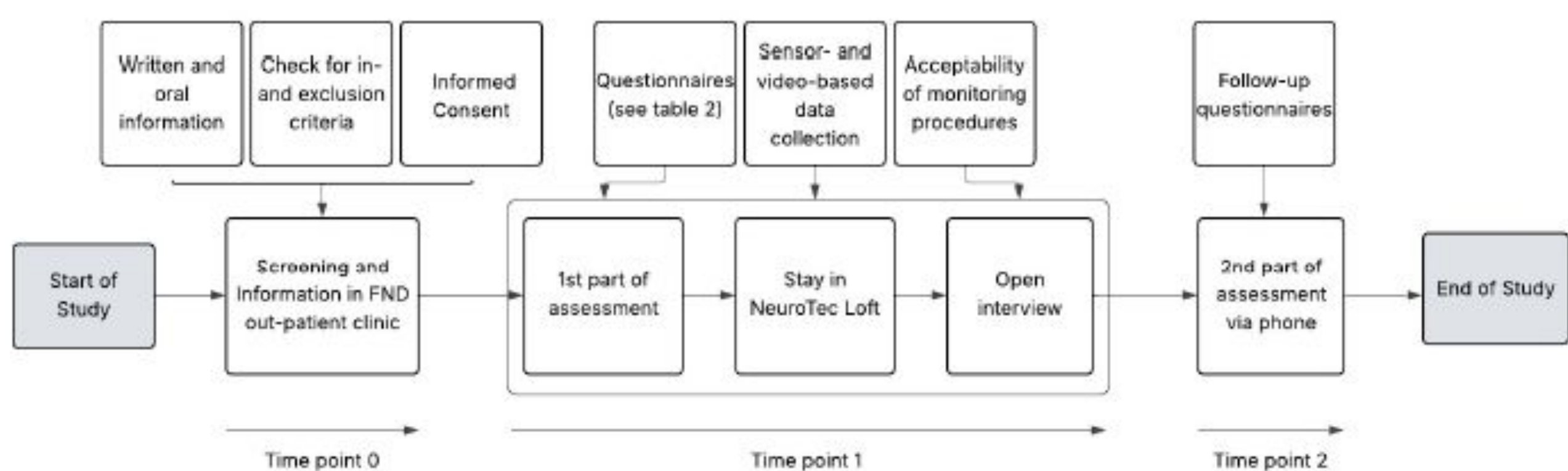
¹ Hallett et al. 2022 ² Hess et al. 2022

NEUROTEC LOFT — INSTRUMENTED HOME ENVIRONMENT



NeuroTec Loft — Instrumented Home Environment, Schindler et al. (2021) Clin. Transl. Neurosci

STUDY TRAJECTORY



METHODS

- Planned n = 34** patients with clinically established FMD (pilot n = 5)
- Recruitment: University Hospital Bern Switzerland, **FND Clinic**
- NeuroTec Loft: 6–8 h** in instrumented apartment: 500+ sensors · 14 cameras — integrated unobstructively
- Standardized ADLs: >= 1 of each activity domain:**
 - Cooking (2 menu options)
 - Beverage preparation (tea / coffee)
 - Light physical activity (workout / yoga)
 - Games (puzzle / sudoku / knitting)
 - Mindfulness exercise (Mindful Walking / Body Scan)

SENSOR & MEASUREMENT TECHNOLOGY

DOMAIN	PRIMARY PARAMETERS	TECHNOLOGY
Movement	Acceleration · Angular velocity · Gait · Posture · Localisation	LiDAR/PIR sensors · Motion tracking · IMUs · Industrial cameras
Body functions	Heart rate · EDA · Temperature	Smartwatch
Environment	Speech · Ambient noise · Temperature · Doors · Water/Device use	Microphone · Environmental sensors · Door/switch sensors

CLINICAL & PSYCHOMETRIC ASSESSMENT

DOMAIN	INSTRUMENTS	TIME POINT
Demographics & medical history	Study specific questionnaire	T1
Clinical	S-FMDRS, QfFMD	T1 + T2
Somatic & Dissociative	PHQ-15 · SDQ-20 · FSS	T1
Interoceptive & Illness Processing	MAIA-2 · B-IPQ · TAS-20	T1
Psychological & Motor Cognition	HADS · PID-5BF+M · MSRS · CERQ	T1
QoL	SF-36	T1
Follow-up	S-FMDRS & acceptability	T2

IN- & EXCLUSION CRITERIA

Inclusion criteria

- Adults (≥18 years)
- FMD (DSM-5 motor type) confirmed by consultant neurologist/neuropsychiatrist
- ≥1 positive clinical sign at enrolment

Exclusion criteria

- Neurological or medical conditions explaining motor symptoms
- Functional seizures requiring supervision
- Severe unstable psychiatric disorder
- Acute medical conditions or pain limiting movement
- Pregnancy (possible influence on measurements unrelated to FMD)

HYPOTHESES

- H1 Feasibility & Acceptability**
Continuous multimodal sensor-video monitoring in a home-like environment shows high data completeness, low dropout, low subjective burden
- H2 Movement Variability**
Movement variability is systematically explained by within-person task- and context-dependency rather than by random fluctuation?
- H3 Explore Clinical Correlates**
Movement variability correlates with clinically and psychosocially relevant dimensions

CLINICAL IMPACT

3–8%
of movement disorder
clinic visits
Finkelstein et al., JNNP 2024

~20%
long-term remission
Gelauff et al., JNNP 2014

FMD is highly heterogeneous, variable, and fluctuates over time, high heterogeneity in course and treatment outcome

Better characterization may reveal digital biomarkers, clinically meaningful subtypes & targets for individualized interventions



Context-dependent motor variability in FMD across tasks of daily living

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